DEVELOPMENT OF A PRESCHOOL CREATIVE PLAY EARLY SCIENCE MODULE

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UNIVERSITY OF MALAYA
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Abstract

Creativity is a crucial 21st century skill which should be developed among young children from an early age. However, this essential skill has not been sufficiently and effectively infused at the preschool level in Malaysia, where preschoolers are at the golden age of learning and development. Therefore, this study developed a preschool Creative Play Early Science (CREPES) module. This module aims to provide pedagogical support for preschool teachers in teaching early science through creative play activities, hence developing preschoolers' creativity. Based on the design and development research (DDR) approach (Richey & Klein, 2007), the study was structured into three phases. The first phase analysed the contextual needs in preschool science teaching and learning in Malaysian private preschools. Qualitative data were collected via interviews and observations. Findings for this phase illustrated and ascertained the need for the development of a creative play science module. In the second phase, the CREPES module was designed and developed. This was achieved through employing a three-round Delphi with a panel of 14 experts. Consensus of the panel experts resulted in 57 items on five aspects including general module design, recommended module sections, module activities, teaching strategies or techniques, and module resources. Based on these items, an initial module was produced and subsequently reviewed by three content experts and two preschool teachers. Appropriate amendments to the initial module were made based on reviewers' comments. Following the review, a module prototype was developed. The last phase of the study involved the implementation and evaluation of the CREPES module. Six module activities were implemented in a preschool setting in Klang Valley by two teachers with 29 preschoolers over three weeks. Prior to the implementation, a module orientation session was held to train teachers in implementing the module effectively.

To determine the usability of the module for teachers and preschoolers, observations and interviews with teachers were conducted. In addition, impact of the CREPES module on preschoolers' creativity was measured in a quasi-experiment. Torrance's Thinking Creatively in Action and Movement (TCAM) was administered individually to preschoolers before and after the module intervention. Findings of ANCOVA revealed that after controlling for the effect of pretest, the overall creativity scores of preschoolers from experimental and control groups differed significantly, $F_{(1,53)} = 5.23$, $p = 0.03$, partial eta² = 0.09. Preschoolers in the experimental group who had participated in the CREPES module activities were found to score significantly higher in their average TCAM posttest score compared to the control group. This reinforces the positive impact of the CREPES module in significantly enhancing preschoolers' creativity, specifically in terms of originality and imagination. This research study demonstrated that the CREPES module effectively helped teachers in incorporating creativity in preschool science instruction. A proposed creative play framework was also postulated to promote the implementation of creative play in developing creativity among preschoolers. Development of other pedagogical tools for preschool education should be vigorously continued in future research studies for the benefit of preschoolers in Malaysia.

REKA BENTUK DAN PEMBANGUNAN MODUL MAIN KREATIF SAINS AWAL PRASEKOLAH

Abstrak

Kreativiti merupakan satu kemahiran abad ke-21 yang perlu dipupuk dalam kalangan kanak-kanak dari awal. Namun, di Malaysia, pelaksanaan dan penerapan kemahiran ini kurang berkesan di tahap prasekolah di mana murid sedang berada di umur optima untuk pembelajaran dan perkembangan. Oleh itu, kajian ini bertujuan untuk membangunkan modul Main Kreatif Sains Awal (CREPES) prasekolah. Modul ini memberi sokongan pedagogikal untuk guru prasekolah dalam mengajar sains awal melalui aktiviti main kreatif, justeru meningkatkan kreativiti murid prasekolah. Berdasarkan kaedah reka bentuk dan teknologi (Richey & Klein, 2007), kajian ini distrukturkan kepada tiga fasa. Fasa pertama melibatkan analisis keperluan dalam konteks, iaitu keperluan dalam pengajaran dan pembelajaran sains awal. Data kualitatif diperoleh dari temubual dan pemerhatian atas tiga kelas sains awal. Dapatan fasa ini menonjolkan dan memastikan keperluan untuk modul CREPES. Pada fasa kedua, modul CREPES direka bentuk dan dibangunkan. Ini dicapai melalui teknik Delphi tiga pusingan dengan 14 pakar. Berdasarkan konsensus panel Delphi, 57 item tentang reka bentuk umum modul, bahagian modul, aktiviti modul, strategi atau teknik pengajaran, dan bahan sokongan modul dikemukakan. Dengan garis panduan untuk reka bentuk modul CREPES dari item-item tersebut, satu draf modul disediakan dan disemak. Semakan draf modul melibatkan tiga pakar kandungan dan dua guru prasekolah. Pembetulan modul dibuat berdasarkan ulasan daripada penyemak sebelum melaksanakan modul. Prototaip modul dibangunkan berikutan semakan modul. Fasa terakhir kajian ini melibatkan pelaksanaan dan penilaian modul CREPES. Enam aktiviti modul dilaksanakan oleh dua orang guru dengan 29 murid prasekolah di

sebuah prasekolah terpilih di Lembah Klang untuk tempoh selama tiga minggu. Sebelum pelaksanaan modul, dua orang guru prasekolah yang terlibat menghadiri sesi orientasi modul yang memberi panduan atas penggunaan dan pelaksanaan modul dengan berkesan. Untuk menentukan kebolehgunaan modul untuk guru-guru dan murid prasekolah, pemerhatian telah dijalankan sepanjang pelaksanaan modul. Di samping itu, guru-guru yang melaksanakan modul juga ditemubual. Impak modul CREPES atas kreativiti murid prasekolah diukur melalui kuasi-eksperimen. Instrumen *Torrance's Thinking Creatively in Action and Movement* (TCAM) ditadbir secara individu kepada murid prasekolah sebanyak dua kali, iaitu sebelum dan selepas intervensi modul. Hasil ANCOVA menunjukkan bahawa selepas mengawal kesan daripada ujian pra, terdapat perbezaan signifikan antara skor kreativiti keseluruhan murid prasekolah dari kumpulan eksperimen dan kawalan, $F_{(1,53)} = 5.23$, $p = 0.03$, *partial* $eta^2 = 0.09$. Dapatan juga mendapati murid prasekolah dari kumpulan eksperimen yang telah menyertai aktiviti-aktiviti modul CREPES mencapai skor purata ujian pasca yang lebih tinggi berbanding dengan kumpulan kawalan. Ini mengesahkan impak positif modul CREPES dalam meningkatkan kreativiti murid prasekolah secara signifikan, khususnya dari aspek keaslian (*fluency*) dan imaginasi (*imagination*). Implikasi kajian ini menunjukkan pengunaan modul main kreatif dapat membantu guru prasekolah dalam menerap kemahiran kreativiti dalam pengajaran dan pembelajaran sains awal dengan berkesan. Kajian penyelidikan mencadangkan pelaksanaan main kreatif untuk memupuk kreativiti dalam kalangan murid prasekolah melalui cadangan rangka kerja main kreatif. Pembangunan alat pedagogi lain untuk pengunaan prasekolah harus diteruskan melalui penyelidikan lanjut untuk memanfaatkan murid prasekolah di Malaysia.

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ECCE	Early Childhood Care and Education
CREPES	Creative Play Early Science Module
DAP	Developmentally Appropriate Practice
DDR	Design and Development Research
ECE	Early Childhood Education
MKO	More Knowledgeable Other
NPSC	National Preschool Standard-based Curriculum
PEMANDU	Performance Management and Delivery Unit
PISA	The Programme for International Student Assessment
STEAM	Science, Technology, Engineering, Art, and Mathematics
STEM	Science, Technology, Engineering, and Mathematics
TCAM	Thinking Creatively in Action and Movement
TTCT	Torrance Test of Creative Thinking
UNICEF	The United Nations Children's Fund
ZPD	Zone of Proximal Development

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Chapter 1

Introduction

Today, early childhood education has been regarded as of paramount importance across the globe by governments, policymakers and societies alike. Decades of research have indicated that high quality early childhood programmes (ECPs) lead to both short and long-term benefits among young children (e.g., Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). However, it can be difficult to determine the quality of service each early childhood institution provides (Whitebread, Basilio, Kuvalja, & Verma, 2012).

As legislated in the "Convention on the Rights of the Child" (2012) by UNICEF, play is one of the basic rights a child is entitled to. A wealth of research documents that play is among the best vehicle leading to a child's development. In addition, play is known as one of the most natural channels of creative expression for young children. There is a general consensus on the position for play in the early childhood curriculum which is deemed vital across the globe. According to the longitudinal study conducted by Sylva et al. (2004), the provision of play is acknowledged to be one of the key indicators of an effective early childhood programme. Therefore, it is legitimate that the play approach be the overarching foundation for the preschool curriculum.

However, the increasing academic emphasis in many preschool settings is resulting in a significant decline of play in the early childhood classroom. This robs preschoolers of their opportunities to develop one of the most essential 21st century skills, which is creativity. While the pedagogy of play has gained much prominence in the field of early childhood education in developed Western countries, there remains a dearth of literature on play in Malaysia where rote learning remains a common practice in a large number of preschool settings.

Therefore, this research study integrated creativity into preschoolers' play in the early childhood science classroom to develop a Creative Play Early Science (CREPES) module. This chapter provides a general background and outlines the key research components that underlie this research study.

The Malaysian Early Childhood Care and Education (ECCE)

This section provides a general overview of early childhood education in Malaysia. The Malaysian government is increasingly aware of the prime importance of early childhood education towards the nation's development (Ng, 2010; UNICEF, 2011). Various initiatives and effort have been planned and implemented to revamp and coordinate the pre-primary education in Malaysia (Ng, 2010; Rohaty Mohd Majzub, 2013). The Malaysian government has also made raising the quality of preschool education a priority in the recent Government Transformation Programme (PEMANDU, 2015).

The current ECCE provision is divided into two categories, childcare centres (*TASKA)* for children under four years old and preschools (*TADIKA*) for those aged four to six (Curriculum Development Centre, 2008; Ng, 2010). The former is under the purview of the Ministry of Women, Family and Community; whilst the latter is placed under the joint coordination of Ministry of Rural and Regional Development (KEMAS), Department of National Unity and Integration (JPNIN) and Ministry of Education (MOE). Besides public early childhood programmes established by government bodies, there are also large numbers of privately owned nurseries and preschools.

Preschool enrolment in Malaysia is not compulsory till the school entry age at seven. The most recent statistics from the Performance Management and Delivery Unit (PEMANDU, 2015) indicated that Malaysian preschool enrolment rate has escalated to 84.26% at the end of 2014, compared to 77% as of June 2011 (Ministry of Education, 2013). The Malaysia Education Blueprint has established that the nation is working towards 100% enrolment for all levels including early education (Ministry of Education, 2013). In preparation for the consistently increasing amounts of children attending preschools, the quality of our preschool curriculum should be constantly maintained and improved to ensure that children gain utmost benefit at the key stage of their lives, in order to build a strong human capital for the nation in the near future.

Through the Education Act 1996 (2006), preschool education has been included under the national education system. It also establishes that all preschools regardless of their types, whether private or government-owned are required to adhere to the national statutory preschool curriculum, i.e. the National Preschool Standard-based Curriculum (NPSC). The NPSC is the current Malaysian preschool curriculum in use since its first enforcement in 2010. The curriculum has been revised in 2016 in tandem with the recent Malaysia Education Blueprint 2013-2025 (Ministry of Education, 2013) and current needs. The aim of the NPSC is to develop preschoolers' potential in a comprehensive way across all developmental aspects including physical, spiritual, social and intellectual, "through safe and conducive learning environment, and fun, creative and meaningful activities" (Ministry of Education, 2017, p. 2). This is in line with the National Education Philosophy which aims to produce holistic individuals for the improvement of the society and country (Ministry of Education, 2013).

In the NPSC, the "learning through play" approach is established as one of the developmentally appropriate approaches for effective and meaningful learning experiences, along with other approaches such as child-centred learning, integrated approach and inquiry-based learning (Ministry of Education, 2017). Development of creative and innovative thinking are also emphasised in the NPSC toward developing a holistic individual in tandem with current demands of the 21st century as shown in Figure 1.1. This is in line with the recent Malaysia Education Blueprint which included creative thinking as one of the goals every student should achieve (Ministry of Education, 2013). The most recent revision of the NPSC established creative thinking as one of the higher order thinking skills (HOTS) and 21st century skills preschool programmes should aspire to develop among preschoolers (Ministry of Education, 2017).

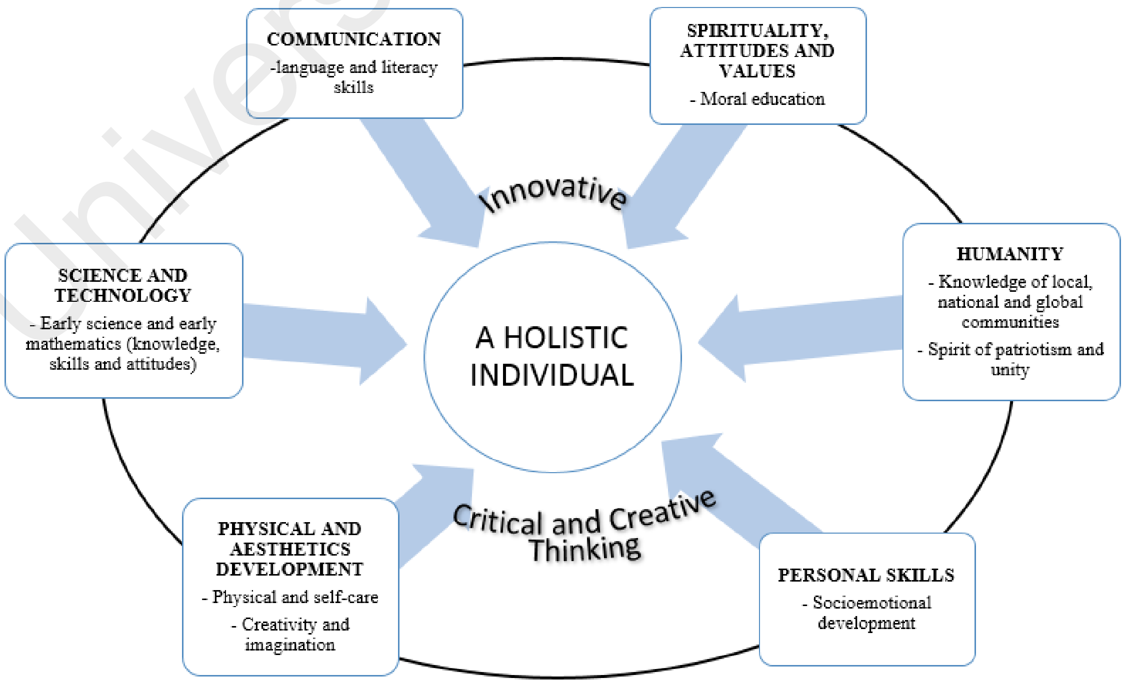


Figure 1.1. NPSC curriculum framework (Ministry of Education, 2017).

The Malaysian ECCE encounters several challenges in service delivery and implementation. According to PEMANDU (2013), approximately 93% of preschool teachers had not undergone any formal training. These untrained preschool teachers are mainly from the private sector that lacks monitoring and control in terms of teacher employment. Without adequate training, their competence in implementing developmentally appropriate practice for children's optimal development is largely questionable. In response to this, the Malaysian Government has established in the education blueprint that all preschool teachers should possess a minimum requirement of Diploma in Early Childhood Education by 2020 in efforts to improve the standards of preschool education (Ministry of Education, 2013).

In addition, Ng (2010) pointed out that there is bound to be a certain degree of mismatch between the planned ideals as established in the NPSC and the implemented reality. The extent to which the philosophies posited by the NPSC is implemented in reality remains uncertain. Moreover, the lack of coherence in the field of early childhood education could be a barrier toward ensuring quality ECCE in the nation.

Early education is crucial as it serves as a head start that strongly impacts a child's future prospects. We should strive towards preparing and equipping our children well to meet challenges of the 21st century. Considering these, there is certainly more room for improvement in the Malaysian early childhood education. Policy makers should work closely alongside preschool stakeholders including teachers to work towards a high-quality preschool education which promotes play and creativity. All Malaysian children should be provided with equal opportunities of access to quality early childhood education; hence grow up to be outstanding future contributors towards Malaysia and the world.

Problem Statement

Play constitutes a significant part in children's lives. It is also the key vehicle for children's learning and development, and the most natural channel of expression especially for children in their early childhood (Einarsdóttir, 2010; Elkind, 2008; Mihaela, 2013). A number of developmental theorists including Piaget (1962) and Vygotsky (1967) had since pointed out the positive correlation between play and cognitive development.

Moreover, decades of research acknowledge the importance of play and its holistic developmental benefits for young children, especially in the context of early childhood education (e.g. Huisman, Catapano, Moody, & Gates, 2013; Milteer & Ginsburg, 2012). Ample research evidence available indicate that under playful conditions, children exhibit positive and holistic gains in various areas including cognitive, socio-emotional, physical domain and also their general well-being (e.g., Lee, 2013; Kennedy-Behr, Rodger, & Mickan, 2015). Due to its vast benefits, play is therefore widely acknowledged all over the world as an invaluable pedagogy in the early years curricula (Cheng, 2012; Kuschner, 2012; Loizou & Avgitidou, 2014; Samuelsson & Carlsson, 2008).

Furthermore, play was established as an essential medium for a child's development of self-regulation, language, cognitive and social skills by the National Association for the Education of Young Children (NAEYC) (2009). Incorporating play into the curriculum is also considered as developmentally appropriate practice (DAP) which should be implemented in every early childhood setting to ensure effective service delivery.

Play has also been frequently associated with creative expressions (Milteer & Ginsburg, 2012; O'Connor, 2014; Othman Talib, Tengku Putri Norishah, & Nor Alley Zulkafly, 2014; Reunamo et al., 2013; Sharp, 2004). Children in their early childhood are at the prime of creativity development, as it is the key period of the germination of creativity (Whitebread & Bingham, 2011). Play is among the best vehicle for young children to exhibit and foster creativity (Catron & Allen, 2007; O'Connor, 2014). As a crucial 21st century skill, creativity is a vital ability that should be developed among all young children to meet the demands of globalization (Eckhoff, 2011). Hence, all preschoolers should be provided with ample opportunities for creative development through play to tap into their potential of holistic and creative development.

Based on the positive impact of play on children's overall development, it is crucial for early childhood programmes to adopt this pedagogy in the curriculum. Despite play being widely recognized as an effective medium through which young children learn best, a plethora of research studies have drawn attention to the global crisis of play in many early childhood institutions. The global emphasis on preschoolers' academic attainment especially the 3R's i.e. writing, reading and arithmetic has increasingly deprived preschoolers of their rights to play. This stifles the development of their creativity and motivation for learning.

Moreover, a mismatch exists between the ideal of learning through play and the reality of the pressure preschool teachers face to get preschoolers ready for primary school (Bennett, Wood, & Rogers, 1997; Bulunuz, 2013; Fung & Cheng, 2012; McInnes, Howard, Miles, & Crowley, 2011; Nilsson, 2009; Wong, Wang, & Cheng, 2011). Due to this work-play dichotomy, play time is significantly replaced by didactic teaching in order to prepare preschoolers for formal schooling (Fisher, Hirsh-Pasek, Golinkoff, & Gryfe, 2008; Huisman et al., 2013; Milteer & Ginsburg, 2012; Nicolopoulou, 2010; Nicolopoulou, Barbosa de Sá, Ilgaz, & Brockmeyer, 2009; Sandberg & Heden, 2011; Van Oers & Duijkers, 2013).

Similarly in the Malaysian context, the learning through play approach has gained greater attention since the enforcement of the National Preschool Curriculum (Ministry of Education, 2003). However, available research evidence indicate that this approach is not widely implemented in practice as required in the national preschool curriculum (Curriculum Development Centre, 2008). Formal approaches such as direct instruction remain a norm in the teaching and learning process in many Malaysian preschools due to the excessive emphasis on children's academic mastery (Aliza Ali & Zamri Mahamod, 2015; Ng & Yeo, 2014; Norsuhaily Abu Bakar, Normadiah Daud, Nadhirah Nordin, & Abdul Hakim Abdullah, 2015).

Despite their positive perceptions on the play approach, research evidence suggest that most Malaysian preschool teachers lack understanding about play and are unprepared to implement it in the curriculum (Curriculum Development Centre, 2007; Curriculum Development Centre, 2008, p. 59; Sharifah Nor Puteh & Aliza Ali, 2013). This could be one of the reasons that teachers tend to revert back to direct instruction approach in teaching. Therefore, it illuminates the need for better guidance and support for teachers on the implementation of play in the curriculum (Norsuhaily Abu Bakar, 2009; Sandberg & Heden, 2011).

As early as more than a decade ago, Cheng (2001) asserted the urgency to fill the gap between teachers' ideal beliefs about play-based learning and the reality of implementing it in practice. To date however, it is believed that this mismatch between theory and practice still exists, especially in the Malaysian context. It is imperative that there has been little progress to solve the challenges early childhood educators encounter in incorporating play in practice.

In contrast to the ideal implementation of play which should be child-directed, research evidence has also shown that play, even when implemented is often teacher-directed and related to specific academic outcomes (Fisher et al., 2008; Norsita Ali & Zainal Madon, 2014; Sandberg & Heden, 2011). This excessive structure in play confines the power that play contains in unleashing preschoolers' creative potential, as it leads to rigidity and limits their space for creative expressions. The demand for academic learning in preschools further reduces the allocation of time for open-ended creative play in many preschools, which eventually leads to a significant decline in preschoolers' development of creativity during play.

Creativity was claimed as one of the main "casualties" due to the heavy emphasis on academic learning (Almon & Miller, 2011). Miller and Almon (2009) asserted that children of this generation lack in the ability of expressing novel ideas of their own. They often require additional support to play creatively due to the ubiquity of media and highly structured environment that surround them (Miller & Almon, 2009). This is supported by Oncu and Unluer (2010) whose findings drew attention to preschoolers' limited ability to exhibit creativity while interacting with play materials. The gravity of this pattern was likewise postulated in the study of Kim (2011) who described it as "the creativity crisis", where creativity scores of children ranging from preschoolers to third graders saw the highest decline as their age progresses.

In the local context, the NPSC postulates creative thinking as one of the main emphases underpinning all the developmental areas. Creativity should be incorporated into and across all content areas in the curriculum. Despite that, creativity development was discerned to be lacking in the Malaysian early childhood classroom (Curriculum Development Centre, 2007). Opportunities for both play and creative expressions are often replaced by structured learning in many early childhood settings. It is therefore imperative that many of the Malaysian preschoolers' potential in creative thinking remain largely underdeveloped.

Realising the importance of creativity development among children, the Malaysian Curriculum Development Centre (2011, 2012) has produced a creativity module to guide primary school teachers to foster creativity in the classroom. While a module exists for primary education, to date there remains a lack of concrete materials to support preschool teachers to integrate creativity in their teaching. This is most likely among the reasons for the lack of emphasis on creativity development in Malaysian preschools today. As vast differences exist between the early childhood and primary education such as greater fluidity in the former level, the need to develop appropriate pedagogical guidance specifically for preschool teachers is crucial.

Similarly, this appears to be true in the teaching of science in the Malaysian preschool context. The preschool environment was found to be unconducive for science learning due to the lack of opportunities for active learning such as hands-on activities (Hashimah Mohd Yunus & Nooraida Yakob, 2014). Based on the researcher's experience in the Malaysian early childhood education, science is often seen merely as a stand-alone subject to teach scientific facts, rather than an avenue to develop children's curiosity and creativity through discovery of the world around them. It is rarely integrated in an interdisciplinary way across the NPSC strands.

Due to this misconception on the nature of the pedagogy of science, preschoolers are often taught by direct instruction using science workbooks and worksheets. This is likely to have a certain extent of impact towards the interest in science among Malaysian primary school students, which Othman Talib et al. (2014) suggested was deteriorating. Preschool teachers' incompetence in teaching science could also be a possible factor resulting the ineffective teaching of early science (Saçkes, Trundle, & Bell, 2013; Trundle & Saçkes, 2012).

Findings of the international student assessment PISA for both 2012 and 2015 indicated below-average performance in science among 15 year-old Malaysian students, especially in terms of creative problem-solving (Organisation for Economic Co-operation and Development, 2012, 2015). The poor assessment outcomes could be traced as far back to their early years where a child's foundation is laid. This urges for serious reflection of the Malaysian education system, specifically the quality of preschool science instruction and the role creativity plays in preschool education.

Since play is the key medium to young children's learning and development, it is an appropriate channel to foster children's creativity in the preschool classroom. Among the known research studies conducted on play in the Malaysian early childhood curriculum, insufficient attention has been directed towards how play can act as an effective medium to enhance creativity among young children, particularly in early science. Although creativity and play are closely associated with each other, many existing literature do not explore play and creativity simultaneously but as separate constructs. There is also a dearth of research that investigates how creativity could be infused into the teaching of early science specifically through creative play.

Thus, this present study integrated both play and creativity, hence the term "creative play" in hope of promoting its implementation to stimulate preschoolers' creativity. This integration was done on the basis of overlapping similarities identified in both play and creativity from the existing body of research. The similarities which were discerned include the similar nature of both the constructs, as well as the uncertainties teachers experience in implementing them in practice. The multifaceted and ambiguous nature of play present great challenges for practitioners to understand and adopt it in the early childhood classroom (Cheng, 2010, 2012). Eckhoff (2011) similarly pointed out that the complicated attributes associated with creativity caused teachers to be unclear of how to foster children's creativity in the early childhood classroom.

In addition, several researchers have highlighted the importance to develop children's curiosity and interest in science from a young age through playful experiences (Akman & Özgül, 2015; Othman Talib et al., 2014). To date however, there is no known existing instructional tool to guide preschool teachers on the development of preschoolers' creativity through early science experiences in the Malaysian context. Therefore, there is a serious need for the development of appropriate instructional support on teaching preschool science through creative play to equip early childhood teachers to incorporate it in practice effectively, as well as benefiting preschoolers in the long run.

The difficulties encountered by early childhood practitioners to implement a creative and play-based curriculum in practice illuminates the need to narrow the gap through developing a module to promote creative play in the early childhood science classroom. Garaigordobil and Berrueco (2011) asserted that there are limited programs that encourage creativity in early years. They also noted the scarcity of products on creativity that are empirically validated. Considering the relationship between play and creativity, they evaluated the effects of a creative-cooperative play program on 5 to 6 year-old Spanish preschool children in their study (Garaigordobil & Berrueco, 2011). This study was the most recent international research study known to the researcher which measured the effects of play on creativity. However, the researcher discerned that this experimental study solely employed quantitative methods to assess children's creativity. In addition, its focus was not on the step-by-step process of designing and developing the program, but rather on the effects of the play program towards children's creativity.

In relation to the study of Garaigordobil and Berrueco (2011), this present study focused mainly on the process of designing and developing an early science module founded on the creative play approach based on the needs in the actual context of study. Considering the dynamic nature of preschoolers' development, the researcher employed both qualitative and quantitative measures to ascertain the impact of the module on preschoolers' creativity.

In both local and international context, this present study was known to be new as it designed and developed a preschool science module based on the creative play approach. It also addressed the gap brought forth by Bodrova and Leong (2010) on the deficiencies in research regarding instructional support on play in early childhood context. This study also represents a response to the study of Greenfield et al. (2009) who highlighted the insufficient empirical studies on early science pedagogies and their outcomes. Hence, it is believed that this research study would contribute significantly in terms of knowledge and practice on play, creativity, early science instruction, and instructional design research in early childhood education both in the Malaysian as well as international context.

Research Objectives

In order to address the research gaps identified above, the main focus of the present study was to develop a Creative Play Early Science (CREPES) module in order to provide pedagogical support for preschool teachers on teaching early science through creative play activities. Based on the design and development research (DDR) approach (Richey & Klein, 2007), the study consisted of three different phases. The objectives of each consecutive phase were as follows:

A. Needs Analysis Phase

In order to determine the needs for the CREPES module in the context of the study, the objective of the first phase was:

1. To explore the needs in the teaching and learning of preschool science

B. Design and Development Phase

This phase involved the design and development of the CREPES module according to the findings obtained from the needs analysis phase.

2. To determine the appropriate CREPES module design according to experts' consensus
3. To review the initial module based on experts and teachers' feedback

C. Implementation and Evaluation Phase

In this phase, usability of the CREPES module and its impact on preschoolers' creativity were evaluated following the implementation of the module prototype developed in the second phase.

4. To evaluate the usability of the CREPES module for teachers

5. To evaluate the usability of the CREPES module for preschoolers
6. To determine the impact of the CREPES module on preschoolers' creativity

Research Questions

To achieve the research objectives as outlined above, research questions for this study were devised as follows:

A. Needs Analysis Phase

1. What are the needs in the teaching and learning of preschool science?

B. Design and Development Phase

2. What is the appropriate CREPES module design according to experts' consensus?
3. How do experts and teachers review the initial module?

C. Implementation and Evaluation Phase

4. How is the usability of the CREPES module for teachers?
5. How is the usability of the CREPES module for preschoolers?
6. Is there a significant impact of the CREPES module on preschoolers' creativity?

Rationale of Study

As established in the Convention on the Rights of the Child (UNICEF, 2012), it is every child's fundamental right to play. In addition, in light of the present technological revolutions today, creativity is viewed as a crucial 21st century skill that lays the foundation for an individual's future success (Eckhoff, 2011). Hence, a significant implication of this shift toward a global education system involves the effective incorporation of creativity into the teaching and learning process, especially in early childhood education. All preschoolers should be given equal opportunities to develop their creative potential from a young age in order to be equipped for the coming challenges.

The rationale to develop a Creative Play Early Science Module stemmed from the importance of both play and creativity toward the development of young children. However, research evidence suggest that the implementation of play is missing from most preschool settings due to the overemphasis on literacy and numeracy to prepare preschoolers for formal schooling (Fisher et al., 2008; Huisman et al., 2013; Milteer & Ginsburg, 2012; Nicolopoulou et al., 2009; Nicolopoulou, 2010; Sandberg & Heden, 2011; Van Oers & Duijkers, 2013). In the Malaysian context, traditional approaches such as rote learning remain the main modes of teaching and learning in many preschool settings (e.g., Aliza Ali & Zamri Mahamod, 2015; Ng & Yeo, 2014; Norsuhaily Abu Bakar et al., 2015). This practice contradicts with the Malaysian preschool curriculum that recognises learning through play as one of the key approaches for young children's learning (Ministry of Education, 2017).

Research has established the need of a balanced curriculum integrating play and work as the curriculum framework (Miller & Almon, 2009; Saemah Rahman, Ruhizan Yasin, & Siti Fatimah Yassin, 2012). Kuschner (2012) asserted that the allocated time for play in the preschool curricula should be defended due to its importance for children, as the overemphasis on tests and drilling lead to extremely stressed, anxious and under exercised preschoolers (Nicolopoulou, 2010). Didactic and teacher-directed approach is detrimental for young preschoolers' development and should be substituted by play, hands-on, and active learning activities (Lillard et al., 2012).

Play is also recognised as a medium for creative expression among young children (Johnson, 2007; O'Connor, 2014; Oncu & Unluer, 2010). However, literature about play in the Malaysian preschool context seem to be scarce. By using the available electronic search engines and research repositories, the researcher only obtained 13 articles directly related to play in the Malaysian context of early childhood education. The dearth in research studies does not parallel to the rhetorical emphasis on the play approach by the NPSC. Moreover, it was also noted that out of the 13 articles, only one explored specifically on creativity i.e. the study by Yin, Abd. Razak Zakaria, Hutagalung, & Umi Kalsum Mohd Salleh (2014).

Most studies examined the effects of play on the acquisition of academic outcomes, such as language abilities (e.g., Aliza Ali, Zahara Aziz, & Rohaty Majzub, 2011; Chin & Effandi Zakaria, 2015; Nair, Yusof, & Arumugam, 2014; Sharifah Nor Puteh & Aliza Ali, 2013), mathematical concept (Zakiah Mohammad Ashari, Azlina Mohd. Kosnin, & Yeo, 2013) and scientific understanding (Othman Talib et al., 2014). Creativity is apparently under researched in the Malaysian context. This does not seem to align with the educational goals proposed in the Malaysia Education Blueprint and the NPSC that established creative thinking as one of the aspirations all preschoolers should be moving towards.

The difference between play in general and creative play should be clearly distinguished. Creative play refers specifically to play activities that stimulate creativity, whereas play in its multifaceted nature does not necessarily involve creative thinking and develop creativity. For instance, structured play often aims to achieve specific learning outcomes among children. However, limited creative thinking is likely to be involved in the process. While several preschool play modules have been developed in the Malaysian context, to date there is yet to be a specific module on creative play. There is also a lack of instructional support for preschool teachers on how to infuse creativity into early science instruction. This has contributed to the researcher's firm rationale behind developing a module on creative play. This present study therefore, focused on creativity development as the outcome through creative play science activities.

Limited opportunities for creative play in preschools have deprived Malaysian children of developing their potential to think "outside the box". Malaysia ranked 39th out of the 44 countries assessed in terms of creative problem-solving among 15 year-olds (Organisation for Economic Co-operation and Development, 2012). The apparent limited focus on creative development in the Malaysian education, specifically at the preschool level might be a possible reason contributing to the unsatisfactory ranking of Malaysia in the Programme for International Student Assessment (PISA). The below-average findings from PISA could rationalise the urgency to develop Malaysian students' creativity from their preschool years through play. Moreover, pertaining to science achievement, Malaysia also failed to perform satisfactorily in the Trends in International Mathematics and Science Study (TIMSS) and were placed at the 32th out of 42 participating countries (Martin, Mullis, Foy, & Stanco, 2012). As early science allows myriad of opportunities for discovery and creative development among young children, science content area was selected to be the focus of this module.

The researcher's personal experiences have also indicated that preschoolers today are generally less capable of formulating creative ideas and playing creatively. Many have difficulties generating novel ideas and prefer conforming to standard ideas. They also tend to be afraid of asking and answering questions for fear of making mistakes, aside from requiring constant affirmation from adults that they are doing things correctly. This could be due to the acclimatisation to closed questions with standard answers that are said to be either correct or wrong, as well as constant instructions and limited open-ended activities in preschool settings.

With little emphasis of creativity in our national education system, Malaysia will possibly fall behind other countries in terms of future development. Children who are not consistently prompted to think creatively in preschools will less likely grow up to be creative and innovative leaders in the future. Similarly, review of the available literature suggested that children today lack creative abilities (e.g., Kim, 2011; Miller & Almon, 2009). Yet, the development of creativity through play among preschoolers has rarely been studied in the Malaysian context.

Moreover, the aim to develop a creative play early science module could be rationalised based on evidence from research that highlighted preschool teachers' limited competence in effectively implementing both play and creativity in the curriculum (e.g. Cheung & Leung, 2013; Sharifah Nor Puteh & Aliza Ali, 2013). Despite the importance of science in early years, preschool teachers were also found to possess weak pedagogical content knowledge in teaching science (Saçkes et al., 2013; Trundle & Saçkes, 2012). In relation to that, Piasta, Pelatti, and Miller (2014) stressed on the need for professional development to consolidate preschool teachers' competence and enable more effective implementation of science in preschool settings. Based on the creative play approach, this preschool science module provides teachers with concrete teaching guidance in terms of implementation. In conclusion, the need to incorporate creative play in Malaysian preschool settings through the development of a creative play science module could not be overlooked.

Significance of Study

This study contributed to the existing literature and field of practice in several ways. First and foremost, it provided concrete instructional and pedagogical support for preschool teachers to incorporate creative play through early science activities. This would eventually benefit children who are at their golden age of development to generate new ideas and think in creative ways. Development of creative thinking skill is stipulated in the NPSC as one of the outcomes for early science learning (Ministry of Education, 2017). Hence, the development of the Creative Play Early Science (CREPES) module in this study was crucial in supporting preschool teachers to translate the ideals stated in the curriculum into actual practice, thus bridging the gap between the theory and practice in preschool settings; as illustrated in Figure 1.2.

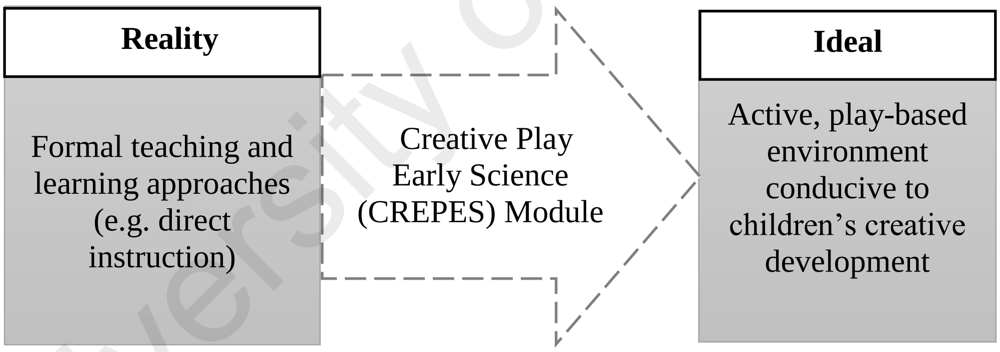


Figure 1.2. The CREPES module as a means to bridge the gap between the reality and ideal preschool learning environment.

Early childhood is a key stage where children's creative potential starts to germinate. Among the existing developed modules for Malaysian preschool context, the CREPES module was the first known module that intended to promote preschoolers' creativity through early science play activities. Consequently, this research study served as an empirical evidence pertaining to the impact of the CREPES module toward preschoolers' creativity in the Malaysian early childhood context. It also addressed the predicament of providing teachers with appropriate guidance to incorporate play and creativity in the preschool classroom, as pointed out by Russ and Wallace (2013).

The CREPES module could be used as an instructional tool to promote creative play in early childhood contexts and even in primary settings. Collecting data through gaining consensus of early childhood experts could also be a reliable source for curriculum developers as a reference to implement creative play in preschool settings. In short, findings of this study contributed to the limited amount of research in the areas of creativity, play and early science instruction in the context of Malaysian early childhood education. In addition, it substantiated both the theory and practice of creative play to be further implemented in Malaysian preschool settings.

In addition, this study raises the awareness of policy makers, curriculum developers, teachers and the public at large towards the importance of play and creativity development in the early childhood classroom, as opposed to the overemphasis on structured academic learning. The researcher maintains that a paradigmatic shift is required in our nation from an academic-oriented environment to a child-initiated, play-based learning ground where a child's creativity thrives, as asserted in Sandberg and Helen's study (2011).

This study emphatically calls for an increased awareness in the Malaysian society that every preschooler should have equal access to quality play-based learning environment in which they could develop creatively, as well as the detrimental long-term effects of didactic learning approaches to young children's development. Lastly, this study intends to result in a renewed interest towards this research area pertaining to creativity development through play in early childhood education.

Conceptual Framework

The conceptual framework of this study was developed based on the variables of the study, outlining the general flow of the study. Structured by phase and in line with the phases of a typical DDR study, the conceptual framework begins with the analysis of needs on preschool science instruction. This analysis ascertained the need for the development of the CREPES module, in light of the gaps found in the existing literature which will be discussed in depth in the next chapter.

The framework moves on to the next phase which is interrelated with the first, as the module is designed and developed based on the identified needs in order to cater to the needs in actual practice. This interrelation is represented by the double-headed arrows from the first variable to the other two variables in the next phase. In the second phase, the variables in the design and development phase included experts' consensus on the appropriate module design and subsequently their review on the initial module. These two variables contributed to the development of a module prototype.

The last phase encompassed the implementation and evaluation of the module prototype. Variables involved include teachers' evaluation on the module's usability, as well as the usability and impact of the module on preschoolers' creativity. These were dependent on their experiences with the module. Evaluation of the module then led to the final product of the study, which is the CREPES module.

The conceptual framework as shown in Figure 1.3 illustrates the process through which various variables in different phases in the study interact, progress and lead to the final product of the study, namely the Creative Play Early Science (CREPES) module. How two different types of theories, namely constructivist theories and creativity theories support and frame the process of module development and subsequently the final module are also shown in Figure 1.3. The role of each of this supporting theory will be explicitly delineated and interpreted in the following chapter.

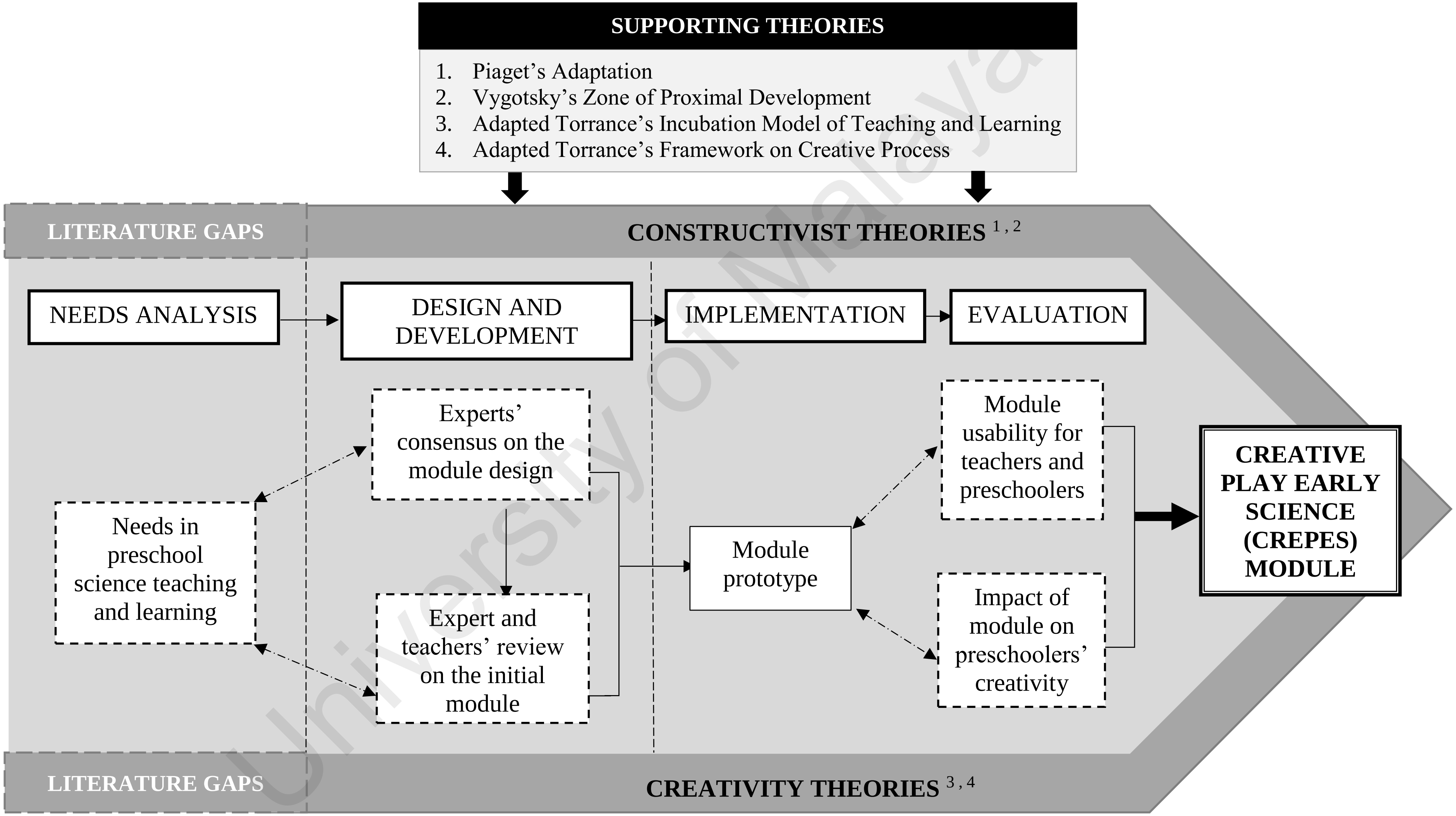


Figure 1.3. Conceptual framework for the study.

Scope of Study

In this present study, the focus was on creativity—specifically how the creative play approach could develop six year-old preschoolers' creativity through the CREPES module activities. Other aspects such as preschoolers' understanding of science concepts or acquisition of science process skills; or developmental areas such as general cognitive abilities, physical and social competencies were not assessed.

Among other types of play, this present study emphasised specifically on creative play as a medium to develop creativity through early science. Children's play out of the preschool environment and child-initiated free play were not the focus of this research. Furthermore, preschool teachers and preschoolers involved in this study were from the private sector. Other types of preschools in Malaysia such as public MOE preschools or international preschools were not studied in this research.

In designing and developing an early science module, this research focused only on the teaching and learning of preschool science throughout the study. The CREPES module activities were specifically designed to be implemented as preschool science activities. Although the module activities were interdisciplinary and involved integration across other curriculum strands, other content areas such as language and literacy were not studied. Next, the module was specifically tailored for preschoolers aged six in the context of this study. The module's impact toward younger or older children such as toddlers or primary school students were not the focus of this study. Implementation of the module only involved two classes of preschoolers in one private preschool in the Klang Valley.

In addition, due to the dynamic development of preschoolers, creativity in this study was not measured per se. Instead, the creativity assessment was used to indicate the impact of the CREPES module on preschoolers' creativity; rather than define their creativity in any way. Whether the module enhanced preschoolers' scientific content knowledge and understanding of concept compared to the conventional approach were also not studied in this research.

Limitations of Study

This research study employed the "product and tool research" under the design and development approach (Richey & Klein, 2014). Due to the nature of this research design, the findings of this study were context-specific and less generalisable (Klein, 2014).

Furthermore, this study was conducted specifically on private preschool settings in the Klang Valley as a measure to help improve practice in the private sector where there is uneven performance and training. Thus, findings from this present study might not represent perceptions of participants from the public preschool sector and those from other regions in Malaysia.

The issue of time was also one of the greatest limitations in the implementation of the CREPES module. As the module was implemented near the end of the year, preschoolers from the setting involved were occupied with year-end graduation and concert practice as well as final assessments before the school holidays. Schedules were especially packed for the six year-old preschoolers who were undergoing assessments before entering into primary school in the following year. Due to time constraints, no official field tests were conducted prior to the module implementation.

In addition, upon request from the preschool management, module implementation had to be condensed into a shorter period of time. As a result, six module activities were conducted within three weeks in order to accommodate to the time constraint as required by the setting. Each activity took approximately 45 minutes to an hour to conduct. A more significant impact of the module could have been achieved had there be longer time available to implement the module. In addition, qualitative data could also be richer and more saturated, as more themes may emerge if the module were to be implemented for a longer period.

Moreover, the CREPES module activities only focused on two topics, namely 1) float and sink, and 2) magnets on the science content area. The evaluation of the CREPES module in Phase 3 only involved a considerably small sample size (n = 56) in one preschool setting, as this present study employed a quasi-experimental design and had to take existing classes to minimise disruption to preschoolers' learning. This affected the generalizability of this research study.

Furthermore, subjects involved in the control and experimental groups were from two different preschool settings, which differ in various dimensions including management, philosophy and sociocultural setting. In addition, two different teachers were involved in implementing the module. Although guided by the same module and orientation session, there may be a certain degree of difference in terms of delivery and implementation of the module activities between both teachers due to varying teaching styles and interpretation of the module. Added together, these methodological limitations may have impacted the overall findings to a certain extent.

Nevertheless, this study has undeniably added to the existing evidence in the areas of play and creativity in the early childhood context. In addition, it contributed new knowledge on the teaching of early science through developing an "empirical basis" (p. 142) for the module developed (Richey & Klein, 2014). The CREPES module was designed and developed based on the identified needs of a selected number of preschool teachers in the teaching and learning of early science, and consensus of experts involved in the Delphi study.

It is also important to note that the CREPES module serves only as a guidance for preschool stakeholders. It could be modified and tailored accordingly to meet the respective needs of various preschool settings with differing nature. The activities suggested are dependent largely on the context of implementation, which includes level of support received from preschool management, teachers' competencies, available resources and space, as well as the preschool's philosophy in practice.

Definitions of Terms

Play. Many different definitions of play exist due to the complex attributes associated with it. It is characterised by being pleasurable (O'Connor, 2014), meaningful and actively engaging for children (Johnson, 2007).

Based upon the perspective that play leads to learning and development, this present study conceptualises play as a medium for teaching and learning under appropriate guidance and facilitation by adults. Play in the context of early childhood education was the focus of this study, by which play is incorporated into the preschool curriculum as a medium for teaching and learning. Essentially, play in this study could be interpreted as a medium to develop creativity among preschoolers through hands-on early science activities in the CREPES module.

Creativity. Similar to play, creativity is also "illusive" and "exceedingly complex" in nature (Johnson, 2007). According to the framework of creative process proposed by Torrance (1964, as cited in Isbell & Raines, 2013), creativity encompasses the following:

a. Originality: the ability to come up with ideas and products that are new or unusual
b. Fluency: the ability to generate a variety of different ideas
c. Flexibility: the ability to modify an idea through thinking in different ways
d. Elaboration: the ability to extend an idea into a more elaborate one.

In light of the relevance of these dimensions to the research context and design of this present study, creativity was interpreted based only on the first two elements from the Torrance's framework of creative process (1964, as cited in Isbell & Raines, 2013) namely "originality" and "fluency". Through the creative process, the aspect of imagination should not be neglected. Hence, in addition to the dimensions of "originality" and "fluency", creativity in this study will also take into account the dimension of "imagination" in line with Torrance's creativity assessment TCAM. It is defined as the ability to imagine, imitate, fantasize and take on unaccustomed roles (Torrance, 2000; Zachopoulou et al., 2009). In the context of this study, it denotes the extent to which preschoolers exercise their imagination to problem-solve and produce ideas in the creative process.

It is important to note that derivation of what creativity is for young children at their early childhood should not be overly stringent – the focus should be on the process rather than the product (Sharp, 2004). Therefore, creativity is not regarded as an end product in this study, rather the desired outcome of the CREPES module among preschoolers, or an ability that develops continually as preschoolers engage in creative play science activities. In light of this, creativity test scores were not used to solely measure and define preschoolers' level of creativity in this research study.

Creative play. Creative play denotes play activities that stimulate creative and imaginative thinking, in other words "out of the box" or "divergent play activities that stimulate creative thinking" (Holmes, Romeo, Ciraola, & Grushko, 2014). It is a medium whereby children are provided with opportunities to be creative, i.e. to formulate a variety of unique ideas and to imagine through active explorations. Garaigordobil and Berrueco (2011) stressed the importance of creative play in stimulating children's curiosity and problem-solving abilities, which contribute to learning.

This study focused on how creativity could be incorporated into play in the early childhood science curriculum. Creative play, in the context of this study was viewed as a platform whereby preschoolers develop creatively through early science activities that specifically enhance their creativity. Hence, structured cognitive play, or play with the mere purpose of achieving predetermined academic learning outcomes with little opportunities for creativity development was not the explicit focus in this present study.

Early Science. The Malaysian preschool curriculum, i.e. NPSC places early science under the strand of science and technology. It emphasises early science as a means to develop scientific attitudes and master science process skills through the exploration of the living world, material world and physical world (Ministry of Education, 2017).

In this present study, the term early science equates to the science content area where creative play is incorporated to develop preschoolers' creativity. The term "preschool science" is also used interchangeably. It is not considered as a distinct standalone subject, rather integrated within a network of different developmental domains including language and communication, and social development among others.

Preschool. The term "preschool" generally refers to pre-primary education, i.e. education provided to children before they receive formal primary education. Preschool in the context of this study denotes all Malaysian private early childhood programmes that provide education for preschoolers from the age of four to six years old. Public and international preschools, as well as childcare services for children below the age of four however, were not included in the scope of this study.

Instructional module. Instructional module refers to a compact set of teaching guidance for teachers with important information on a specific selected topic. It typically contains clear instructions for users and comes with complementary learning activities to be applied in the teaching and learning process.

In context of this study, the CREPES module is also known as a "teaching module". Specifically, the module was designed and developed, implemented and finally evaluated in this study. This module consists of different creative play early science activities to be implemented by teachers in the early childhood classroom with preschoolers. It also acts as pedagogical support for preschool teachers to promote creative play particularly in teaching early science and developing creativity among preschoolers.

Instructional design. Instructional design is a systematic process of developing instructional materials based on learning and instructional theories in order to help learners learn more effectively. It is also an intellectual means to solve instructional problems (Rothwell & Kazanas, 2011; Shambaugh & Magliaro, 2001). This whole process generally includes analysis of learners' needs and problems, developing instructional materials and activities to meet the needs, and the evaluation of the developed instruction (University of Michigan, 1996).

In the context of this present study, instructional design refers to the entire process of 1) analysing the needs in preschool science teaching and learning; 2) designing and developing the CREPES module; and 3) implementing and evaluating the CREPES Module in an actual preschool setting. The product of this process of instructional design was the CREPES module which aimed to enhance preschoolers' creativity through creative play science activities.

Chapter Summary

This chapter provided a brief background of the study. It described the need for this study and how it could fill the gap between actual practice and the ideal of creative play implementation in early childhood settings. In accordance with the problem identified, the research objectives and questions were stated consecutively by phase. The need for this study, as well as how the research findings contributed to the existing body of knowledge and the Malaysian early childhood sector were also discussed.

A conceptual framework was developed and discussed, followed by the scope of the study. Limitations of the study were also delineated in this chapter. The chapter ended with definition of terms used throughout the research study. The next chapter will explore related literature and relevant theories that support this study.

Chapter 2

Literature Review

Conducting a literature review enables the researcher to relate this present study to existing literature in line with the context of the study. It allows critical analysis and comparison between past research studies conducted on play, creativity and early science. This literature review included a comprehensive synthesis and analysis of the relevant literature in order to highlight the research gaps.

This chapter is structured in several sections using the top-down approach, starting from the general to the specific research area. A general overview of play is outlined in the first section, followed by play in the context of early childhood education. Play is then discussed alongside creativity and science. Next, preschool teachers' competence in implementing play, creativity and early science instruction are explicated. This chapter also discusses and interprets the theories used to support the study. A theoretical framework is then presented. The main gaps identified from the literature review are summarised at the end of this chapter.

Background of Play

A plethora of definitions exist pertaining to what constitutes play. The multifaceted nature of play and the wide range of behaviours it includes lead to the difficulty in reaching a consensus on the definition of play (Fleer, 2009; Fisher et al., 2008; Fung & Cheng, 2012; McInnes, Howard, Miles, & Crowley, 2009; Van Oers & Duijkers, 2013; Whitebread, Coltman, & Jameson, 2009; Wong, Wang, & Cheng, 2011). Slunjski and Ljubetic (2014) suggested that play is generally a "non-specialized, non-clear cut multifunctional activity" (p. 127). Nevertheless, various characteristics of play have been identified through the attempts to define play. Some common defining features of play include pleasure (O'Connor, 2014; Singer, 2013), active engagement, and the intrinsic value play contains (Johnson, 2007; Singer, 2013).

For decades, play has been recognised as an important medium of learning especially in the context of early childhood education (Einarsdóttir, 2010; Huisman et al., 2013; Kuschner, 2012; Milteer & Ginsburg, 2012; Samuelsson & Carlsson, 2008; Whitebread, Coltman, & Jameson, 2009). Cohen (2007) suggested that the history of play could be traced as far back as the creation of man. However, the importance of play and its powerful impact on children's development were underestimated until the 18th century when theories of play began burgeoning (Santer, Griffiths, & Goodall, 2007; Van Der Kooij, 2007). Classical theories have defined play as a form of relaxation (Lazarus, 1883, as cited in Saracho & Spodek, 1995), preparation for the adults' world (Groos, 1901), the expenditure of excess energy (Schiller, 1873, as cited in Saracho & Spodek, 1995), or an expression of instincts (Hall, 1906). These classical theories were over-simplified as the correlation between play and child development were neglected to be considered.

Cohen (2007) noted that educationists were the pioneers who laid the early foundation for play in early childhood education. This was when the intertwined relationship between play and learning began to be increasingly noticed. One of these key pioneers was Froebel, also known as the "Father of Kindergarten". He saw play as a medium for learning in his first established kindergarten. He believed play leads children to a happy childhood through the invention of play materials he called "gifts and occupations" (Tovey, 2012). Froebel (as cited in Lilley, 1967) articulated the power of play in children's development:

> Play is the highest level of child development…It promotes enjoyment, satisfaction, serenity, and constitutes the source of all that can benefit the child… At this age play is never trivial; it is serious and deeply significant. It needs to be cherished and encouraged. (p. 83-84)

Besides Froebel, Maria Montessori also advocated structured play through children's manipulation of educational toys as one of the core principles of learning; whose philosophies are still in use in many early childhood classrooms till today.

Contemporary educational psychologists subsequently identified links between children's play and cognitive development, which was then a breakthrough to the available body of research pertaining to play. Piaget and Vygotsky were notable theorists who contributed significantly on the knowledge about children's play. In a Piagetian perspective, play reflects one's level of cognitive development; whereas Vygotsky noted that play has the ability to propel a child forward in terms of cognitive development (Saracho & Spodek, 1995). As Vygotsky (1978) emphatically posited, "play creates a zone of proximal development in a child... play contains all developmental tendencies in a condensed form and is itself a major source of development" (p. 102).

With these early literature forming the foundation of play theories, the body of research on play continues to grow today. Differing conceptualizations of play have spurred researchers to ascertain the vast developmental benefits of play for children (Fisher et al., 2008). Compared to didactic formal learning approaches, children were found to learn, participate and perform better in playful conditions in terms of motivation and concentration (McInnes, Howard, Miles, & Crowley, 2009); thinking skills (Lee, 2013); physical abilities (Milteer & Ginsburg, 2012); cognitive understanding (Ismail Abdul Fatai O, Asrul Faqih, & Wafa K. Bustan, 2014; Sandberg & Heden, 2011); language development (Aliza Ali, Zahara Aziz, & Rohaty Majzub, 2011; Reynolds, Stagnitti, & Kidd, 2011; Van Oers & Duijkers, 2013); social competence (Nicolopoulou et al., 2009; Reynolds et al., 2011; Sandberg & Heden, 2011); and also the development of healthy self-image (Jackman, 2011). Miller and Almon (2009) further asserted that play has a vital role in children's neurological development as the processes involved during play allow the linkages of the neural system, through which a child's competence in learning, cognition and communication is enhanced. In addition, findings from the research study of Kennedy-Behr, Rodger, and Mickan (2015) posited that participation in group play is positively correlated to preschool children's general well-being.

This long-standing history and theoretical development of play affirm the importance of play towards children's learning and holistic development. Hence, play is enshrined as the main approach for children's learning and a crucial philosophical foundation of early childhood education in many countries including Finland, Sweden, the United Kingdom and Malaysia alike. Based upon the perspective that play leads to effective learning and development, this present study conceptualised play as a pleasurable, actively engaging medium for teaching and learning.

Nevertheless, there remain several gaps in the literature surrounding play and its developmental benefits. A review of the past studies conducted internationally (Table 2.1) and locally (Table 2.2) on the play approach and its association to children's development was outlined to illuminate the research gaps.

Table 2.1

Matrix on Past Studies of Play and its Developmental Outcomes (International)

Study	**Developmental area**	**Country**	**Research Objective**	**Research design/method**	**Sample**	**Main Findings**
McInnes, Howard, Miles, & Crowley (2009)	Children's behaviour	England	Explore behavioural differences among children under playful compared to formal condition	Experimental study with pre- and post-test under 2 different conditions: formal and playful by using videotaped observations	32 children from 3 to 5 years old from 3 early years settings	Positive learning outcomes were exhibited among children under playful condition compared to formal condition (improved concentration, more sophisticated problem-solving abilities, higher performance and better learning experience).
Whitebread, Coltman, & Jameson (2009)	Cognition and self-regulation	England	Explore relationship between children's play and their metacognition and self-regulation	Experimental and observation	1st study: 35 children aged 5-7 years 2nd study: 16 children aged 3-4 years	Play leads to significant gains in metacognition and self-regulation among children, especially pretend play.

Table 2.1 (*continued*)

Study	**Developmental area**	**Country**	**Research Objective**	**Research design/method**	**Sample**	**Main Findings**
Newton & Jenvey (2011)	Social competence	Australia	Investigate whether social play is associated with preschool children's social competence	- Testing sessions to measure children's verbal ability and "Theory of mind" - Parent-rated survey on children's social competence - Observation of children's free play sessions	85 children of 3-5 years	Frequent involvement in social play is associated with higher social ability.
Reynolds, Stagnitti, & Kidd (2011)	Social and language ability	Australia	Compare children's play, language and social skills in a traditional structured versus a play-based classroom	Quasi-experimental over a six-month period	Baseline assessment: 31 children (mean age: 5.5) Follow-up: 26 children (mean age: 5.9)	Children in play-based curriculum exhibited significant gains compared to those in traditional structured classroom.

Table 2.1 (*continued*)

Study	Developmental area	Country	Research Objective	Research design/method	Sample	Main Findings
Bulunuz (2013)	Understanding of Science concepts	Turkey	Investigate preschool children's understanding of science concepts through play versus direct instruction	Quasi-experimental pre-test/post-test design	27 children from public kindergarten of age 5-6 years	Teaching Science through play enhances students' understanding of Science concepts.
Lee (2013)	Thinking skills	New Zealand	Explore children's thinking abilities during play activities	Qualitative study by cognitive task analysis	28 primary pupils of 7-8 years old	Play acts as a powerful medium for students to utilize their thinking abilities.
Van Oers & Duijkers (2013)	Vocabulary acquisition	Netherlands	Compare children's vocabulary acquisition through play-based versus teacher-directed classroom	Quasi-experimental pre-test/post-test design	42 children of age 4-6 years old	Positive gains in vocabulary mastery through play approach compared to didactic learning.

Table 2.2

Matrix on Past Studies of Play and its Developmental Outcomes (Malaysian Context)

Study	Subject area	Research objective	Research design/method	Sample	Main findings
Aliza Ali et al. (2011)	Reading (language and literacy)	Determine how the play-based intervention enhances children's reading ability	Action research with mixed mode design	4 private preschool teachers and 6 year old preschool children	Learning through play helps enhance reading ability.
Jaslinah Makantal (2012)	Social skills	Identify levels of social skills acquisition during play	Qualitative case study	6 preschoolers	Children showed positive outcomes in social skills during play activities.
Zakiah Mohammad Ashari et al. (2013)	Mathematics (Understanding of number concept)	Ascertain the effectiveness of a learning through play module to children's understanding of number concept	Quasi-experimental pre-test/post-test design using a learning through play module	96 preschoolers aged 4+ and 5+ and 4 teachers from 4 Ministry of Education preschools	Use of play module significantly increased understanding of number concept.
Nair et al. (2014)	Malay language (vocabulary)	Compare children's language learning through the use of play and traditional method in teaching the Malay language	Experimental research	100 preschoolers from Tamil government preschool	Play method improves students' mastery of Malay vocabulary and raises interest level towards Malay language.
Yin et al. (2014)	Creativity and imagination	Examine children's creativity and imagination through messy play	Qualitative multi-site case study	2 preschool principals and 4 children	Messy play helps in children's development of creativity and imagination.

Based on Table 2.1 and 2.2, the researcher argues that there are gaps and limitations in the literature surrounding play and its effects toward children's development. Interestingly, all of the studies conducted internationally as outlined in Table 2.1 employed preschoolers as samples. In contrast, studies in the Malaysian context (Table 2.2) involved a greater range of samples including teachers and principals. This present study included a variety of samples namely preschool teachers, early education experts and preschoolers according to the respective research questions. This contributed to the development of a valid module based on multifaceted data collected from different groups of participants.

For decades, the effects of play on children's learning and development have been studied by a significant body of research. The significance of play towards children's development has been established by many researchers. However, the researcher holds the view that there should be new research directions regarding play in the present era. Firstly, an emergent gap from the review revealed that many studies inclined toward examining the effects of play towards the cognitive domain. Despite the importance of creative abilities today, how creativity can be infused and developed through play has not been explicitly explored. There is an apparent focus specifically on academic-related outcomes such as language skills and numeracy. This is especially evident in the studies conducted in Malaysia as outlined in Table 2.2, where only one study looked at how play could promote creativity and imagination.

In many research studies conducted, play is often seen and used as a tool within the frames of specific subjects. For instance, in the study of Chin and Effandi Zakaria (2015), preschoolers were taught mathematics using the game-based approach. Subsequently, their mathematics achievement levels were tested. The researcher contends that play is often compartmentalised within the structure of subjects with little consideration of the integration of other content areas. Most studies have neglected to consider the integrated and dynamic nature of young children's development and learning. Hence, although this module focuses on preschool science instruction, its activities are interdisciplinary in nature. This justifies the selection of creativity as a generic skill to be tested, instead of focusing on the measurement of children's science proficiencies such as the acquisition of scientific concepts per se.

Moreover, the researcher has also discerned a methodological limitation based on the literature review. Most researchers tend to focus on measuring children's outcomes by solely employing quantitative methods. By evaluating the desired outcome of the CREPES module i.e. preschoolers' creativity using both quantitative and qualitative methods, this present study was able to gain solid evidence through both types of data collected and hence overcome this methodological limitation. How this study helped in addressing the gaps found in the literature was outlined in Table 2.3 to further establish the significance and contribution of this present study.

Table 2.3

Role of this Study in Addressing Gaps

Gaps	**How this study addressed these gaps**
Inclination toward examining effects of play on cognitive domain and academic outcomes— creative abilities rarely studied	This present study evaluated the impact of creative play on preschoolers' creativity through the CREPES module implementation.
Compartmentalisation of play within subjects— multidisciplinary nature of play disregarded	Despite the focus on the science content area, the CREPES module involved multidisciplinary play activities integrating various curriculum strands.

Table 2.3 (*continued*)

Excessive focus on measuring children's outcomes solely by quantitative methods	Both qualitative and quantitative methods were used in this study as an evaluation of preschoolers' creativity.

Play in the Preschool Curriculum

Since play forms the foundation for children's learning and development, it should be a prevalent component integrated in the preschool curriculum. According to the Developmental Appropriate Practice (DAP) as a universal standard for early childhood programmes, play is an essential instrument in a child's development in terms of self-regulation, language, cognitive and social skills (National Association for the Education of Young Children, 2009). Aligned with many other researchers, Whitebread, Basilio, Kuvalja, and Verma (2012) firmly reiterated that play is a crucial element in enabling optimal development among young children.

Despite this, there still seems to be a certain degree of uncertainty and fuzziness about what entails a quality early childhood curriculum. For instance, there remains a controversy of the weightage of play and work in early childhood programmes, with divergent views among stakeholders and researchers. Kuschner (2012) emphasised that allocated time for play in the preschool curricula should be defended due to its importance to children; as the overemphasis on tests and rote learning may lead to extremely stressed, anxious and under exercised preschoolers (Nicolopoulou, 2010). Yet, play time around the globe was found to be significantly reduced due to the overemphasis on literacy and numeracy to prepare for formal schooling (Fisher et al., 2008; Huisman et al., 2013; Kemple, Oh, & Porter, 2015; Milteer & Ginsburg, 2012; Nicolopoulou et al., 2009; Nicolopoulou, 2010; Sandberg & Heden, 2011; Van Oers

& Duijkers, 2013). Despite the fact that teachers regard play positively and acknowledge its benefits to children's development (Sandberg & Heden, 2011), their authority to allocate more time for play in the curriculum is jeopardised by parental expectation and obligation of academic mastery (Fung & Cheng, 2012). Hence, play is often crowded out and replaced by long hours of structured, teacher-directed learning in the early childhood classroom.

Among the underlying problems behind this issue could be the misperception of stakeholders about what play and learning encompass. Samuelsson and Carlsson (2008) pointed out that play and work are commonly perceived to be two activities of different nature. While work takes place during learning and direct instruction, play occurs only during free time between work.

A recent research study by Norsuhaily Abu Bakar et al. (2015) concurs with the above researchers. While Samuelsson and Carlsson (2008) distinguished both the constructs by when they typically take place, Norsuhaily Abu Bakar et al. (2015) reported that preschool teachers view play and work as having extremely differing attributes—play as pleasurable whereas work as structured, "serious…and even stressful…for young children" (p. 238).

Several evidence highlighted that this "work-play dichotomy" has created a mismatch between the ideal implementation of play-based learning and the reality of implementing a didactic structured curriculum in order to prepare children for primary school (Anning, 2011; Gleave & Cole-Hamilton, 2012; Wood, 2010). This discrepancy between the ideal rhetoric and practice in reality pertaining to the implementation of learning through play has led to a global crisis of play in many early childhood institutions (Bulunuz, 2013; Fung & Cheng, 2012; Wong et al., 2011).

To alleviate this “tug-of-war” between play and work, Samuelsson and Carlsson (2008) argued that play and learning should not be perceived as isolated elements but rather as interweaving connected bodies with a significant degree of congruity. This concurs with Fisher, Hirsh-Pasek, Golinkoff, Singer, and Berk (2011) who maintained that both play and learning are “not incompatible” (p. 342). They contended that play and academic mastery complement each other i.e. “play *via* learning”, instead of contradicting each other as “play *versus* learning” (p. 353). In tandem to this conceptualization, they proposed the pedagogy of “playful learning” which combines both free play and guided play to strive towards developing children with 21st century competencies. While free play occurs under minimal adult control, guided play takes place as an adult purposefully directs a child towards certain content knowledge in a “playful, fun, and relaxed” manner (Lillard, 2013, p. 157). Lillard (2013) further characterised playful learning as “child-centred, constructivist, affectively positive, and hands-on” (p. 158).

Similarly, recognising the importance of active exploration for preschool children, Miller and Almon (2009) proposed a “kindergarten continuum” which centres upon two essential components to ensure children’s holistic well-being. They emphatically called for a balance of both child-directed play and teacher-guided playful learning in the preschool curriculum. Likewise, the need for a balanced preschool curriculum integrating both play and learning as the curriculum framework was also highlighted by several other researchers (Beghetto et al., 2012; Saemah Rahman et al., 2012).

Adapting "the kindergarten continuum" by Miller and Almon (2009), the researcher integrated the concept of "playful learning" posited by Fisher et al. (2011) to propose a more comprehensive kindergarten continuum as shown in Figure 2.1.

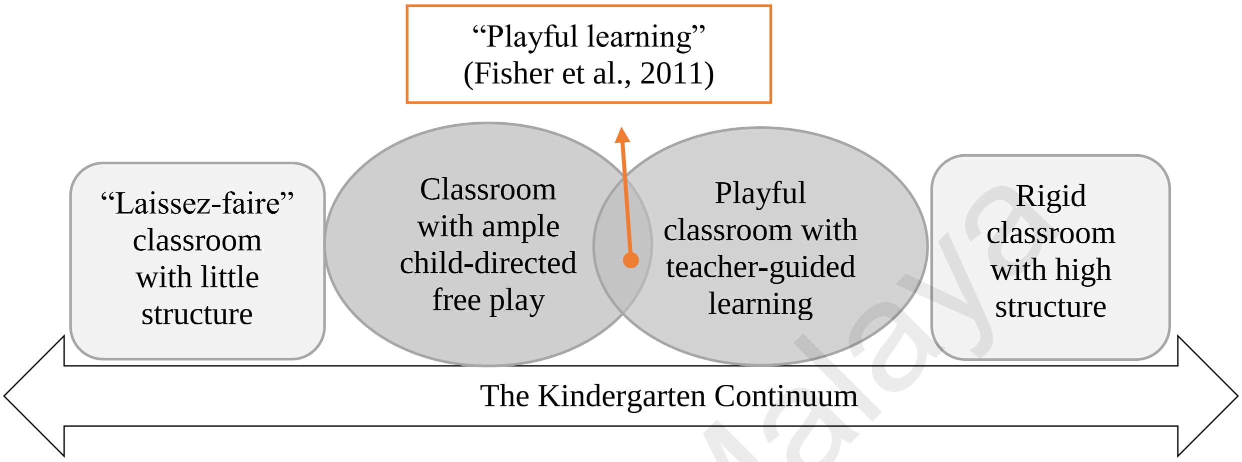


Figure 2.1. Adapted kindergarten continuum.

This proposed framework implies the importance of the role of adults in children's play. Furthermore, it pinpoints the significance to strike an appropriate balance between free-flow child-initiated play and adult-directed learning. It is however, important to note that child-initiated play does not imply that it should be completely free from academic learning as pointed out by Beghetto et al. (2012). Rather, the key issue is how play could be integrated and applied while children indirectly learn academic content.

Achieving proper balance of both child-initiated and teacher-guided play is heavily dependent on a teacher's competence and professionalism. It has been widely recognized that outstanding teachers are one of the key determinants to the success of any education system. To be competent at conducting developmentally appropriate activities for children's optimal development, the bottom line is that all preschool teachers as key stakeholders of an early childhood programme should be equipped with adequate knowledge and hold right perceptions towards play in the early childhood curriculum.

While teacher-guided play is equally important as its free play counterpart, it is worth noting that teachers should be mindful of crossing the boundaries of children's play territory, overpowering and eventually taking control of their play. Children's ideas and control over their own play scenarios should be safeguarded and retained at all times. Teachers should only intervene when appropriate to allow leeway for children's own creative expressions, rather than attempting to manipulate children's play by their own ideas and to excessively link play with academic goals. Excessive emphasis on the academic outcomes in play would risk robbing away children's intrinsic motivation and enjoyment (Singer, 2013).

The integration of play has not been apparent and effective in a majority of Malaysian preschools. In contrast to the rhetoric established in the NPSC, a myriad of research evidence indicate that formal learning is still used as the main mode of teaching in many early childhood programmes across the nation (Aliza Ali et al., 2011; Aliza Ali & Zamri Mahamod, 2015; Chen & Chong, 2014; Ng & Yeo, 2014; Norsuhaily Abu Bakar, 2009; Norsuhaily Abu Bakar et al., 2015; Rohaty Mohd Majzub, 2013; Sharifah Nor Puteh & Aliza Ali, 2013). Findings from a preliminary study indicated that large numbers of young Malaysian preschoolers in private settings still learn in traditional, structured classrooms where academic and rote learning take up most of the daily preschool routine. This contradicts with the ideal balance and integration of play and learning in order to create a conducive environment for young children to learn and develop holistically.

What could be the factors behind the lack of implementation of the play approach in the Malaysian preschool context? Asian parents are known to place greater value on academic learning rather than play (Fung & Cheng, 2012). Generally, to what extent is this true regarding Malaysian parents? Literature revealed similar findings. Malaysian parents expect their children to be prepared for formal schooling through their enrolment in preschools (Curriculum Development Centre, 2007; Norsuhaily Abu Bakar et al., 2015). According to the study conducted by Norsuhaily Abu Bakar et al. (2015), Malaysian parents generally possess three different types of perspectives on play in early childhood education. Firstly, academic-related learning is perceived as more important to children compared to play. This implies that they view children's play as frivolous and without meaning. Secondly, play should only serve a recreational purpose when children's work is completed. This reflects the concept of "work-play dichotomy". Lastly, some parents perceive play as an instrument for educational uses. While this perspective appears sound, it undervalues the intrinsic qualities within children's play, limits children's control, and jeopardises their play ownership. Analysis of the researcher discerned an underlying reason behind all three perspectives which originated from the excessive emphasis parents place on children's academic achievement. There is a need for a paradigmatic shift in the conventional misconception that academic excellence is the priority for children in their early childhood.

Teachers' perceptions on play. As key stakeholders, preschool teachers' perceptions on play will significantly influence the implementation of play in the curriculum. Available research evidence indicate that most Malaysian preschool teachers see play as a powerful tool of learning and development (Hafsah Jantan, Abdul Rahim Hamdan, Fauziah Hj Yahya, Halimatussadiah Saleh, & Mohd Hanafi

Azman Ong, 2015; Norsuhaily Abu Bakar et al., 2015; Sharifah Nor Puteh & Aliza Ali, 2013). Findings from the study of Wirawani Kamarulzaman (2015) echoed that preservice preschool teachers were aware of the potential of play towards children's development of critical thinking skills.

However, play was regarded by some Malaysian preschool teachers as a practical approach only if it is related to the learning content (Norsuhaily Abu Bakar et al., 2015). This concurs with Fung and Cheng (2012) who highlighted that Hong Kong preschool stakeholders perceived play only as an instrument for the "transmission of teaching content" (p. 26). This instrumentalisation of play defeats the purpose of children's play and leads to the loss of the very nature of children's play. Nicolopoulou (2009) cautioned against viewing play merely as a tool to achieve specific outcomes without taking into account the intrinsic motivation attached with it. As such, play is at risk of becoming excessively scripted and structured with predetermined objectives or learning outcomes; instead of spontaneous, pleasurable and child-initiated (Gleave & Cole-Hamilton, 2012).

Arranged chronologically, Table 2.4 delineates recent research studies pertaining to teachers' perceptions of play. An obvious trend among the studies done indicated that preschool teachers generally acknowledge the power of play towards children's learning and development. However, the challenges in implementing the play approach remain unaddressed due to the significant degree of mismatch between teachers' beliefs and their practice. Besides parental expectations as discussed previously, the incorporation of play in practice is also constrained by other factors including lack of resources or space, and obligations to complete the syllabus (Norsuhaily Abu Bakar et al., 2015). Another factor that was less often postulated is teachers' competence to implement play in practice, as pointed out in the study of Sharifah Nor Puteh and Aliza Ali (2013). This will be subsequently discussed in a distinct section in this chapter. Through the development of the CREPES module, this study aimed to help improve preschool teachers' pedagogical knowledge to deliver creative play activities in early science.

Table 2.4

Research Studies Regarding Teachers' Perceptions of Play

Study	Country	Research Objective	Research design/method	Sample	Main Findings
Sandberg & Heden (2011)	Sweden	Explore teachers' perception on how play contributes in children's learning processes	Qualitative study with the use of semi-structured interviews	7 elementary school teachers	Through play, teachers discerned evident gains in terms of children's social and academic competence.
Bulunuz (2012)	Turkey	Explore the development of teachers' understanding and attitude towards the use of play in teaching science at the start and ending of a science course	Mixed method design with interviews, student' reflections and survey	94 preservice preschool teachers	Teachers recognised the importance of play in teaching science.
Fung & Cheng (2012)	Hong Kong	Investigate stakeholders' perceptions on learning through play in ECE settings	Qualitative case study through observation and interviews	20 ECE settings including principals, teachers and parents	Stakeholders agreed on the benefit of play. However, findings suggested challenges for play implementation and disagreements between stakeholders.

Table 2.4 *(continued)*

Sharifah Nor Puteh & Aliza Ali (2013)	Malaysia	Determine teachers' perceptions about the effects of play towards children's language skills	Quantitative structured questionnaire	60 preschool teachers from various setting types	Overall positive feedback about play and its effects towards language skills. Barriers that hinder play approach were found.
Sherwood & Reifel (2013)	United States	Explore preservice teachers' beliefs on the role of play in learning	Basic qualitative methodology with interviews	7 preservice preschool teachers	Participants believed that play has its value but is not essential to children's learning.
Jung & Jin (2014)	United States	Explore participants' perceptions about the role of play in early childhood classrooms	Quantitative survey	207 preservice preschool teachers	Participants generally held positive perspectives towards play.
Wirawani Kamarulzaman (2015)	Malaysia	Explore participants' perceptions about the effects of play towards children's critical thinking skills	Qualitative study with the use of semi-structured interviews	2 preservice preschool teachers from a private institution	Participants were aware of the importance of play towards inculcating critical thinking skills among preschoolers.
Ramlah Jantan, Nor Afni Resad, & Siti Fathimah Az-Zahra (2016)	Malaysia	Survey on teachers' perceptions on effectiveness of fun-play approach on literacy skills among preschool pupils	Quantitative survey	80 MOE preschool teachers	Majority considered fun-play approach easy to implement, fun, and effective in improving children's literacy skills.

Creativity in the Preschool Curriculum

Today, creativity has been regarded globally as a significant 21st century skill which determines one's later success (Eckhoff, 2011; Siti Zakiah Syed Mustafa & Norazila Abd Aziz, 2011). The importance of this skill has prompted researchers to formulate definitions to ascertain what creativity entails. Defining creativity however, has been regarded as a complicated quest, as creativity is relatively vague and complex in nature (Eckhoff, 2011; Johnson, 2007). Reuter (2007) reasoned that the difficulty in reaching a consensus on the definitions of creativity is one of the causes for the neglect of creativity research. Various definitions regarding creativity have been posited by different researchers. Several overlapping elements that emerged through different scholars' attempt to define creativity include:

a. Imagination
b. Originality: the ability to come up with ideas and products that are new or unusual
c. Productivity: the ability to generate a variety of different ideas through divergent thinking
d. Problem-solving: application of knowledge and imagination to a given situation
e. The ability to produce an outcome of value and worth (Sharp, 2004, p. 5)

The NPSC defines creativity as the ability to exercise imagination to gather and formulate ideas; or to create something new or original through inspiration or combination of available ideas (Ministry of Education, 2017). Alkuş and Olgan (2014) posited that creativity is viewed in two distinct angles by scholars. While some focus on the creative process and experience, others define creativity based on the end product produced. However, pertaining to creativity in the context of early childhood education, the researcher contends that the focus should be inclined toward the process of creative development instead of the outcome produced in alignment with the views of O'Connor (2014), Saracho (2012) and Sharp (2004). One of the most well-known researcher on creativity, Torrance (1964, as cited in Isbell & Raines, 2013) established a framework with four main components in the creative process as shown in Figure 2.2.

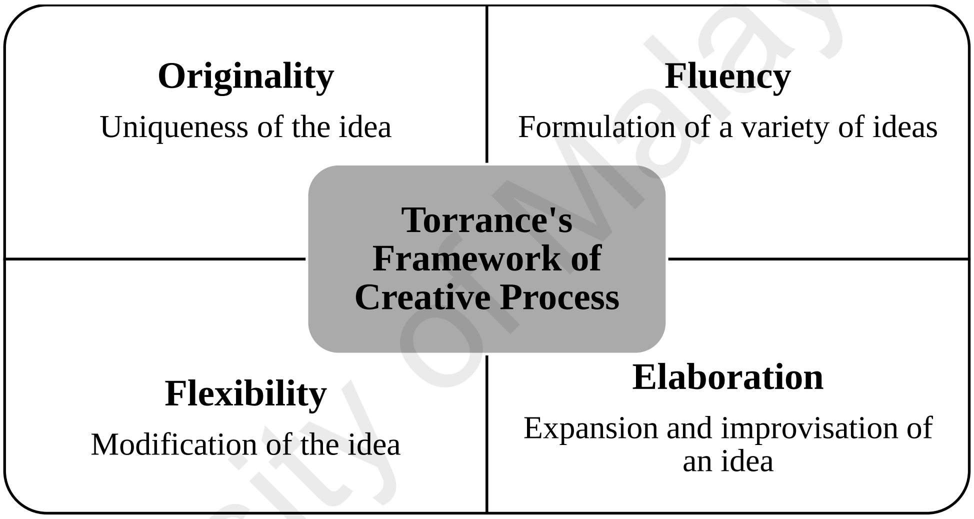


Figure 2.2. Torrance's framework of creative process.

O'Connor (2014) stressed the role of education in nurturing creativity among young children. Many researchers have established the need to begin developing creativity right from the preschool years (e.g., Kim, 2011; O'Connor, 2014). It is believed that ample creative stimulation during the preschool years will contribute to positive outcomes toward children's creative potential in future. This justifies the importance to foster creativity among young children in their early years (Garaigordobil & Berrueco, 2011). This is in accordance with Gardner (1993) who established that the "sensitive period" for creativity development is from the age of three to five (as cited in Cheung & Leung, 2013, p. 397). Integrating creative practice in the classroom will also motivate children to learn, leading to happy children who enjoy learning (Cheung, 2013; O'Connor, 2014).

Despite the fact that the preschool age is generally known as a golden age for creativity development, research evidence suggests that there is a lack of emphasis on children's development of creative potential in preschool settings due to the priority to achieve academically. Creativity was regarded as one of the main "casualties" in early education because of the excessive priority on academic learning (Almon & Miller, 2011). Beghetto et al. (2012) emphasised that the premature focus on structured learning in the ECE curriculum could suppress children's later learning and creative development.

In addition, Kim (2011) claimed that there is a "creativity crisis", i.e. the constant deterioration in creativity among Americans across all ages. The sharpest drop in creativity scores was observed among kindergarten to third grade children which is alarming. However, Kim's study measured creativity only through creativity scores. The researcher argues that this contradicts with the immensely complex nature of creativity especially among young children, whose creativity might not be accurately reflected through scores alone.

According to the NPSC, creativity should be infused in the everyday teaching and learning process. Despite creativity being one of the key skills preschoolers should achieve through the Malaysian preschool education, it is ironic that there is a scarcity of research evidence on this area. To date, little research evidence on creativity in Malaysian preschools is available. A dated report from the Curriculum Development Centre (2007) indicated the lack of creativity development in Malaysian preschool settings. A preliminary study conducted by the researcher reinforced that limited opportunities for hands-on explorations were given to preschoolers, resulting in little space for them to develop creatively.

Azli Ariffin and Roselan Baki (2014) urged for further research to be done to determine an effective approach to develop creativity among preschoolers. This research study therefore represents an earnest effort toward responding to this call by designing and developing an early science module to specifically enhance preschoolers' creativity.

Creativity assessment for preschoolers. Torrance's four components of creativity imply that creativity can be measured by standardized tests (Saracho, 2012). However, the predicament of creativity research lies in the reliability, validity and objectivity of its measurement (Reuter, 2007). Meanwhile, Torrance (2000) contended that there has been a lack of interest in creativity assessment for preschoolers compared to other age groups. One probable reason might be due to the difficulty in measuring young children's creativity levels which resulted in the lower number of research studies about creativity among young children (Wright & Diener, 2012). There are also limited instruments that are suitable to assess preschool children's creative abilities (Torrance, 2000; Starkweather, 1964, as cited in Zachopoulou, Makri, & Pollatou, 2009, p. 318).

Most existing research studies (e.g., Holmes et al., 2014; Kim, 2011; Parsasirat Zahra et al., 2013) have solely employed quantitative tests to measure preschoolers' level of creativity. The researcher questions the appropriateness and accuracy in gauging young children's level of creativity based on numerical test scores alone. It is questionable how creativity, with such complex and ambiguous nature could be measured accurately only by standardized tests for children in their early childhood. This concurs to Zachopoulou et al. (2009) who emphasised the inadequacy of measuring creativity based on quantitative means alone. Isbell and Raines (2013) suggested the use of observations and work sampling as informal methods of creativity assessment for young children. These assessment methods could better cater to young children's individuality and dynamic learning dispositions. Moreover, they could effectively consolidate and triangulate quantitative data in evaluating young children's creativity.

Few research studies have attempted to explore preschoolers' creativity through qualitative methods. Therefore, this present study aimed to fill this methodological gap by employing both qualitative alongside quantitative methods to gauge preschoolers' creativity levels through the implementation of the CREPES module. This research also represents a response to the recommendation for future research by Zachopoulou et al. (2009) on employing a combination of quantitative and qualitative measurement of creativity to obtain naturalistic data.

Moreover, young children's products should not be subjected to adults' judgement as a measure of their level of creativity. This is because they do not yet possess sufficient competencies to produce a creative outcome which could be regarded by the society as outstanding and successful (Sharp, 2004). Children enjoy being engaged in the process of their creative explorations and do not necessarily end up with an end product (Isbell & Raines, 2013). Hence, creativity in this study focused primarily on the process children go through rather than the end product produced.

Torrance Test of Creative Thinking (TTCT). Among the existing creativity measures, Torrance Tests of Creative Thinking (TTCT) is the most common instrument in assessing creativity. Kim (2011) acknowledged its value in measuring the trend in creative thinking over time due to its wide usage and psychometric soundness. TTCT comprises of two different sections, which are TTCT-Verbal test, and the TTCT-Figural test which elicits pictorial responses. This test generally measures four different dimensions namely, fluency (amount of ideas produced), flexibility (number of categories in the responses), elaboration (depth of creative thinking through details), and originality (novelty of ideas).

The revisions of TTCT after its first publication in 1966 have led to the elimination of flexibility from the Figural test and addition of "abstractness of titles" and "resistance to premature closure" and "creative strengths" (Kim, 2007). It is suitable to be administered with preschoolers from aged 6 through adults. It has been used extensively in various research studies both internationally (e.g., Garaigordobil & Berrueco, 2011; Kim, 2011) and in Malaysian context (e.g., Parsasirat Zahra, Fatimah Yusooff, & Mohd Safar Hasim, 2013; Siti Zakiah Syed Mustafa & Norazila Abd Aziz, 2011). Nevertheless, Torrance maintained that test scores should not be used as "a static measure of person's ability" (p. 118), rather they should be used as a means to plan effective instruction to enhance and develop one's creative potential (as cited in Kim, 2007; 2011).

Thinking Creatively in Action and Movement (TCAM). Torrance (2000) pointed out that preschoolers possess limited competencies in expressing their creativity through verbal, written or pictorial responses as their development in these areas are still ongoing. Most creativity tests however, require creative expressions through words and figures.

Considering this predicament, Torrance (1981) developed TCAM test that calls for kinaesthetic rather than verbal or written responses (Kim, 2007; Torrance, 2000). Although this instrument has been tested and proven for its satisfactory levels of reliability and validity (Torrance, 2000; Zachopoulou, Makri, & Pollatou, 2009), the researcher discerned that few studies have employed TCAM as a research instrument. Hence, in light of this methodological gap and TCAM's suitability with the research context of this present study, TCAM was chosen to evaluate preschoolers' creativity in order to ascertain the impact of the CREPES module.

TCAM was specifically developed to be administered to young children from three to eight years old. This test is appropriate for preschoolers as it does not require verbal or written responses. Moreover, it is informal and hence will less likely induce stress or fear among young preschoolers. Torrance (1981, 2000) stressed that the kinaesthetic modality is the most appropriate modality to evoke preschoolers' creative expressions, as skills in this area are most commonly practiced at the preschool age. TCAM is therefore developmentally appropriate for young children. Since the creative play approach through the CREPES module emphasises hands-on experiences and active involvement, this test was the most appropriate for the context of this present study.

It consists of four activities which elicit young children's responses through their physical movements. It assesses young children's creativity in three dimensions including fluency, originality and imagination. Fluency involves the ability to generate many different ideas. Originality is defined as the formulation of unique and unusual ideas. Imagination is the ability to imagine, imitate, fantasize and take on unaccustomed roles (Torrance, 2000; Zachopoulou et al., 2009). Some advantages of

TCAM include few and easily accessible materials, and considerably short time to administer. Table 2.5 describes the activities included in TCAM (Torrance, 1981).

Table 2.5

Description of the Activities included in Torrance Thinking Creatively in Action and Movement (TCAM)

No	Name of activity	Description	Dimension(s) of assessment	Materials required
1	How Many Ways?	Child is required to move across the room in as many ways as possible.	Fluency Originality	Red and yellow tapes
2	Can You Move Like?	Child has to imagine and pretend to be: 1) an animal or object (tree, rabbit, fish, and snake) in 4 situations 2) playing a role related to objects (driving a car and pushing an elephant off a desired object)	Imagination	None
3	What Other Ways?	Child demonstrates different ways to put a paper cup into a wastepaper basket.	Fluency Originality	Paper cups Wastepaper basket
4	What Might It Be?	Child formulates alternate uses for a paper cup (e.g. a hat)	Fluency Originality	Paper cups

Meanwhile, Kim (2007) pointed out a limitation of TCAM, that the instrument and its scoring have not been revised since its initial development by Torrance in 1981. Nevertheless, TCAM has been found to be a valid and reliable instrument for creativity assessment with high values of interscorer reliability, test-retest reliability and validity (Kim, 2007; Torrance, 2000; Zachopoulou et al., 2009). Pertaining to its validity, Kim (2007) maintained that significant positive correlations had been determined between

TCAM and other creative measures such as the modified Piaget's tests of convergent and divergent thinking.

Table 2.6 shows a comparison between Torrance's creativity tests, TTCT and TCAM.

Table 2.6

A Comparison between TTCT and TCAM

Full name	**Torrance Test of Creative Thinking (1966)**		**Thinking Creatively in Action and Movement (1981)**
Acronym	TTCT		TCAM
Nature of measurement	<u>TTCT- Figural</u> 3 activities 1. Picture Construction 2. Picture Completion 3. Repeated Figures of Lines or Circles	<u>TTCT- Verbal</u> 6 activities 1. Ask Questions 2. Guess Causes 3. Guess Consequences 4. Product Improvement 5. Unusual Uses 6. Just Suppose Hypotheses	4 activities: 1. How Many Ways? 2. Can You Move Like? 3. What Other Ways? 4. What Might It Be?
Type of response elicited	Pictorial and written responses	Verbal	Physical action and movement
Dimensions of assessment	1. Fluency 2. Originality 3. Elaboration 4. Abstractness of titles 5. Resistance to premature closure 6. Creative strengths	1. Fluency 2. Flexibility 3. Originality	1. Fluency 2. Originality 3. Imagination

Table 2.6 (*continued*)

Estimated time required	30 minutes	5 to 10 minutes for each activity	15 to 30 minutes
Target group	Preschoolers aged 6 through adulthood		Young children in their early childhood aged 3 to 8

Based on Table 2.6, it is evident that TCAM would be more practical to be applied in this study as compared to TTCT. The ultimate purpose of assessing their creativity in this study was not to measure preschoolers' creativity per se. Rather, scores from the assessment represent quantitative reflections of the module's impact on their creativity, as well as a complementary set of data to triangulate the qualitative data gathered. Since the quantitative measure is not the only means to evaluate the CREPES module, a simpler and less complicated assessment was preferred. Pertaining to the factor of time, TTCT would also be more time-consuming to administer individually compared to TCAM.

In addition, TCAM shows more consistency with the module objectives and could better cater to preschoolers' development. One notable similarity between TCAM and the CREPES module is that both elicit active involvement, where verbal or written responses are not necessarily required. Therefore, TCAM was selected over TTCT as the instrument to ascertain the impact of the module on preschoolers' creativity in this study.

Play and creativity. Since creativity is a crucial skill to be developed in this present era, researchers and educators around the world have been exploring on how best to integrate creativity in educational settings in order to stimulate children's creativity from a young age (Cheung, 2013).

According to Craft (1999), creative development thrives in preschool settings that adopt a pedagogy of play (as cited in Cheung & Leung, 2013). Creativity has been frequently associated with play, especially in context of preschool education (Garaigordobil & Berrueco, 2011; Milteer & Ginsburg, 2012; O'Connor, 2014; Norsiah Fauzan & Norfarahin Mat Zaini, 2015; Oncu & Unluer, 2010; Othman Talib et al., 2014; Reunamo et al., 2013; Sharp, 2004). Through different types of play such as role-play, children are provided with opportunities to imagine, problem-solve and exercise divergent thinking; hence develop their creative potential. O'Connor (2014) emphatically emphasized that "creativity is developed in the early years through a wide spectrum of play. As all developmental learning in the early years is centred within play as a medium of learning, here too lie the foundations of creativity development" (p. 2).

Although play alone does not directly result in creativity development as other external factors such as sociocultural factors have to be taken into account; play is still acknowledged as a crucial catalyst for the development of prospective creativity (Johnson, 2007). In fact, Piaget (as cited in Elkind, 2008) had suggested the relationship between play and creativity through his writing: "Play is the answer to the question: how does anything new come about?" (p. 6). As asserted by Elkind (2008), it is important for adults who consider play as a waste of time to be reminded that as they provide opportunities for young children's natural predisposition to be creative through play, they benefit them in the long term by laying the cognitive groundwork for their future success.

Furthermore, there are several similar features between both play and creativity. Divergent thinking is the main component found in both elements (Russ, 2003). Imagination also stems from both play and creativity. Both are complex and ambiguous; they also own similar attributes which include “intrinsic motivation, spontaneity, initiative, intellectual autonomy, and self-expression” (Johnson, 2007, p. 12).

Besides the theoretical aspect of both these constructs, the researcher also found similarities regarding the play approach and creativity in practice. Both play and creativity are increasingly being crowded out of the preschool curriculum by formal and academic learning in many preschool settings across the globe. One of the main reasons is the apparent clash between both play and creativity with academic goals. Johnson (2007) maintained that Asian countries focus less on the creative component as compared to the Western counterpart. Similarly, play is also considered less important than academic mastery in Asian countries (Fung & Cheng, 2012).

Research evidence from the Malaysian context revealed similar findings. According to the Curriculum Development Centre (2007), both the play approach and creativity development were discerned to be lacking in terms of implementation in the Malaysian preschool settings. One of the reasons for this could be teachers’ misconception on both play and creativity. While play was considered as playing with toys and any activities that make children happy (Curriculum Development Centre, 2007); creativity was seen only in relation to art (Azli Ariffin & Roselan Baki, 2014).

Pertaining to teachers’ competency to foster children’s creativity in the curriculum, a number of studies indicated that most teachers are unprepared to do that, although they acknowledge the importance of creativity (Akbiyik & Gülsüm, 2014;

Azli Ariffin & Roselan Baki, 2014; Eckhoff, 2011; Kampylis, Berki, & Saariluoma, 2009). This parallels to the case for the play approach. Besides that, a comparison regarding factors restraining the effective implementation of play (Norsuhaily Abu Bakar et al., 2015) and creativity (Alkuş & Olgan, 2014; Azli Ariffin & Roselan Baki, 2014; Cheung, 2013; Eckhoff, 2011) in actual practice resulted in similar issues which include limited time, pedagogical constraints and administrative obligations.

Meanwhile, as emphasised by Sharp (2004), it is crucial to stress that not all play is creative, or leads to the development of creativity. Despite acknowledging the importance of creativity among children of the 21st century, Fisher et al. (2011) questioned whether their play is creative and if they are playing creatively. Likewise, available literature provided ample evidence on the demise of children's creative play today. Constant structure in the environment and the ubiquity of technology surrounding children today have led to difficulty in generating ideas and the need for guidance to engage in creative play (Miller & Almon, 2009). Oncu and Unluer (2010) indicated that a large number of Turkish preschool children were found to be incompetent at playing creatively with various play objects due to limited opportunities for unstructured play.

The focus on academic learning in many early childhood settings has led to a significant decrease in opportunities for creative, unstructured play initiated by children. These have been largely replaced by teacher-controlled, academic-driven structured play laden with learning outcomes, which provide limited opportunities for creative expressions. Miller and Almon (2009) reported that teachers regard play is important when it is "highly scripted, teacher-directed" (p. 26) and related to children's learning. Concurring to this, several researchers claimed that play implemented in preschools are usually teacher-centred and education-related (Fisher et al., 2008; Norsita Ali & Zainal Madon, 2014; Sandberg & Heden, 2011). This leads to the question whether creativity development would thrive in highly structured play where specific solutions or patterns are expected and outcomes are predetermined. The degree of control children has and the extent to which children could express their creativity when engaging in such play are questionable.

Regarding the ideal implementation of creative play, one important factor that has been prevalent through the literature is the degree of control children have over play. O'Connor (2014) maintained that creativity development is directly proportional to the "degree of freedom" children are empowered with. This could be achieved by allowing ample opportunities for children to make decisions in play. Johnson (2007) added that creative play encompasses flexibility and little structure so that children's imagination will not be suppressed, rather be propelled into creativity. Adding to that, Garaigordobil and Berrueco (2011) asserted the importance of creative play as it encourages "flexibility" and "improvisation" (p. 609) that would contribute to learning. As children gain ownership to their own play, they will more likely be intrinsically motivated to engage in it.

Furthermore, the elements of fun and pleasure should be present within creative play to foster children's motivation to learn (O'Connor, 2014). Activities which employ multisensory and multiple intelligences are also catalysts for children's creativity to flourish. Next, there should be "a sense of unhurriedness" (p. 7) where children are given ample time to develop and extend their play scenarios despite academic obligations (O'Connor, 2014). These aspects make up the optimal condition for creativity development among young children through play.

The identified overlapping aspects which cover both theoretical and practical domains formed the basis to integrate both play and creativity in this present study. It also justifies the exploration of both elements as an integrated construct, i.e. creative play. In addition, Russ (2003) posited that the available literature had focused largely on exploring the correlations between play and creativity per se (e.g., Mullineaux & Dilalla, 2009; Yin et al., 2014). There is a deficiency of studies on creative play as a combined construct and how it could be developed as a validated instructional tool.

As shown in Figure 2.3, a literature map was formulated to provide a visual picture of how this present study relates to the gaps and limitations which emerged from the literature review regarding play and creativity.

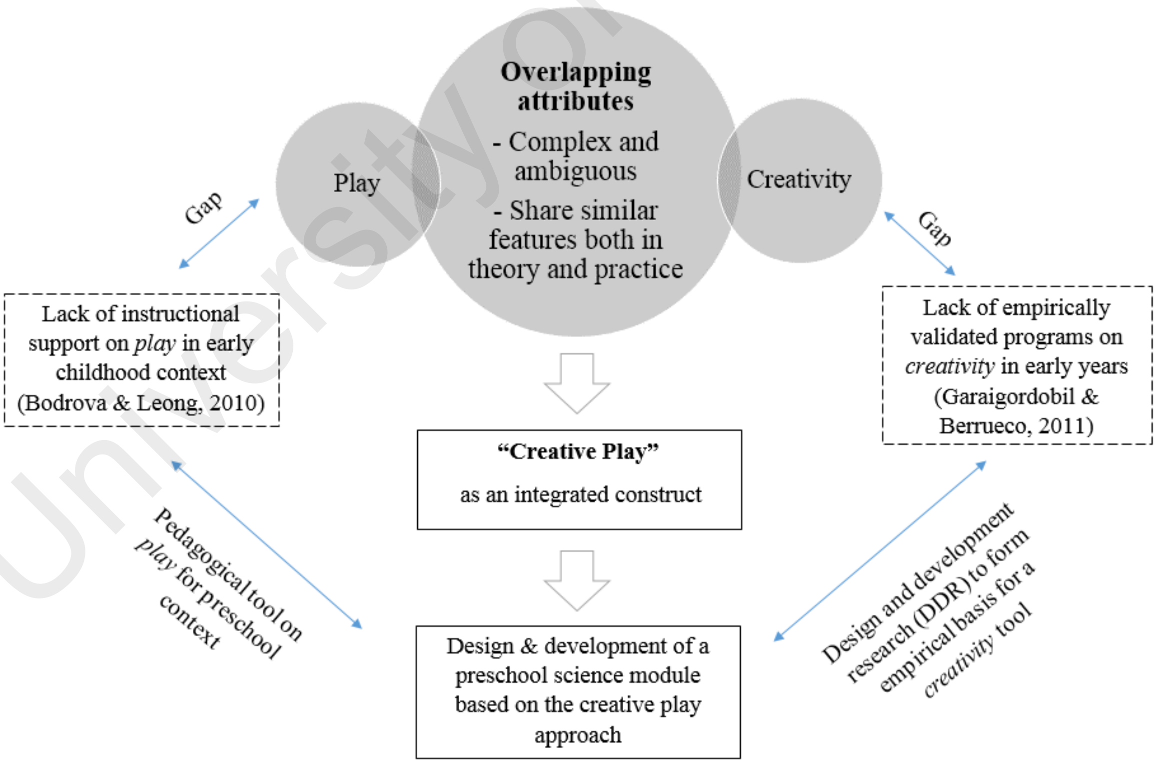


Figure 2.3. Brief literature map for play and creativity.

Science in the Preschool Curriculum

Science involves a systematic understanding of the world around us. The 21st century and its subsequent years present global challenges to humankind to constantly refine the existing knowledge to tackle a variety of socio-scientific issues (Hammer & He, 2014). This implies a crucial need for the acquisition of scientific knowledge among students. As preschool education forms the foundation of children's learning and heavily influences their prospective disposition toward learning, science concepts should be introduced and developed among all preschool children through effective science instructions. This resonates with researchers who were consistent in their view that young children are competent at learning science even at a young age and should be provided with opportunities to be exposed to science in a rich environment (Eshach & Fried, 2005; Nayfeld, Brenneman, & Gelman, 2011).

Trundle and Saçkes (2012) asserted that effective early childhood science learning should be a prerequisite for a quality preschool education. The teaching and learning of science in the preschool years builds upon children's innate curiosity and their inclination to discover the world around them (Greenfield et al., 2009; Hammer & He, 2014; Pendergast, Lieberman-Betz, & Vail, 2017; Trundle, 2015; Worth, 2010). Preschool educators should use this existing disposition as an advantage to nurture young children's interest in science in order to spark a lifetime motivation in learning science. Science education in children's early years also lays a strong foundation for science learning in their primary education through developing core scientific skills and concepts (Eshach & Fried, 2005; Mirzaie, Hamidi, & Anaraki, 2009).

Offering a deeper perspective, Andersson and Gullberg (2014) contended that the purpose of learning science in preschool should not merely be about the acquisition of key science concepts, provoking children's interest or developing the human capital by cultivating future scientists for the next generation. Findings from their study acknowledged early science as a medium that empowers children with self-confidence, sense of achievement and resilience through active participation in science activities. This drew attention to how preschool science learning could be a stepping stone toward developing a holistic child across all developmental domains, instead of lopsidedly focusing only on the science content area. On the basis of this connection between science and children's holistic development, science was not considered as a standalone subject in this study but rather a multidisciplinary platform through which creativity could be developed.

In the NPSC, early science is placed under the strand of "science and technology". It stipulated that the focus of early science is the formation of scientific attitudes and mastery of science process skills through explorations of living things, the material world and physical world (Ministry of Education, 2017). Creative thinking is listed as one of the desired outcomes of early science learning as preschoolers acquire science process skills through observation, classification, measuring things, making inferences and predictions, and communication.

While the NPSC has included content standards as well as learning standards under each content standard, the researcher questioned whether teachers possess sufficient competence and knowledge in planning child-centred exploratory activities to guide preschoolers toward reaching the written standards and the intended outcomes of early science. There is a lack of specific guidance for teachers on how to effectively deliver early science activities in the teaching and learning process. Despite the NPCS being a comprehensive document stating a list of general teaching and learning approaches, it is believed that what preschool teachers are truly in need of is concrete pedagogical support on *how* to translate and implement these rhetoric ideals into the curriculum specifically in the area of early science. Hence, this module acts as the tool providing teachers with solid pedagogical guidance on early science to implement hands-on activities which stimulate preschoolers' creativity in accordance to guidelines in the NPCS.

Eshach (2005) emphasised that it is suitable to introduce science to children in their early childhood considering their "sense of wonder and intrinsic motivation" (p. 320), thus it is crucial for teachers to retain this curiosity. However, Trundle (2015) maintained that in actual practice, schools "institutionalise the wonder out of children" (p. 2). Moreover, research evidence indicated that little opportunities are provided for science learning in preschool compared to other domains such as literacy and numeracy (Nayfeld et al., 2011; Patrick & Mantzicopoulos, 2015; Pendergast et al., 2017; Saçkes et al., 2013). Moreover, early science education in many preschool settings is ineffective (Hashimah Mohd Yunus & Nooraida Yakob, 2014; Saçkes et al., 2013; Trundle, 2015; Trundle & Saçkes, 2012). The tragic consequences of this situation may include individual's little motivation in learning science through secondary and tertiary school years (Patrick & Mantzicopoulos, 2015; Trundle, 2015). Children's achievement in science in subsequent school years will also be negatively affected (Saçkes et al., 2013).

Play and creativity in early science. Aside from the rhetorical ideals outlined in the curriculum, the key question that concerns every preschool stakeholder is: "What encompasses quality science instruction and how to effectively teach science to preschoolers?". Young children learn best through first-hand experiences. In line with the developmental appropriate practice, Greenfield et al. (2009) posited that hands-on activities should be the core element in early science instruction.

The play approach is claimed as one of the most appropriate pedagogy in teaching science to young children (Akman & Özgül, 2015; Bulunuz, 2013). Bulunuz (2013) conducted a study to compare kindergartners' understanding of science concepts between two groups, one group taught with the play approach and the other using the conventional teaching approach. Findings reinforced the effectiveness of the play approach in kindergartners' understanding of science concepts. McLean, Jones, and Schaper (2015) added that play is the sociocultural context where science teaching and learning takes place. Akman & Özgül (2015) further reiterated that play should be integrated into the early childhood curriculum as it propels young children to learn and discover, besides providing ample opportunities for preschool science learning.

In light of available research evidence that indicated the ineffectiveness of early science instruction (e.g. Saçkes et al., 2013; Trundle, 2015), it could be implied that play is rarely incorporated in early science instruction despite its importance. Most research conducted focused on the effect of play on preschoolers' general learning of science. There is a deficiency of studies that explore how teaching early science through play could enhance preschoolers' creativity. Therefore, the play approach forms the foundation of the CREPES module in this present study, with the development of creativity among preshoolers as its intended outcome.

Unquestionably, science is important in the preschool years as it enables children to develop their creativity, aside from other skills including problem-solving and language competencies (Nilsson, 2015; Mirzaie et al., 2009). Glauert & Manches (2012) stressed on the need for a paradigmatic shift in the science and mathematics education for young children, whereby the main focus is no longer on knowledge per se but also on the development of innovative and creative thinking. This concurs with Hunter-Doniger (2016) whose study proposed the infusion of creativity into mathematics through the arts. She argued about the inadequacy to teach each subject by itself and that creativity should be the key focus in tandem with the needs of the 21st century. In the Malaysian context, creativity is also established as one of the intended outcome for early science learning in the NPSC (Ministry of Education, 2017).

Similar components that were identified between early science and creativity, which include the "exploratory and investigative" (p.406) nature of both the elements (Cremin, Glauert, Craft, Compton, & Stylianidou, 2015). Adzliana Mohd Daud, Jizah Omar, Punia Turiman, and Kamisah Osman (2012) also reiterated that science education should be a medium for creativity development. Albert Einstein in his quote: "To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science" clearly relates creativity to science (as cited in The National Center of Quality Teaching and Learning, 2012). It is important to note that the systematic structure in science does not undermine its use as a medium for creative development among young children.

According to Cremin et al. (2015) however, a majority of preschool teachers do not put in deliberate effort to think of ways to incorporate creativity in science learning. This could be due to misperception among Malaysian preschool teachers that creativity is only related to or developed through art (Azli Ariffin & Roselan Baki, 2014). In fact, just as not all play activities lead to creativity development; Sharp (2004) pointed out the possibility that not all art activities stimulate creativity. The researcher argues that creativity is a generic ability that should be fostered across all developmental domains. In the study of Hunter-Doniger (2016), arts were selected as a medium to foster creativity into mathematics. In this present study, early science was used as an unconventional channel to develop preschoolers' creativity.

Moreover, Glauert and Manches (2012) pointed out the ambiguity of integrating creativity into science education in order to support the teaching and learning process. It is also unclear how creativity can be developed through early science instruction. As such, this provided a basis to justify of the aim of the CREPES module which was to provide concrete guidance for preschool teachers to instil creativity into early science through the creative play approach.

In light of the interrelation between play, creativity and preschool science, Figure 2.4 shows a visual representation of their overlapping relationship. It illustrates the pedagogy, expected outcome, and the content area merged through the CREPES module. Through creative play approach (pedagogy), creativity (expected outcome) is infused into early science (content area) by means of the CREPES module.

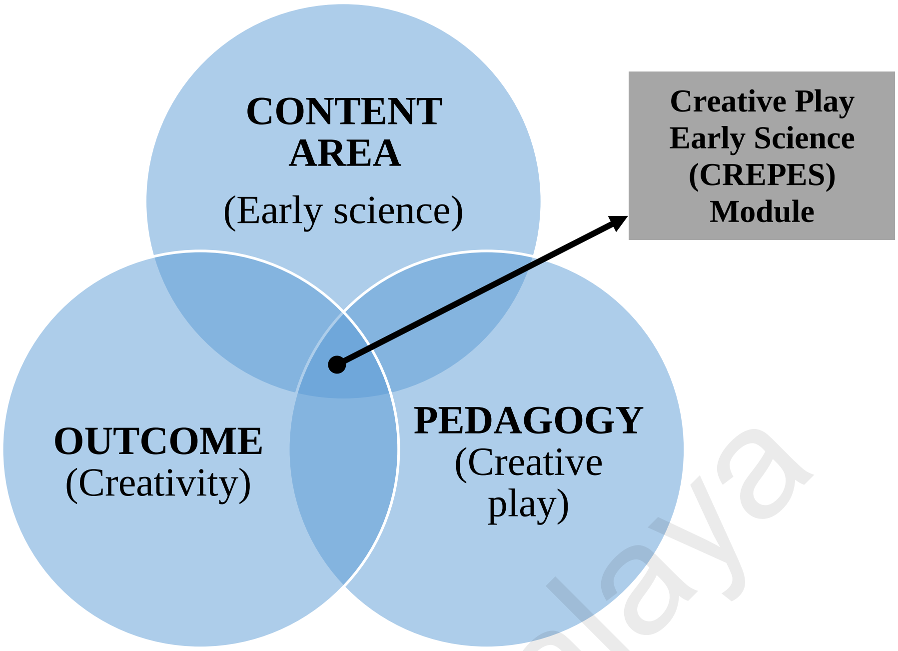


Figure 2.4. Three main components integrated in the CREPES module.

Teacher Competence

Teachers constitute a crucial part in a curriculum, as their quality of teaching directly influences learners' learning and development. Based on Figure 2.4, a key factor that influences the impact of module implementation is teachers' competence regarding the pedagogy, expected outcome, and the content area which includes subject-matter knowledge. This exemplifies the importance of teachers' competencies in these three areas including the pedagogy of play, creativity and science content area encompassed in the CREPES module.

Teacher competence in implementing play. The researcher argues that the implications of research pertaining to teachers' perceptions on play are less impactful compared to teachers' actual skills and knowledge in applying the play approach in the early childhood classroom. As Bulunuz (2012) emphasised, holding a positive perception towards play does not equate having practical proficiencies to incorporate play into the curriculum. Existing literature indicate teachers' lack of understanding in play and their uncertainties in implementing play in the curriculum (Bulunuz, 2012; Fung & Cheng, 2012; Huisman et al., 2013; McInnes et al., 2011; Sandberg & Heden, 2011; Wen, Elicker, & McMullen, 2011).

Similar to the international research evidence, Malaysian preschool teachers were also identified to have limited understanding about play. According to a study conducted by the Curriculum Development Centre (2007) as cited in Ng (2010), Malaysian preschool teachers provided shallow responses when asked to explain the play approach. Examples of their responses include "not sure of the concept of play, as long as they are happy and show interest, that is play" and "if the material used is toys, then the activity is learning through play" (p. 54). These imply that teachers possess little understanding of the learning through play philosophy though it is one of the main approaches as required in the NPSC. Despite positively acknowledging the importance of play towards children, preschool teachers' inadequate knowledge about play greatly jeopardises their professional judgement and ability to effectively incorporate play in the early childhood classroom. Thus, the extent to which the play approach is incorporated in preschools across the nation today remains questionable.

Although the National Preschool Standard-based Curriculum (NPSC) could act as an essential guide for preschool teachers, it is much more crucial to ensure that teachers have adequate abilities to effectively put the strategies to use in actual practice (Wirawani Kamarulzaman, 2015). This issue pertaining to teachers' lack of knowledge and competencies to implement play remains largely unresolved till today. Bulunuz (2013) postulated the insufficient empirical and theoretical evidence on how play can be incorporated as a teaching approach. Concurring to that, Akman and Özgül (2015) similarly highlighted the limited sound empirical evidence of play as a pedagogical tool in the early childhood curriculum.

Hence, in accordance with Vu, Han, and Buell (2015), the researcher asserts the need for professional development among preschool teachers in order to increase their awareness and competence on the play approach toward preschoolers. This study aspired to address this gap by developing a creative play module on preschool science as pedagogical support for teachers. The CREPES module was intended to familiarise preschool teachers to the implementation of creative play in early childhood science curriculum and to equip them with adequate competencies to apply the creative play approach across all subject areas in future.

Teacher competence in incorporating creativity. Teachers play a crucial role in developing creativity among preschoolers (Eckhoff, 2011). An essential factor towards the successful implementation of a creative preschool classroom is the provision of appropriate support to teachers (Cheung, 2013; Cheung & Leung, 2013). Cheung (2013) stressed that devising educational policies alone would not be able to lead to an effective implementation of creativity.

However, research evidence indicated that teachers are uncertain and unprepared to promote and enhance creativity in actual practice (e.g., Cheung & Leung, 2013; Eckhoff, 2011; Kampylis et al., 2009). Cropley and Cropley (2007) reiterated about teachers' uncertainty on what to do in practice, despite being aware of the importance of creative development. Moreover, Cheung (2013) pointed out that many preschool teachers favour expected answers from children and do not encourage the inquiry of unique and unexpected ideas. This contradicts to the principle of the creative development where children's creative expressions are encouraged.

Although teachers are aware of their role in facilitating children's creativity and the principles of implementing creative practice, there is an urgent need for further training and support to guide teachers in the process of implementation (Cheung & Leung, 2013; Kampylis, Berki, & Saariluoma, 2009). Garaigordobil and Berrueco (2011) drew attention to the limited programs that promote creativity in the early years and lesser that are empirically validated. Moreover, there is also a deficiency of empirical evidence on the use of validated instructional tools to help teachers promote creativity through play in preschool contexts.

In light of these identified gaps, the product of this present study, namely the CREPES module aspired to help address these gaps by acting as a pedagogical support tool which provides essential guidelines for Malaysian preschool teachers to infuse creativity into teaching early science.

Teacher competence in early science instruction. The quality of preschool science instruction is influenced by teachers' competence in teaching science. Despite the importance of science in early childhood education, a thorough literature review revealed that many preschool teachers lack in their competence to teach early science. Several studies reiterated that few preschool teachers possess adequate pedagogical content knowledge and most have low confidence in teaching science (Nilsson, 2015; Saçkes et al., 2013; Trundle & Saçkes, 2012).

To address these problems, continuous professional development on the teaching of science is integral to equip teachers with practical pedagogical guidance on effective science instruction in preschool settings (Nayfeld et al., 2011; Piasta et al., 2014; Saçkes et al., 2013; Trundle & Saçkes, 2012). In their study, Siew, Nazir Amir, and Chong (2015) found that professional development workshops enabled researchers to further determine the support teachers need to incorporate the Science, Technology, Engineering, and Mathematics (STEM) approach into secondary science teaching. Similarly in the preschool science context, teachers' needs pertaining to preschool science education should first be ascertained to further develop teachers' proficiency in teaching science (Mirzaie et al., 2009). Greenfield et al. (2009) added that the problems teachers experience in teaching science should also be identified. Hence, in alignment to this, this present study began by analysing the current needs in teaching early science among preschool teachers. The module was then designed and developed based on the identified needs, and then used as a core material to support teachers to adopt the creative play approach in their early science instruction.

In the Malaysian preschool context, teaching and learning modules have been developed to help enhance teachers' competencies in teaching various content areas. Table 2.7 outlines a non-exhaustive matrix of preschool modules based on an extensive search through the Malaysian literature.

Table 2.7

Modules Developed in the Malaysian Preschool Context

Module	Author and year	Focus/ Content area	Research design	Findings
Reading Intervention Module (MIM)	Rohaty Majzub & Kamisah Buang (2010)	Malay Language	Randomised Quasi-Experimental Pre-test - Post Test	Preschoolers achieved better reading skills when taught with the MIM.
Learning through play module	Zakiah Mohamad Ashari, Azlina Mohd. Kosnin, & Yeo Kee Jiar (2013)	Mathematics (number concept)	Quasi-experimental design with pre and post-tests	The module increased preschoolers' understanding of the number concept.
Creative Arts Activity Module (ASK)	Ling, Sharifah Nor Puteh, & Hasnah Toran (2014)	Creativity	Developmental research	Module helped in preschoolers' creative development.
Play-based instructional module	Aliza Ali & Zamri Mahamod (2015)	Language skills	Qualitative DDR study	Through the module, children acquire language easier and better.

Table 2.7 *(continued)*

Game Based Learning Module (GBLM)	Chin & Effandi Zakaria (2015)	Mathematics (number concept and number operation)	Quasi-experimental design with non-equivalent control group pretest/posttest research design	Game-based learning improved the achievement of number concept and operation among preschoolers.
Project Approach Module (PProKom)	Noor Miza Abdul Rahman (2015)	Communication skills	Qualitative case study	Preschoolers showed enhanced communication skills.
Higher Order Thinking Skills (HOTS) Module	Norsiah Fauzan & Norfarahin Mat Zaini (2015)	Creativity	Qualitative case study	Children show increased creativity as they engage with the module with teachers' scaffolding and freedom to learn.
Emotional Intelligence (EI) teaching module	Nor Aizal Akmal Rohaizad, Azlina Mohd Kosnin, & Muhammad Umar Khan (2015)	Emotional Intelligence	Experimental design pretest/posttest with experimental and control groups	The module is effective for developing preschoolers' emotional intelligence.

Table 2.7 *(continued)*

STEM Module	Mazlini Adnan et al. (2016)	Inquiry, exploration, invention, reflection, interests, and communication and teamwork	Mixed methods design	Significant improvement in outcomes measured among children.
Investigative Project Module	Azizah Zain, Zaharah Osman, & Halim Masnan (2017)	Communication and social skills	Qualitative research	Children's communication with teachers, peers and environment was enhanced.
Creative Movement Module (PeTif-Ma)	Jamariah Muhamad & Loy (2017)	Verbal interaction	Quantitative survey research	Module can be comprehensive teaching guidance for teachers in creative movement and drama.

Based on Table 2.7, the researcher discerned that there is a lack of preschool modules on the science content area in the Malaysian preschool context despite its importance in the present era. The use of preschool science as a medium to develop preschoolers' creativity has not been investigated by far. While modules on play had been developed, the incorporation of play to develop creativity has not been explicitly explored. The HOTS module developed in the study of Norsiah Fauzan and Norfarahin Mat Zaini (2015) focused on developing HOTS through creativity. Among the activities implemented to achieve the intended outcome included building a snowman using playdough, and drawing by observation. In light of these identified gaps, the CREPES module aimed to develop preschoolers' creativity through creative play early science activities.

Moreover, most of these modules take little account of the fluidity and interconnection in preschoolers' learning whereby various developmental domains complement and interact with each other. Hence, the CREPES module was designed based on an interdisciplinary perspective. Albeit focused on the science content area, the suggested module activities purposefully involve multiple developmental areas to ensure holistic development among preschoolers.

Greenfield et al. (2009) pointed out the deficiency in empirical studies on the effectiveness of preschool science instruction practices. Moreover, the researcher discerned a severe dearth of research evidence on the quality of the Malaysian preschool science instruction following a thorough search from local databases. It is uncertain how effective is the teaching and learning of science in preschools across Malaysia. Responding to these deficiencies, this research study represented an earnest attempt to design, develop and evaluating the effects of a preschool science module based on the creative play approach.

To summarise, the effective incorporation of creative play in early science requires preschool teachers who are highly skilled, knowledgeable and possess adequate understanding of play, creativity and preschool science. Analysis of literature on teachers' competence indicated a general deficiency of competence in all three areas namely pedagogy (play), outcome (creativity), and content area (science). Thus, preschool teachers require concrete guidance to translate rhetoric into reality. This directed to and reinforced the purpose of this study to develop a Creative Play Early Science (CREPES) module. Through the CREPES module, preschool teachers are expected to acquire the basic understanding and competence to implement creative play science activities, which would in turn enhance preschoolers' creativity.

Theoretical Framework

The theoretical framework underpinning this present study is an integration of constructivist learning theories and creativity theories. These theories have been selected and integrated to formulate the theoretical framework. They collectively justify how the CREPES module acted as a medium to enhance preschoolers' creative potential through creative play. The selected theories were used in this present study to support the development of the module. Specifically, these theories formed the basis of the module development in this research study by informing the overall module structure and content. The incorporation of theories ensured that the module would be theoretically sound and in line with the relevant child development and creativity theories.

The theoretical foundation of the CREPES module is based upon the philosophy of constructivism, whereby learners construct meaning based on first-hand interaction through play in order to develop creatively. Hence, two constructivist learning theories were selected and integrated in this study. They include Vygotsky's concept of Zone of Proximal Development (ZPD) (1978) and Piaget's process of adaptation (1952).

In addition, the selected theories pertaining to creativity include an instructional model for creativity namely Torrance's Incubation Model of Teaching (1979) and Torrance's Framework of Creative Process (1964, as cited in Isbell & Raines, 2013). Figure 2.5 shows the theories that underlie and support this present study.

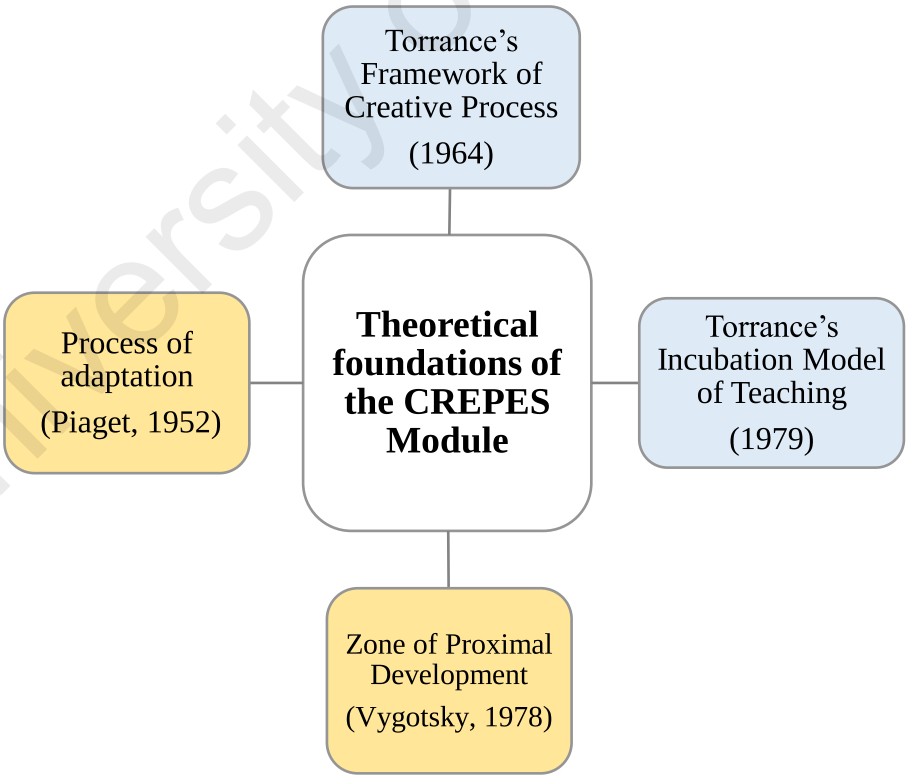


Figure 2.5. Constructivist and creativity theories underpinning this present study.

The following section consecutively explains and interprets each theory in relation to the present study. Finally, the theoretical framework for the study is presented in Figure 2.12. How these theories were merged to form the theoretical framework is then discussed.

Zone of proximal development (ZPD). Vygotsky's theory has been acknowledged as the foundation for a significant body of research on children's play in the context of education (Kamakil, 2013; Whitebread et al., 2009). Through the "zone of proximal development" (ZPD), Vygotsky (1978) posited that a child's learning should take place within a dynamic zone in order to reach a higher developmental level. Moreover, Vygotsky also theorized that ZPD can be created for each individual learner through play. Therefore, creative play is placed at the heart of the ZPD as the central medium to advance preschoolers' creativity, guided by the CREPES module.

The role of adults is extremely crucial in the scaffolding process to individualize learning experiences based on each child's ZPD. Scholars have postulated the central role of a teacher in scaffolding children's creativity (Kampylis et al., 2009; O'Connor, 2014; Sharp, 2004) and play (Miller & Almon, 2009; Samuelsson & Carlsson, 2008). In the context of this study, ZPD includes the appropriate support, or scaffolding provided by more knowledgeable others (MKOs) which could be teachers or even peers to enhance children's creativity through creative play. This will move a child to move from his/her actual level of creativity towards a higher potential level. The CREPES module will serve as a guide for teachers to effectively plan and implement creative play activities to optimize the child's advancement along the ZPD. Due to the dynamic nature of ZPD, a child advances from one level of ZPD to another as he or she develops creatively through play. These newly defined levels will be modified continually as new links are formed and consolidated upon prior acquired abilities.

In addition, Vygotsky (1978) also emphasized greatly on social interaction in learning. Interaction with more capable peers and adults helps provoke children's imagination and thoughts to formulate a variety of ideas. Hence, creativity will thrive under a condition where there is active social interaction between children and adults. Concurring to this, Malaguzzi (1993) added that "interpersonal exchange" (as cited in Sharp, 2004, p. 8) is the catalyst for creative development. Figure 2.6 illustrates how scaffolding by MKOs within a preschooler's ZPD could help enhance his or her creativity.

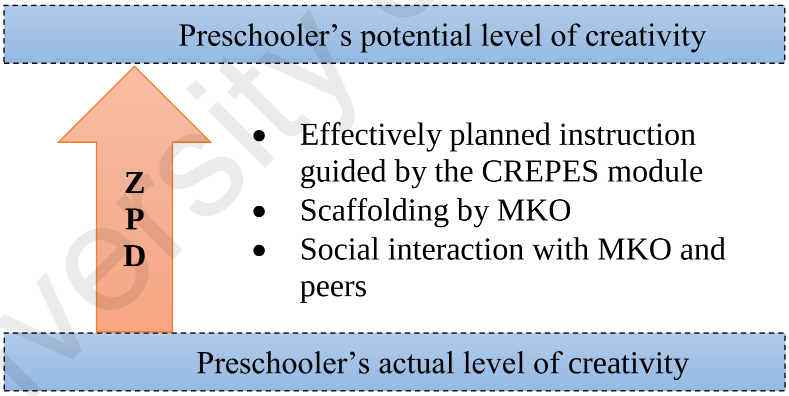


Figure 2.6. Zone of proximal development in the context of the present study.

The adaptation process. Piaget (1952) proposed two main processes which make up the adaptation process through which children learn, namely assimilation and accommodation. As children engage in creative play, they assimilate by taking in new concepts and linking them with their existing schema, while concurrently accommodate by reorganizing old and new ideas when their present cognitive structure could not adapt to the new situation. Therefore, creative play serves as a medium by which children could apply their pre-existing ideas and concepts, and refine them in various novel ways. Through this process, children are indirectly developing their creativity.

Figure 2.7 illustrates how assimilation and accommodation constitute a part of preschoolers' development of creativity. The adaptation process stems from a cognitive conflict which causes a disequilibrium, where the existing schema conflicts with the new input. It is a continuous process as a child continually organises and modifies his existing schemas through the process of assimilation and accommodation, thus progressing from a state of disequilibrium to equilibrium. The interplay between the processes will thus lead to an enhanced creativity level (Piaget, 1960, as cited in Alkuş & Olgan, 2014). Thus, the CREPES module provides an optimum context for these processes to take place in order to aid children's creative development.

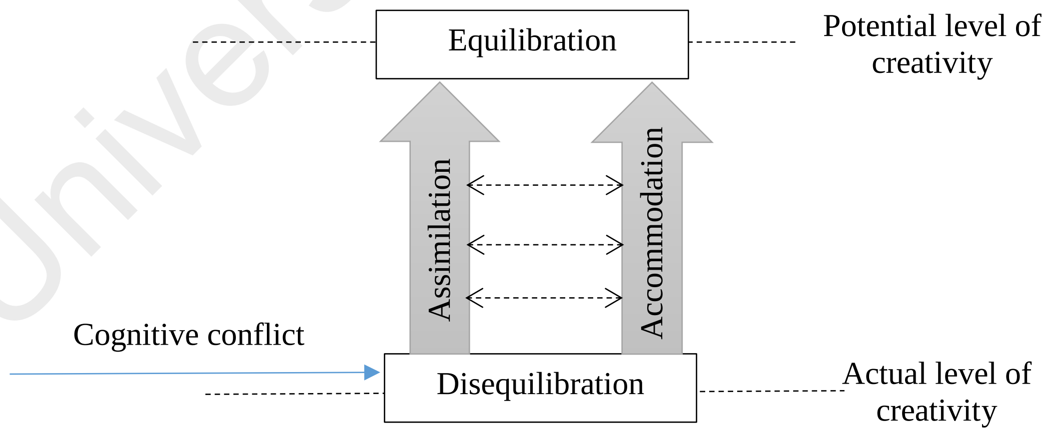


Figure 2.7. Assimilation and accommodation as two main interconnected processes towards an enhanced level of creativity.

Piaget's theory postulated several important implications which strengthened the justification of applying it in the present study. Some key implications for teaching include:

- the importance of active participation (Webb, 1980);
- importance of adults' role to set up a conducive and stimulating environment to support children's learning (Smidt, 2000);
- personalising children's learning according to their individual levels and interests (Webb, 1980); and
- minimising structure in learning to encourage creative thinking (Webb, 1980)

The proposed philosophy of the CREPES module is in line with the principles of DAP and the implications above. Therefore, Piaget's theory was selected to support the present study.

The inclusion of both Piaget and Vygotskian theories was based upon the similarities discerned between Piaget's concept of adaptation and ZPD proposed by Vygotsky, as well as the consistency of their ideas with the research context. Both emphasized on the learning process over the product which leads to a higher level of development, namely assimilation and accommodation in Piagetian terms; and in Vygotskian term through the ZPD.

Moreover, both Piaget and Vygotsky established the importance of active exploration instead of passive learning. It is also important to note that both theories complement instead of contradict each other in this research context. While Webb (1980) posited that social interaction was considered by Piaget as fundamental for children's cognitive development; Smidt (2000) maintained that Piaget emphasises on interaction with the environment such as exploring with the materials around them, with less emphasis on social interaction.

It is important to note that both theories are to be seen in light of the research context. Vygotsky's theory complements Piaget's in that it clearly stresses the importance of social interaction. Both theorists had posited the importance of interaction, although Piaget's emphasis on social interaction might not be as explicit as in Vygotsky's social constructivism theory. In relation with the CREPES module, preschoolers' interactions with other preschoolers and adults are as crucial as their hands-on explorations with materials in the module activities. Hence, the researcher maintains that the ambiguity in the Piagetian view from the literature strengthens the justification behind merging the Piagetian and Vygotskian beliefs in the theoretical framework of this study.

Incorporating the ideas of both theorists implies that a) assimilation and accommodation should take place within the ZPD, b) social interaction and active exploration with the physical environment are core elements for the advancement towards a child's potential creativity level. Collectively, both theories of Piaget and Vygotsky support and frame this research study theoretically in terms of teaching and learning.

Torrance's framework on creative process. Since this present study focused on the process of young children's creativity development, Torrance's framework on creative process (1964, as cited in Isbell & Raines, 2013) was selected and integrated into the theoretical framework. Figure 2.8 shows four components that are involved in the creative process; namely fluency, originality, flexibility and elaboration. All four components are interconnected and make up the process of creative development.

These components are commonly used as dimensions in creativity assessments developed by Torrance.

However, considering the context of this study and the limited time frame; the researcher adapted Torrance's framework of creative process to better suit the needs of this present study. Corresponding to the instrument selected to measure preschoolers' creativity in relation to the module's impact, namely Torrance's Thinking Creatively in Action and Movement (TCAM), only two out of four of these components were included in this study i.e., "fluency" and "originality". "Elaboration" and "flexibility" were not the focus of the module as eliciting these dimensions require more advanced cognitive maturity and hence are more suitable for older children. As preschoolers engage in creative play through the CREPES module, they are provided with ample opportunities to formulate a variety of (measured by "fluency") unique ideas ("originality") in the creative process.

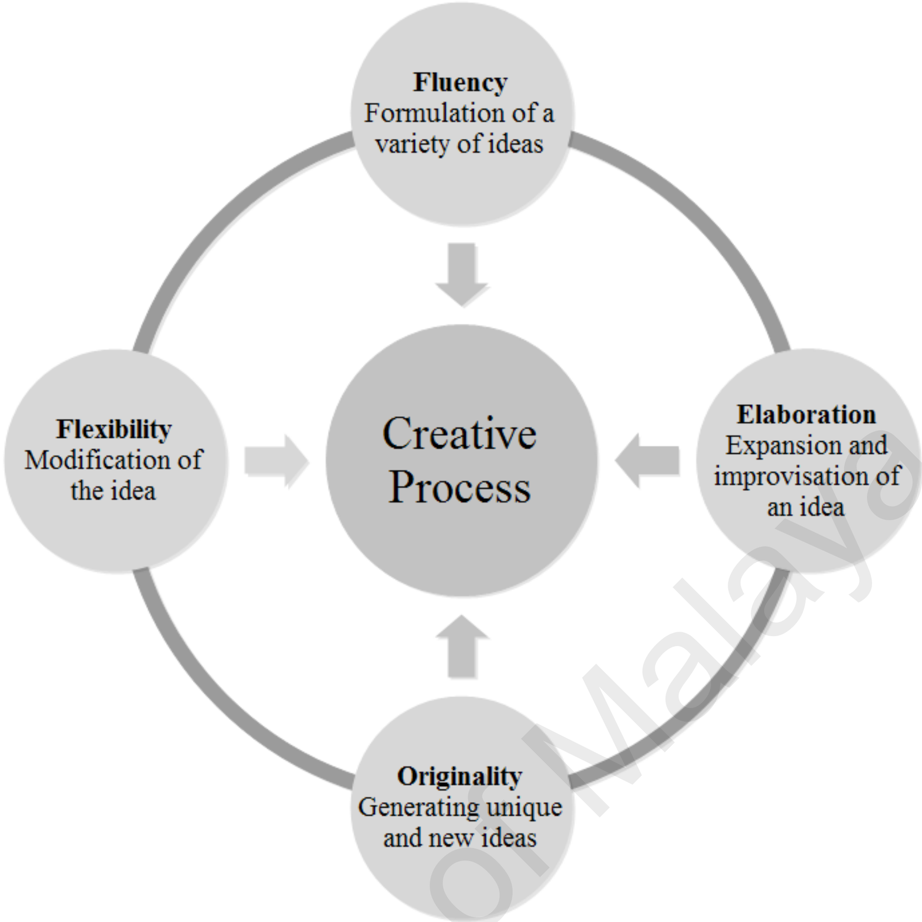


Figure 2.8. Torrance's framework of creative process (1964, as cited in Isbell and Raines, 2013).

In addition, review of the literature established the intertwined relationship between creativity and imagination. Imagination is defined as the ability to imagine, imitate, fantasize and take on unaccustomed roles (Torrance, 2000; Zachopoulou et al., 2009). Therefore, imagination was added as another dimension of assessment of children's creative process through the module implementation in Phase 3.

Figure 2.9 illustrates the modified framework of creative process for the purpose of this research study. Through preschoolers' engagement in the creative play science activities in the module, the dimensions of creativity involved include "fluency", "originality", and "imagination". These three dimensions are in accordance with the dimensions measured in the TCAM. Each of the dimension is interdependent with each other and coexist simultaneously in the entire creative process. As children formulate a variety of (fluency) new ideas (originality) while exercising their imagination, their creativity is being developed.

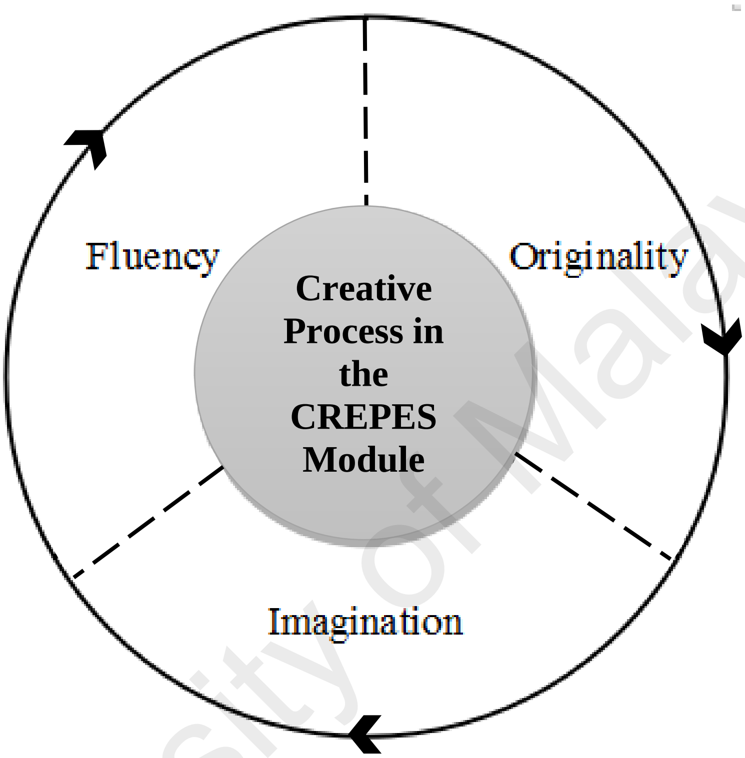


Figure 2.9. The cyclic and reciprocal creative process in the CREPES Module.

Torrance's incubation model of teaching. Torrance Incubation Model of Teaching (1979) is a three-stage instructional model. This model guides teachers to enhance creative thinking among learners in the teaching and learning process. Torrance (1993) noted that this model is suitable to be applied for preschoolers through senior citizens. Outlining the process of promoting creative thinking, this model is built upon the perspective of the creative process instead of the product (Torrance, 1993).

Considering that this module focuses specifically on the pedagogical aspect of helping teachers incorporate creative play in preschool settings, an instructional model is essential to help guide its design. For effective instruction of creativity, Torrance (1979) stressed the importance of multisensory learning and the need for engagement with the activity concerned. These are in line with the principles of DAP for early childhood education. Hence, this model is appropriate to be incorporated as one of the theories to frame the present study as it is parallel to the focus and context of this research study.

Torrance's Incubation Model of Teaching (1979) is envisioned by the researcher as a continuous cycle (Figure 2.10). The model begins with "heightening motivations" as its first stage. This is where teachers stimulate learners' curiosity and imagination by preparing a conducive environment to infuse creativity. The second stage, "deepening expectations" involves retaining the motivation stimulated at the first stage to encourage deeper explorations. Meanwhile, the final stage "keeping it going" focuses on extending the learning beyond the learning context to enhance integration and application of creativity into the daily life of learners.

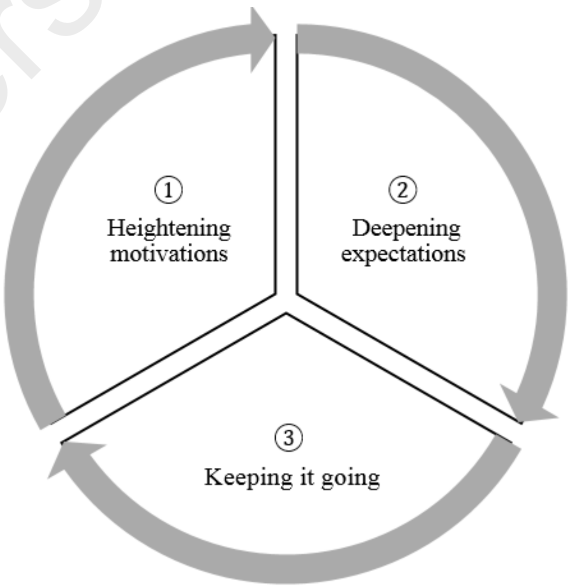


Figure 2.10. Three stages in Torrance's Incubation Model of Teaching (1979).

In order to cater to the needs of CREPES module users who are preschool teachers, Torrance's teaching model has been adapted and simplified according to research context to ensure that teachers could easily link and apply it in practice. The adapted model, known as the SEA model encompasses three stages namely: 1) Stimulate, 2) Explore, and 3) Apply as shown in Figure 2.11.

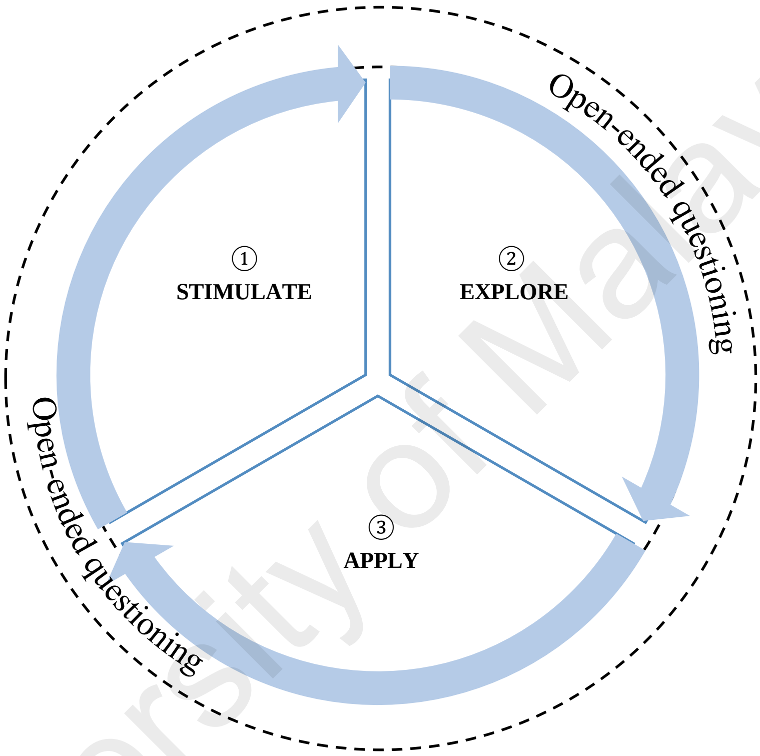


Figure 2.11. The SEA model adapted from the Torrance's Incubation Model of Teaching.

This three-step model guides the design of the CREPES module activities, as well as the creative teaching and learning process of teachers and preschoolers. Specifically, it provides practical guidelines for preschool teachers to continuously inculcate creativity through the CREPES module. Firstly, "stimulate" involves provoking and stimulating preschoolers' interest. The next stage "explore" is where teachers lead preschoolers into deeper explorations. In the final stage "apply", teachers facilitate preschoolers in extending the learned skills and knowledge into their daily lives. The SEA model is encapsulated by open-ended questioning. Coupled with relevant open-ended questions throughout the process, teachers could better facilitate and enhance the development of creativity of preschoolers through the SEA model.

As all three stages in this model are progressive, cyclical and interconnected, the SEA model was visualised as a spiral in the theoretical framework for this present study. This idea was adapted from Bruner's proposal of a spiral curriculum for instructional planning (1960). This spiral-like form exemplifies the importance of continuous reinforcement of each stage throughout the process of creative instruction especially for preschoolers whose development are ongoing. As this cycle continues in a spiral-like pattern over time, preschoolers' creative development builds upon their previous experiences and they eventually require less facilitation from adults. It also implies that creativity development among young children is a gradual process that continues even after the module implementation as they develop into adulthood. Fostering young children's creativity plays a crucial role in building up their foundation by involving them in the consistent practice of formulating ideas. The continual revisiting of the basic ideas, and linkages of the developed competencies is expected to advance them toward a higher level of creativity.

Summary. The theoretical framework for this study was developed by integrating creativity theories and constructivist learning theories. It is an interplay of two essential components:

1. Preschoolers' personal cognitive process and how the CREPES module serves as a facilitator to enhance their creativity through the learning process; and

2. The instructional component, which pertains to how teachers effectively stimulate preschoolers' creative development.

How these theories were integrated and envisioned in the theoretical framework of this study is presented in Figure 2.12.

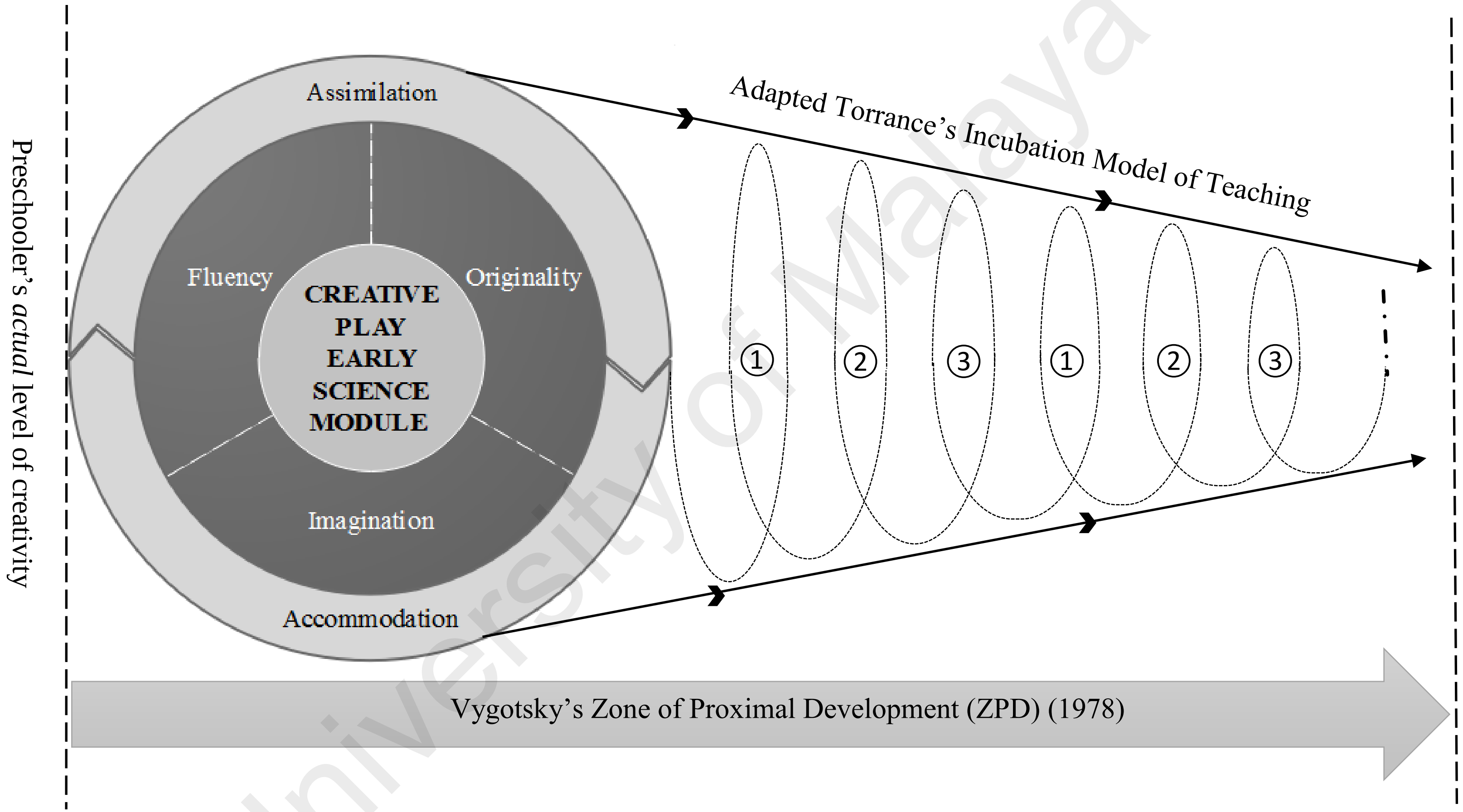


Figure 2.12. Theoretical framework of the study.

The CREPES module was placed at the heart of the theoretical framework. As preschoolers engage in creative play through the CREPES module activities, they generate new (originality) and a variety of different ideas (fluency), and exercise their ability to imagine (imagination). Moreover, they develop creative thinking skills by employing their cognitive thinking abilities through the assimilation and accommodation process. This adaptation process occurs within each preschooler's zone of proximal development (ZPD).

At the same time, a key component which is evident in the integration of these theories is the crucial role of adults as facilitators as children progress in their development of the creative domain. Through the spiral process representing the SEA model, teachers continually facilitate preschoolers' creative development by provoking their curiosity, encouraging them to explore further, and providing guidance to enable application of the creative abilities in their daily lives. Beginning with preschoolers' respective cognitive development, coupled with continuous facilitation by the more knowledgeable other (MKO), preschoolers progress from their actual level of creativity to an enhanced level through active involvement in the module activities.

To summarise, through the CREPES module, creative play is the medium through which:

- a ZPD is created, which provides a platform for children to advance from their actual to potential level of creativity (*Vygotsky's ZPD*);
- preschoolers are given opportunities to generate new and many different ideas, and exercise their imagination (*Adapted Torrance's framework of creative process*);

- preschoolers apply their pre-existing ideas and concepts, while refining them in various novel ways through assimilation and accommodation (*Piaget's adaptation*); and
- teachers continuously stimulate children's curiosity, lead them to explore deeper in learning and guide them to apply their creativity in their daily lives (*Adapted Torrance's incubation model of teaching*).

Based on the theories selected, the respective implications toward the content and overall structure of the CREPES module were outlined in Table 2.8.

Table 2.8

Theoretical Implications toward Module Design and Development

Theories/ Models	**Implications**
Constructivism • Piaget's assimilation and accommodation • Vygotsky's Zone of Proximal Development (ZPD)	• Children should be given ownership and opportunities to construct their own knowledge through fun, hands-on, creative experiences instead of teacher-centred lessons • Role of adult support in the implementation of creative play in the preschool classroom
Adapted Torrance's Framework of Creative Process	Module activities should be a platform for preschoolers to: a. formulate many different ideas (fluency) b. generate new ideas (originality) c. exercise imagination (imagination)

Table 2.8 *(continued)*

Adapted Torrance's Incubation Model of Teaching	Teachers' implementation of creative play activities should be a continuous revisiting of the following stages in the SEA model, reinforced by open-ended questions: 1. Stimulating preschoolers' interest 2. Exploring 3. Applying acquired knowledge and skills in everyday life

Chapter Summary

This chapter has delineated, identified and analysed the gaps present in the relevant literature available surrounding the research topic. The gaps identified from the literature reinforced the significance and the need to conduct this present study as shown in Figure 2.13. The theories which underpin and frame the study were also interpreted. The literature review concluded with the theoretical framework which illustrated how selected theories formed the theoretical foundation for this present study. The next chapter will explicate the research design and data collection methods involved to bridge the gaps described in this chapter.

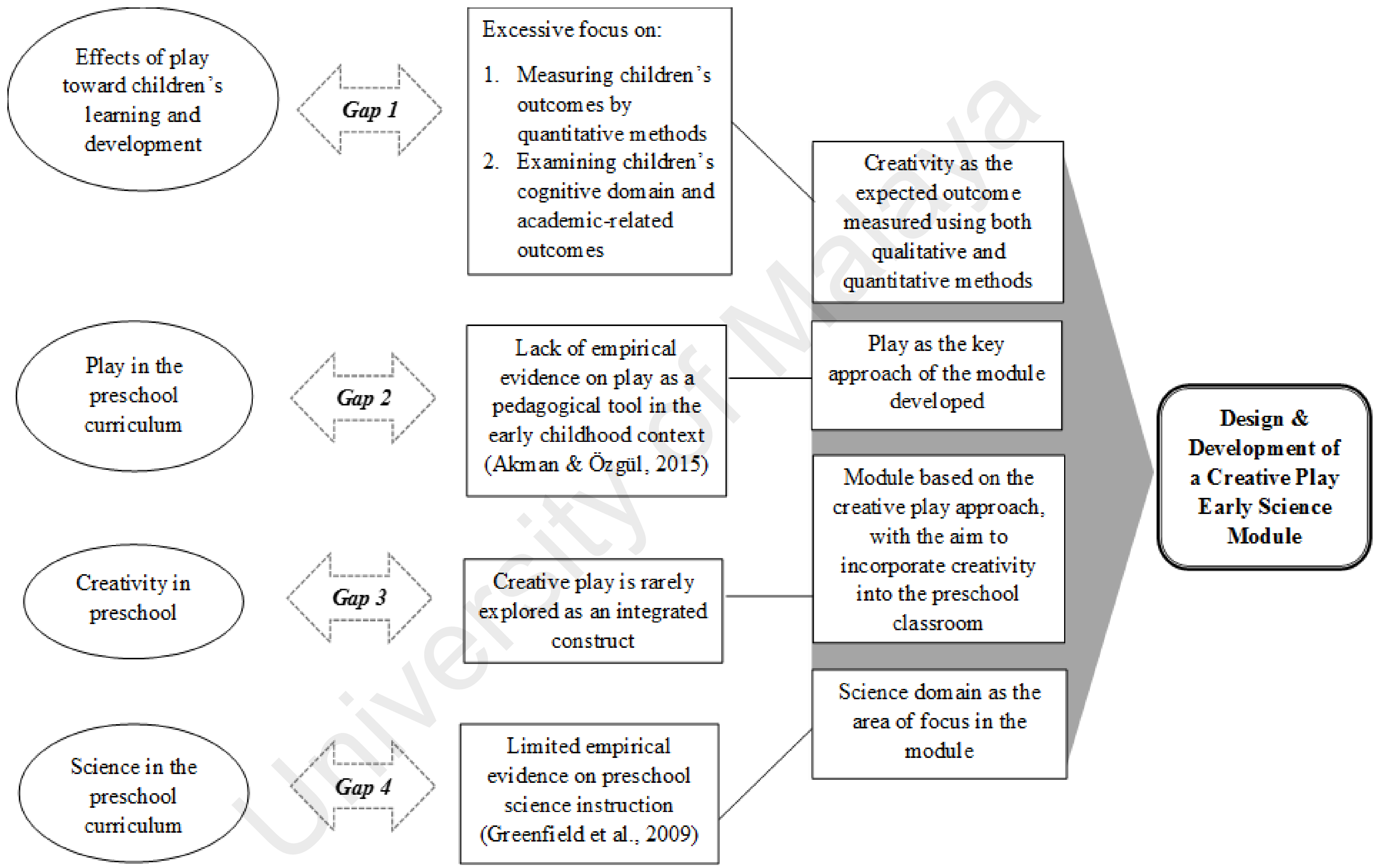


Figure 2.13. A brief literature map outlining the main gaps leading to the present study.

Chapter 3

Methodology

To select the most appropriate research design for a research study, it is crucial to take into account the research objectives, participants and also the context of the study. A suitable research design should also attempt to overcome methodological gaps discerned in the literature review. This chapter explicates and justifies research methods that were employed by the researcher in order to answer the research questions. In the following section, the researcher describes in detail the research design, context, participants, data collection methods and the process of data analysis for this present study.

The Research Design

This study designed and developed a preschool instructional module on early science using creative play as an approach. Therefore, this research study was categorised as a design-based research. This is a growing field of research, especially in educational research (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). It is typically employed to develop products including a model, module, system or program.

There are a variety of terminologies used by different researchers to refer to design-based research studies (van den Akker et al., 2006). Some of the terms used include "development research" (van den Akker, 1999), "design-based research" (Wang & Hannafin, 2005), "developmental research" (Richey & Klein, 2005; Richey, Klein, & Nelson, 2004), "design research" (van den Akker et al., 2006), "design and development research" (Richey & Klein, 2007, 2014) and "educational design research" (McKenney & Reeves, 2014; Plomp, 2007). Table 3.1 briefly describes each of this terminology.

Table 3.1

Related Terminology for Design-based Research

Terminology	Description
Development research (van den Akker, 1999)	• Used in different domains including curriculum, media and technology, learning and instruction, and teacher education • Focuses on prior investigation, the underpinning theory, empirical testing, and documentation, analysis and reflection throughout the process • Formative evaluation of product is crucial
Design-based research (Wang & Hannafin, 2005)	• Pragmatic as it influences theory and practice • Underpinned and guided by theory • Collaboration between designers and participants (interactive), continuous cycle of design (iterative), not rigidly framed • Employs multi-method approach • Contextually-based
Developmental research (Richey & Klein, 2005; Richey et al., 2004)	• Type 1 research focuses on instructional product design and development (context-specific conclusions); while type 2 on process of development (general conclusions) • Divided into different phases (e.g., analysis, development, evaluation phase) • Helps in the study of new models, programs or tools in order to solve significant problems in a field • A medium to establish new programs and tools • Aims to establish empirical evidence systematically derived from practice

Table 3.1 *(continued)*

Design research (van den Akker et al., 2006)	• Defined as "a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings" (Barab & Squire, 2004, as cited in van den Akker et al., 2006, p. 5) • Impact on practice through the intervention designed • Spiral cycle of design, evaluation and redesign • Context-specific
Design and development research (Richey & Klein, 2007, 2014)	• Aspires to create new knowledge and validate current practice • First category involves design and development of product or tool that focus on the whole process, specific phases and development or use of tool • Second category concerns model research involving the development, validation and use of model
Educational design research (McKenney & Reeves, 2014; Plomp, 2007)	• Research genre that develops solutions (educational products, processes, programs, or policies) to practical educational problems; creates setting for scientific inquiry and new knowledge to improve educational practice (McKenney & Reeves, 2014) • A "systematic study" that formulates "research-based solutions for educational practice" (Plomp, 2007, p. 13)

Note. Terminologies included above are not exhaustive.

The existence of ample terminologies for a single research design implies that design-based research is continuously evolving and being refined (van den Akker et al., 2006). It also indicates the widespread use and adaptable application of such research in the field of education as well as other areas. Nevertheless, it is important to note that most features pointed out by different researchers overlap each other and point to a similar research paradigm. They all point to one similar aim, which is to develop new theories, tools or products which could improve practice.

One of the most apparent feature of a design-based research is its contribution of practical implications (Plomp, 2007; Richey & Klein, 2007; van den Akker et al., 2006). Conventional research designs such as survey or experimental studies often overlook the practical contribution of their findings toward the respective field of practice (van den Akker, 1999). Regardless of the terminologies used, a research study of this type seeks to address important problems in actual practice by establishing a medium of intervention. Concurring to Richey and Klein (2007), Ellis and Levy (2010) precisely illustrated development research as a bridge that links theory and practice as shown in Figure 3.1.

Figure 3.1. The role of development research as a bridge linking theory and practice (Ellis & Levy, 2010).

Upon considering the various terminology related to DDR and their relevance with the research study, the term “design and development research” (DDR) was selected to be used throughout this study. It is defined by Richey and Klein (2007) as “the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools" (p. 1). According to Norlidah Alias, Saedah Siraj, Mohd Nazri Abdul Rahman, and Dewitt (2013), DDR is a specific study on the process of development of a product, in light of the analysis of a specific context which includes evaluation of the product developed.

This present study employed the first category of DDR namely, product and tool research (Richey & Klein, 2007), as it involved designing, developing and evaluating a product, namely the Creative Play Early Science (CREPES) module for use in preschool context. Since this study was conducted in an educational context and specifically intended to improve preschool practice through development of an educational product, it could also be considered concurrently as an "educational design research" as postulated by Plomp (2007) and McKenney and Reeves (2014). In specific terms, this study employed DDR in an educational context for the purpose of developing a research-based intervention to address educational problems. Hence, in the context of study, DDR was used as an "umbrella term" (Richey & Klein, 2014, p. 142) that refers to the design, development and evaluation of the CREPES module in the preschool context.

Richey and Klein (2014) noted the versatile structure of DDR which is dependable on the creativity of the researcher. On the other hand, a review of the related literature discerned a similar pattern in various DDR studies. The process of development often begins with analysis of the needs and context, moves on to the design and development stage, and finally implementation and evaluation of the intervention developed (McKenney & Reeves, 2014; Plomp, 2007; Richey & Klein, 2014). These stages may be structured differently based on the suitability to the research context. However, design and developmental researchers generally adhere to these iterative phases in working towards developing a practical solution to a particular issue in practice.

As in a typical DDR study, this study was structured into three phases as shown in Figure 3.2. The respective purpose for each phase was also briefly outlined. As each phase addresses distinct research question(s), the methods and participants involved in each phase may differ from one phase to another. Details for each subsequent phase involved are discussed in the following sections.

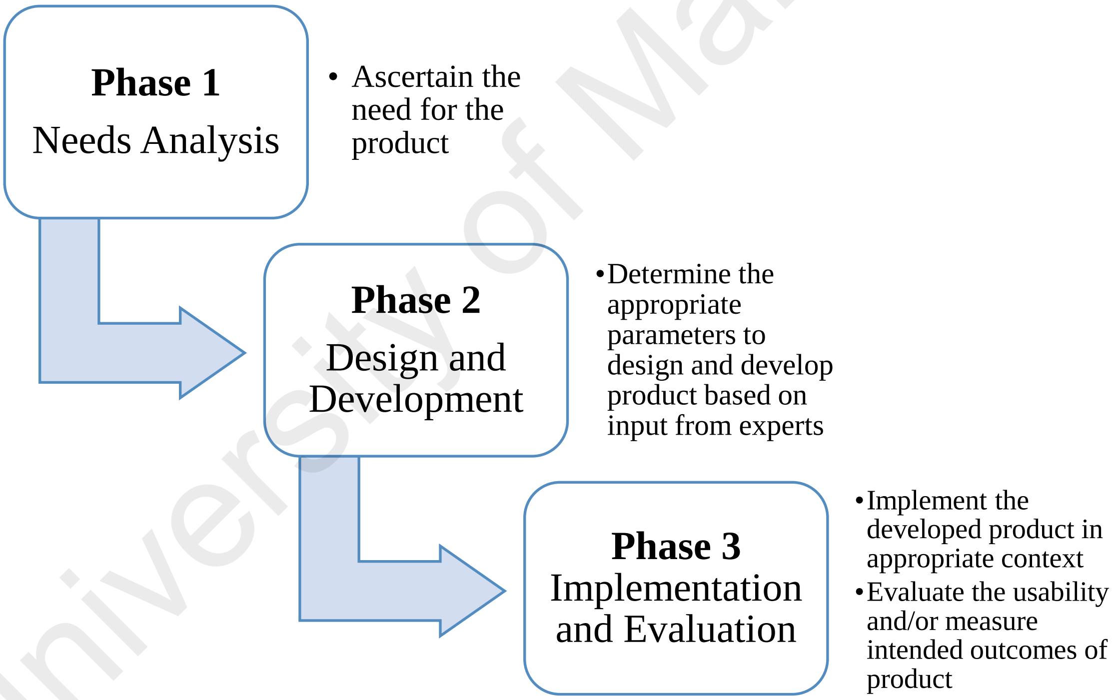


Figure 3.2. Phases involved in this present DDR study.

Context of Study

This study was conducted in context of private preschool settings in the Klang Valley. Klang Valley was selected due to the wealth of resources and expertise available around the region which enabled the development of a valid and trustworthy module. As the capital city of Malaysia, findings from the study served as an appropriate model and reference. Implementing the research study in the Klang Valley also created a larger impact toward the Malaysian early childhood education through increasing public awareness about the importance of creative play.

Today, large amounts of private preschools continue to mushroom in the nation. Although available evidence show that private preschool settings are growing in numbers, the governance, performance and training in the private preschool sector remain uneven. Statistics from the Curriculum Development Centre (2007, as cited in Lily Muliana Mustafa, Nek Kamal Yeop Yunus, & Mohamed Nor Azhari Azman, 2014, p. 106) indicated that the highest percentage of Malaysian preschoolers were enrolled in private preschools in comparison with its public counterpart which are the MOE, KEMAS and PERPADUAN preschools. There is also an emerging trend of parents enrolling their children in private preschools (Lily Muliana Mustafa & Mohamed Nor Azhari Azman, 2013). Since most preschoolers are enrolled in private preschools, there is a need to ensure the quality of the preschool education in private settings. Most private preschools are obliged to cater to the demands of parents who mostly expect preschoolers to be drilled academically and consider play as not productive (Lily Muliana Mustafa & Mohamed Nor Azhari Azman, 2013; Ng, 2010). The implementation and evaluation of the CREPES module provided solid evidence to heighten the awareness on the significance and impact of creative play toward preschoolers' learning and development.

Moreover, private preschool settings were selected because of the lower percentage of qualified preschool teachers in the private sector (PEMANDU, 2013). Without adequate training, their competence in implementing developmentally appropriate practice for children's optimal development is largely questionable. Hence, there is a crucial need for instructional support in order to guide private preschool teachers to incorporate creative play in their respective settings.

Phase 1 Needs Analysis

Mirzaie et al. (2009) emphasised the importance to identify the needs of preschool science teachers in order to develop programs that could fulfill their needs and increase their competencies in teaching early science. Therefore, the research process began with an analysis of needs to determine specific needs in the research context for the development of CREPES module. This phase also allowed the researcher to involve preschool teachers as potential module users in the process of designing and developing the module.

According to Greenfield et al. (2009), determining the problems teachers encounter in teaching science is crucial. Hence, needs analysis was useful for the researcher to gain a comprehensive understanding on the actual context and significant problems encountered in practice. This ensured that the module caters specifically to the identified needs. Figure 3.3 shows a flowchart of needs analysis phase as the first phase of the DDR process.

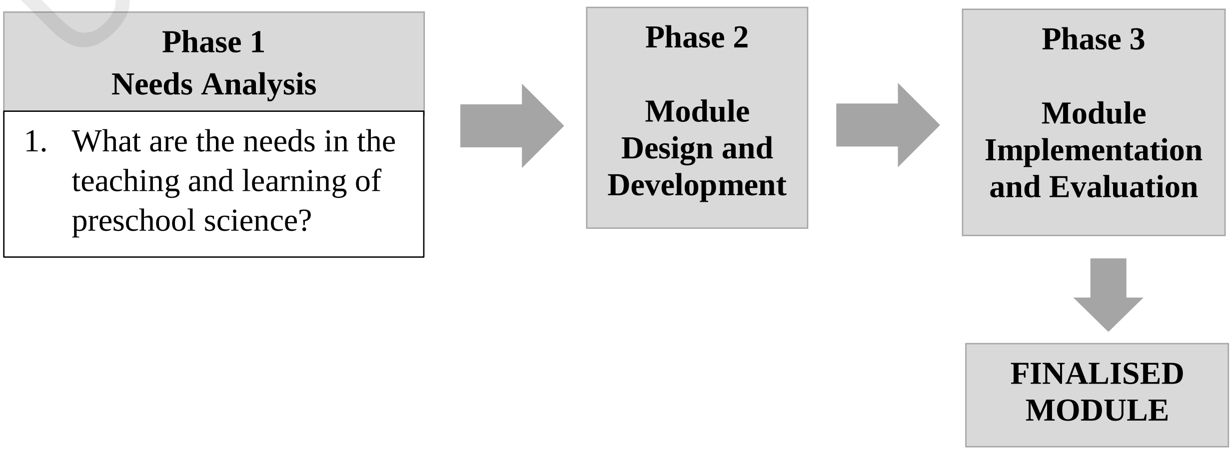


Figure 3.3. Flowchart of the research process – Phase 1 with its research question.

Data collection procedure. In the first phase, data were collected through semi-structured interviews and observation. Interviews allowed the researcher to carry out in-depth investigations on the needs in preschool science teaching and learning; and gain rich descriptive data regarding the implementation of science in preschool settings.

An interview protocol was initially prepared based on the literature reviewed. Validation of the interview protocol was done by three subject experts to ensure its validity prior to data collection. The first expert is the head of the Faculty of Education in an established Malaysian private university, with specific expertise in early childhood education. The second and third experts are senior lecturers in the field of early childhood education in a Malaysian public university and teacher training institute respectively. They were selected based on their expertise and experience in the field of early childhood education.

Appropriate amendments on the interview protocol were made based on experts' comments. The comments provided were regarding the terminologies used, compatibility of the interview questions with the research objective, breaking down of questions to avoid multiple dimensions in one question, and several suggestions to further improve the interview protocol. Following the validation, pilot interviews were conducted with two preschool teachers to further ensure the validity of the interview protocol. Feedback from pilot interview participants resulted in the merging of two repetitive and similar questions; and the addition of two more items to reflect the needs in the preschool science classroom in a more comprehensive manner.

Prior to conducting the interviews, the purpose of the research study and other related research details were clearly explained to the participants involved. Participants were required to sign a consent form to gain their consent on the use of information given for research purpose (Appendix B). Guided by the validated interview protocol (Appendix C), the interviews were audio recorded and transcribed. Subsequently, the interview transcripts were checked by the interview participants in order to confirm its accuracy. As recommended by Merriam (2008), this strategy, known as "member checks" (p. 229) was employed to enhance the reliability and validity of qualitative data.

In addition to interviews, observations were conducted on three six-year-old science lessons to triangulate the interview findings. Permission was obtained from the gatekeepers of two different preschool settings situated in the Klang Valley (Appendix D). The observations were guided by an observation protocol (Appendix E) in order to obtain first-hand information about the current practice of early science teaching and learning for six years old preschoolers. Several aspects that were observed included the learning environment and preschoolers' responses during the lesson. The role of the researcher during the observation was that of an observer as participant (Merriam, 2009) with little direct involvement with the individuals on site. During the observation, detailed fieldnotes and video records were taken. Data recorded were then transcribed and analysed accordingly.

Interview participants. A total of seven participants from private preschool settings around the Klang Valley were interviewed in the needs analysis phase. Through purposive sampling, they were selected based on their common engagement and experience in preschools, specifically in the early science domain; as well as their willingness to participate in the research study.

As shown in Table 3.2, the participants involved included one preschool principal, one teacher in charge of the science centre, and five teachers of six year-old preschoolers. Their experience in preschool settings ranged from a minimum of four years to 23 years. Involving a heterogenous group of participants enabled a wide range of perspectives, specific to address the research question pertaining to the needs in the teaching and learning of preschool science.

Table 3.2

Phase 1 Participants' Information

Participant	Position	Experience (in years)
1	Six years old class teacher	12
2	Science centre specialist	10
3	Principal	16
4	Six years old class teacher	4
5	Six years old class teacher	6
6	Six years old class teacher	9
7	Six years old class teacher	23

The selection of seven participants was adequate because data collected was rich, informative and sufficient to answer the research question which was to determine the needs in the teaching and learning of preschool science. Involving participants from various positions allowed data to be gathered from different perspectives, which enhanced the reliability and validity of the study.

Observation context. Pertaining to observations, three preschool teachers from two different preschool settings were observed while conducting science lessons. One observation was done in Preschool A, while another two were conducted in Preschool B. The observations aimed to explore different needs in preschool science teaching and learning in the respective preschool settings.

Preschool A is a religious-based, non-profit preschool established back in 1958 for the purpose of providing preschool education for the underprivileged community of the suburban area. Basic facilities, which includes a school hall, playground, and a computer room are provided in the setting as shown in Figure 3.4.

Figure 3.4. Playground and computer room in Preschool A.

The non-profit nature of this setting has also indirectly affected the quality of its teachers. Most of the teachers in this setting had little to no early education training. The approach used in the preschool is generally traditional "chalk-and-talk" based on the researcher's previous research experiences in this setting. The teacher-child ratio in this preschool could go up to 1:26 in the case of a six year-old class with only one teacher per classroom. Figure 3.5 shows the physical environment of a typical classroom in Preschool A.

Figure 3.5. Physical setting of a typical classroom in Preschool A.

On the other hand, Preschool B is an established preschool available nationwide. Compared to Preschool A, this setting has better physical environment and facilities, management, teachers' quality and professional development opportunities, as well as greater exposure to research-based teaching and learning approaches. Children in this preschool are generally from middle to upper class families. A six year-old classroom ratio is around 1:20. While guided by the philosophy of active learning, Preschool B also emphasises on the mastery of academic, reading and writing skills for six year-old preschoolers in practice. Figure 3.6 shows a snapshot of the classroom environment in Preschool B.

Figure 3.6. Six year-old preschoolers completing their workbooks in Preschool B.

Data analysis. Data from this phase were analysed by following the general procedures commonly employed for analysing qualitative data. Following data collection and transcription, analysis process of the collected data began by “open coding” (Merriam, 2009). The information gathered was critically read and examined before formulating the initial codes. The same process was repeated on the observation data.

This was followed by axial coding and selective coding, as suggested by Strauss and Corbin (1998) pertaining to analysing qualitative data. Patterns and themes which emerged from the data were identified and formulated systematically in the form of analysis matrices. The researcher then compared and combined similar codes from both interview and observation data as appropriate. The grouping and organization of the codes led to the emergence of themes and categories for the first phase of this present study regarding the needs for the CREPES module. This concluded the first phase for this present study.

Phase 2 Design and Development

After determining the needs for the module in the first phase, the second phase concerned the design and development of the CREPES module. Data from the previous phase was used to guide the module design and development in order to address the needs in actual practice. The first research question of this phase focused on determining the appropriate module design for the CREPES module through experts' consensus. Based on the consensus obtained through the Delphi technique, the module content, including its activities in the module were also ascertained.

Meanwhile, the second research question included the final review and validation of the module by experts and teachers before its actual implementation. This led to the development of a module prototype at the end of the phase. Figure 3.7 outlines the research process with explicit emphasis on Phase 2.

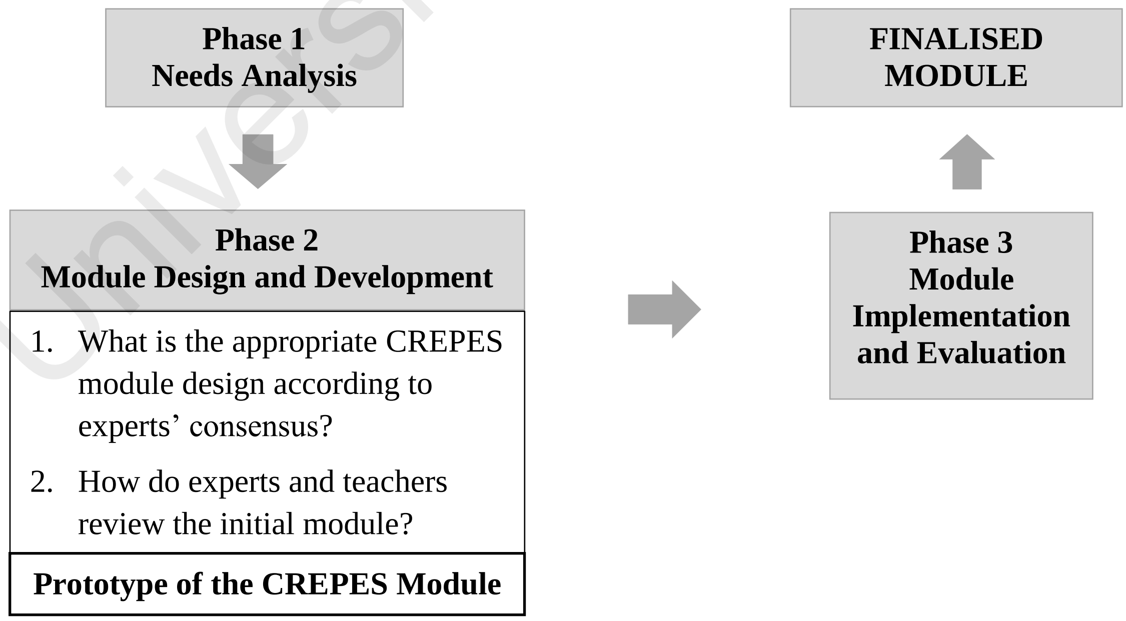


Figure 3.7. Phase 2 and the research questions involved.

The Delphi technique. For the second phase of this design and development research study, the Delphi technique was selected to inform the design of the CREPES module. The Delphi technique is an established method used to obtain consensus from a number of experts through two or more rounds of data collection on a specific issue (Yang, 2003). It is originated from the field of military and defence in the United States during the 1950's (Sinha & Saracho, 2015). It has been used extensively in various fields including healthcare, nursing, information systems, tourism, business as well as education. Clayton (1997) asserted that the role of Delphi to gather experts' opinions in order to make significant educational decisions should not be underestimated.

Specifically pertaining to the field of ECE, Sinha and Saracho (2015) emphasised that the Delphi is an increasingly common method to reach consensus among a panel of participants. One of the recommended purpose of the Delphi technique as suggested by Sinha and Saracho (2015) was to come out with possible topics to be included in a curriculum. This was consistent with the use of Delphi in this phase, which was to determine the overall design and appropriate content to be incorporated in the CREPES module.

The rationale behind selecting the Delphi technique was based on its congruence with the objective for this phase. The objective of this phase was to collect feedback from a diverse group of experts to contribute to the design of the CREPES module. This parallels with the purpose of the Delphi technique which is for "gathering data from respondents within their domain of expertise" (Hsu & Sandford, 2007, p. 1) and "developing curricula and learning experiences" (Green, 2014, p. 2). Sinha and Saracho (2015) reiterated that group responses are more reliable when participants with various expertise and experience come together to form a pool of knowledge. In addition, Green (2014) emphasised the role of Delphi in a developmental research.

The Delphi technique was also selected for its suitability in addressing complex issues with conflicting perspectives (Gruber, 1993; Saedah Siraj & Muhammad Ridhuan Tony Lim Abdullah, 2011). As Delphi subjects have the advantage to remain anonymous, hence they would be more likely to express their genuine perspective on an issue (Gruber, 1993). Considering the play-work dichotomy identified in the literature review (e.g., Anning, 2011; Norsuhaily Abu Bakar et al., 2015), different experts may have varying perspectives on the implementation of early science activities through creative play in the preschool classroom. As the Delphi panel included a wide range of experts including policy makers, instructional designers and early childhood experts from public and private sector with differing backgrounds on theory and practice; their views on the appropriate content to be incorporated in the module could also vary. In light of the controversial nature of the issue under investigation, the Delphi technique was therefore deemed most appropriate in gaining consensus from the panel.

The use of Delphi was most relevant as compared to other data collection methods such as survey and interview, as it effectively addressed the research question regarding the design of the CREPES module. In addition, the Delphi method was selected as it can result in findings that are more valid and reliable to inform the design of the CREPES module based on "informed judgement" (Helmer, 1966, as cited in Green, 2014) of a heterogeneous group of experts.

In the Malaysian context, the Delphi technique has been widely employed in the field of education, as outlined in Table 3.3.

Table 3.3

Studies Conducted using the Delphi Technique in the Context of Malaysian Field of Education

Study	Type of Delphi	Purpose for employing the Delphi method	Number of experts
Parsons (2008)	Three-round Delphi	Getting consensus among academic experts on best practices of online instructional design practices in Malaysian higher education	12
Saedah Siraj & Azdalila Ali (2008)	Three-round Delphi	Attain principals' consensus on future Malaysian secondary school curriculum	10
Chin (2009)	Three-round Delphi	Get experts' consensus on the aspects to be incorporated into the webpage for Form 2 Malay language	10
Kamisah Osman & Marimuthu (2010)	Two-round Delphi	Gain experts' consensus on the domains of Science teaching and learning objectives relevant for the 21st century learners that should be incorporated into the Malaysian secondary science curriculum	40
Norlidah Alias (2010)	Two-round Delphi	Obtain consensus from experts on a suitable design for a Physics pedagogical module for Form 4 students based on the Felder-Silverman learning style and technology	21
Saedah Siraj et al. (2012)	Three-round Delphi	Attain consensus of experts on the future projection of the patriotism spirit among Malaysian secondary school students	10

Table 3.3 *(continued)*

Fong, Ch'ng, & Por (2013)	Modified Delphi with three rounds	Get experts' consensus on the type of ICT skills secondary school Mathematics and Science teachers should possess to develop an ICT competency standard	33
Ruhizan M. Yasin, Asnul Dahar Minghat, & Saemah Rahman (2013)	Two-round Delphi	Identify the main elements for the sustainability of vocational subjects in Malaysian secondary schools	12
Amani Dahaman (2014)	Two-round modified Delphi	Obtain information from experts on the design of the m-learning Arabic module for the Malaysian Teacher Training Institute (*Institut Pendidikan Guru*)	15
Muhammad Faizal A Ghani (2014)	Four-round Delphi	Get experts' consensus on the aspects to be incorporated into the Malaysian Effective Primary School Model	15
Mohd Bekri Rahim (2015)	Three-round Delphi	Determine the potential of e-portfolios for competency assessment and virtual learning in technical and vocational education (TVET)	11
Norfariza Mohd Radzi, Muhammad Faizal A. Ghani, & Saedah Siraj (2015)	Three-round Delphi	Develop an effective school-based profile for financial management	15

Based on the past studies outlined above, the researcher discerned that most studies were conducted in the context of secondary school. A thorough literature search has found that the Delphi method has rarely been used for the benefit of early childhood education in Malaysia thus far. In light of these justifications, the Delphi technique was therefore appropriate to be employed to achieve the objectives set for this phase. By applying this technique, opinions of a group of early childhood experts were harnessed and converged systematically to ascertain the relevant design and content of the CREPES module.

Selecting an appropriate panel of experts is crucial for the Delphi technique (Hsu & Sandford, 2007; Saedah Siraj & Muhammad Ridhuan Tony Lim Abdullah, 2011). This strengthens and ensures the validity of the Delphi method, as well as the accountability of the product at the end of the study (Clayton, 1997). According to Sinha and Saracho (2015), two key aspects to consider when selecting a panel include size of the panel and qualification of the experts.

Regarding the number of Delphi experts involved in a panel, there has not been a definite agreement in the literature (Akins, Tolson, & Cole, 2005; Hsu & Sandford, 2007). Based on past Delphi studies, Thangaratinam and Redman (2005) suggested that the number of experts should range between four to as many as 3000; whereas Sinha and Saracho (2015) maintained that the range was from seven to 154.

A small panel size may not result in a representative decision (Hsu & Sandford, 2007; Saedah Siraj & Muhammad Ridhuan Tony Lim Abdullah, 2011). Nevertheless, it is important to note that small number of experts in a Delphi study would not necessarily reduce its strength and rigour. Powell (2003) emphasised that the representativeness of the sample is dependent on the experts' quality rather than its quantity. Concurring to this, Akins et al. (2005) maintained that careful selection of experts based on stringent criteria could compensate a small Delphi panel size, resulting in equally reliable findings. In light of the limited time frame for this present study, the Delphi panel of this present study involved only 14 panellists. This was as suggested by Okoli and Pawlowski (2004) who recommended a panel size of 10 to 18 experts.

Similar to the ambiguity surrounding the size of the Delphi panel, there is also ambiguity on who should be considered an 'expert' in the existing literature on the Delphi technique (Hasson, Keeney, & McKenna, 2000; Hsu & Sandford, 2007). Several scholars suggested that experts involved in a Delphi study should have adequate knowledge and rich experience related to the research topic (Clayton, 1997; Hasson et al., 2000; Hsu & Sandford, 2007). Scheele (2002) posited that stakeholders who are directly influenced by the research study and experienced experts in the related field will form a sound Delphi panel.

Selecting and forming the Delphi expert panel. As suggested by Hasson et al. (2000), criterion sampling was used to carefully select the Delphi experts in this study. As a form of purposive sampling, experts were selected if they fulfil specific predetermined criteria and are highly experienced and knowledgeable in the subject (Palinkas et al., 2013).

Based on recommendations from the literature, an "expert" for this present study was defined based on the criteria as follows in order to avoid any ambiguity and establish strength for the Delphi technique:

a) Preschool science experts with at least 10 years of involvement in material development

b) Early childhood academicians with expertise on play and/or creativity research

c) Preschool curriculum developers with at least 10 years of experience

d) Preschool principals or teachers with a minimum of 10 years' experience

An expert is qualified to contribute in the Delphi panel upon fulfilling one or more criteria and upon agreeing to take part in the entire Delphi process. These standards ensured that experts in the panel are a combination of various areas of expertise including science, play and creativity, curriculum development and early childhood education. With at least 10 years of experience in their respective fields, experts would have adequate exposure and knowledge to be able to contribute ideas to the design of the CREPES module. Involving academicians in the Delphi process is crucial as the researcher is able to tap into the expertise and knowledge of researchers who are most aware of recent trends and research orientations in the field of play and creativity whether within the country or internationally.

As shown in Figure 3.8, the Delphi expert panel in this study contained a balanced mixture of experts in both the theoretical and practical aspects. This ensured that data collected were comprehensive and represented perspectives from both theorists and practitioners. In the context of this present study, theorists refer to policy makers and academicians; while practitioners are implementers of curriculum with direct, regular contact with preschoolers, their families and communities. This mixture of experts from various backgrounds reflected the recommendation of Linstone and

Turoff (2002) who stressed on maintaining the “heterogeneity of the participants” (p. 4) to ensure the validity of findings.

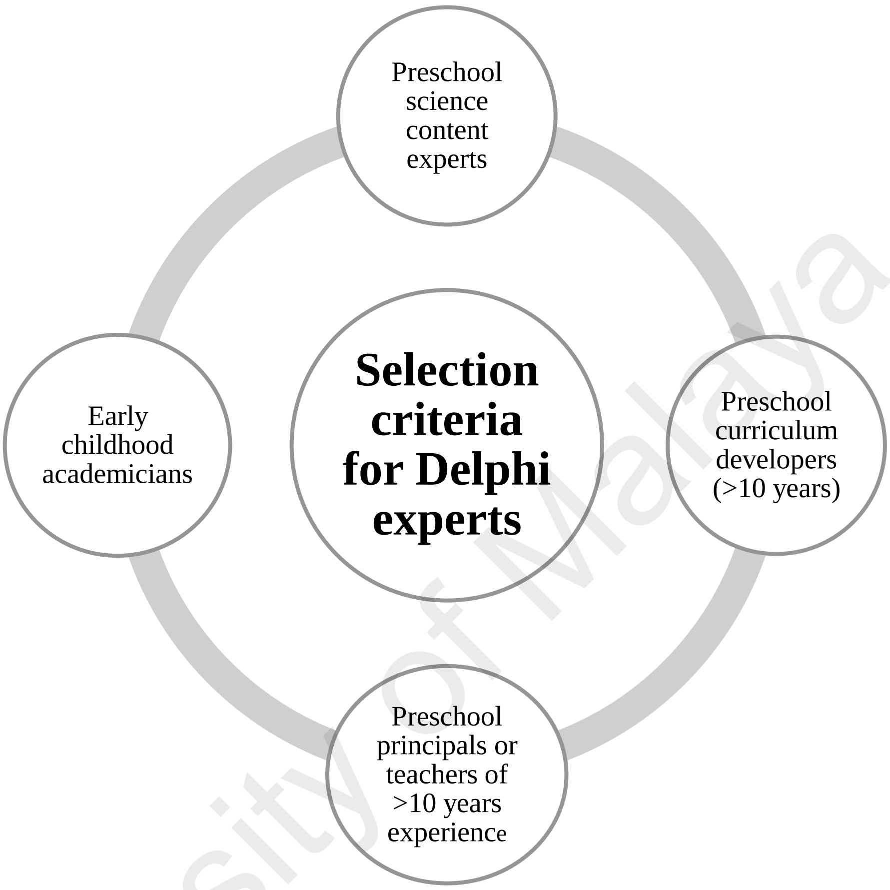


Figure 3.8. Selection criteria for Delphi experts.

A total of 18 experts were invited to join the Delphi panel (Appendix F). Out of the 18 experts, 14 agreed to participate as panel experts. Detailed description of the expertise of each expert selected in the Delphi technique is crucial to ensure the credibility of the Delphi (Hasson et al. 2000). Table 3.4 outlines the panel experts’ information including their area(s) of expertise, years of experience, and whether they are theorists or practitioners. Based on Table 3.4, each expert was numbered accordingly to allow easy reference and identification of experts throughout the Delphi study.

Out of 14 experts in the Delphi panel, seven of the experts are theorists and another seven are practitioners. The classification of whether an expert is considered a theorist or practitioner could be difficult to gauge, as it is likely that an expert has a combined expertise of both theory and practice. Hence, it was determined by the dominant nature of their current jobs—whether it is more inclined towards theory or practice.

Table 3.4

Information of Delphi Panel Experts

Expert	Area(s) of expertise	Years of Experience	Theory (T) / Practice (P)
1	Science content, creativity	25	T
2	Play, curriculum development	16	T
3	Play, curriculum development	33	T
4	Play, preschool administration	15	P
5	Preschool administration	15	P
6	Preschool curriculum development	28	T
7	Play, preschool administration and teaching, curriculum development	10	P
8	Science content, Science curriculum development	31	T
9	Preschool curriculum development	11	T
10	Science content, Science curriculum development	14	T
11	Preschool administration	28	P
12	Preschool teaching	28	P
13	Preschool administration, curriculum development	25	P
14	Preschool administration	13	P

Data collection procedure. Once the panel of experts has been determined, consent was gained from the experts after explaining the detailed purpose of the study (Appendix G). Hasson et al. (2000) emphasised the importance of preparing the experts by providing adequate information about the process and establishing rapport with experts in order to increase response rates. Hence, experts were thoroughly briefed on the Delphi technique so that they possess adequate understanding about the entire Delphi process and the commitment required upon participation.

Data were collected through a three-round Delphi in order to obtain consensus from experts on the design of the CREPES module. In the first round, semi-structured face-to-face interviews with all 14 experts were conducted to explore the possible CREPES module design that would support preschool teachers in their practice. Since the Delphi technique requires commitment and prolonged responses from panel experts for three successive rounds, face-to-face interviews for the first round encouraged experts' continual participation in the entire Delphi process (Hasson et al., 2000).

The overall module design encompassed aspects pertaining to the module content. Each Delphi expert formulated their ideas via in-depth interviews in the first round of Delphi. The interview protocol was prepared and subsequently validated by three subject experts with specific expertise in early childhood education (Appendix H). Findings obtained from the interviews were used to develop the questionnaire for the subsequent Delphi round.

In the second round, questionnaire that was developed based on the emergent themes from the interviews in Round 1 were administered to the panel experts (Appendix I). The questionnaires were distributed via two mediums i.e. email or in person based on experts' preferences. Although traditional Delphi is usually paper-based, Hasson et al. (2000) noted the increased use of online platform as a medium for Delphi survey distribution. Specifically, the questionnaire was distributed via email to 12 out of 14 of the experts. Email was selected as the medium of distribution for its "ease, convenience and comprehensiveness" (p. 28) which facilitated the continuous participation of the experts (Hanafin, 2004). Okoli and Powlowski (2004) reiterated that usage of online mediums presents an advantage for the Delphi technique which could be time-consuming, whereby time between each round can be reduced. Time frame to return the questionnaire was set at two weeks, which provided experts with sufficient time to respond.

Based on themes pointed out by the panel in the first round, the items in the questionnaire sought experts' responses on five different areas. These areas include the general features of the module design, suggested module sections and activities, teaching strategies or techniques, as well as supporting resources for the module. The Delphi panel was required to rate their level of agreement on each item for the abovementioned areas. This was done based on a four-point Likert scale: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree. In addition, experts were also encouraged to add related comments for the items in the spaces provided. The median and interquartile (IQ) range values for each item were calculated. Based on the mean values, the items were rearranged before the questionnaire for the next round was distributed.

In the final round, a similar questionnaire as in Round 2 was used. However, median, IQ values, and experts' respective ratings for the previous round for each item, along with newly added items were added for this round (Appendix J). Items in each section were also rearranged from the highest to the lowest mean values. Similar to Round 2, experts were to rate their agreement for all the items, including the newly added items suggested by the experts. The inclusion of the median and IQ values enabled experts to reconsider their responses in light of other experts in the Delphi panel (Chin et al., 2013). Experts could choose to retain or modify their answers depending on the overall median value and IQ range of the panel. Justifications of their choices could also be made if ratings were out of the median value of the overall panel.

The mean, median and IQ range for Round 3 were then calculated. Once consensus has been achieved, findings obtained were used to finalise the appropriate content to be included in the CREPES module. This resulted in an initial module designed based on recommendations and consensus of the Delphi panel.

Data analysis. Data analysis was conducted accordingly for each Delphi round in line with the data collection procedures, as illustrated in Table 3.5. Data were analysed to determine the appropriate design for the CREPES module based on experts' consensus.

Table 3.5

Summary of Delphi Data Analysis

	Round 1	**Round 2**	**Round 3**
Data Collection	Semi-structured interview with panel experts	Survey questionnaire based on Round 1 interview	Similar survey questionnaire including values of median and IQ range from Round 2
Data Analysis	Thematic analysis	Mean, median and IQ range	Mean, median and IQ range; Wilcoxon Signed Ranks Test

For Round 1, interview findings collected from the selected panel experts were transcribed, analysed thematically and used as the basis to develop the survey questionnaire for Round 2. Themes were identified and formed different sections of the questionnaire. Suggestions from experts were also collectively gathered and formed the items under the various sections of the survey questionnaire.

Analysis for the findings from Round 2 and 3 were based on two measures of central tendency i.e. mean and median; and interquartile (IQ) range as a measure of variability. For the analysis of Round 2, the mean, median and IQ range values for each item in the survey were calculated using the IBM SPSS version 22; which led to the development of the questionnaire for Round 3.

As suggested by Muhammad Faizal A. Ghani (2014), the mean was used to rearrange the questionnaire items in a descending order, from the highest mean value to the lowest. Mean was selected to determine the ranking of an item, as 43 out of 45 items had a similar mode value of 4. Therefore, mean was a more precise option to rank the items compared to mode. Median value was used to represent the level of agreement among the experts—a median score of 4 indicates that most experts strongly agree with the item. Meanwhile, the IQ range represented the level of consensus among experts and revealed the relationship between an item and an expert's opinion (Chin et al., 2013; Saedah Siraj et al., 2012). Measurement of the levels of consensus based on IQ values with reference to Chin et al. (2013) and Norfariza Mohd Radzi et al. (2015) is outlined in Table 3.6.

Table 3.6

Measurement of the Level of Consensus

Consensus level	High	Medium	Minimal
IQ value	0 - 1	1.01 – 1.99	>2.0

In Round 3, similar methods were employed for analysis, which included mean, median and IQ range values. In addition to these, Wilcoxon signed ranks test was conducted in this round to allow comprehensive comparisons between the findings from Round 2 and 3. The Wilcoxon signed ranks test is a nonparametric test similar to the *t* test used to compare sample means. Since data collected in both rounds measured the level of agreement in Likert scale, it is therefore classified as ordinal data. Since ordinal data is assumed to be non-normally distributed as compared to interval or ratio data, non-parametric test was used. It is measured by the *Z* score computed for each item in the questionnaire to compare whether there are significant differences in ratings of the panel between Rounds 2 and 3.

As recommended by Norfariza Mohd Radzi et al. (2015), a *Z* score below -1.99 indicates no significant difference between experts' ratings in the two Delphi rounds. In other words, a value below -1.99 indicates that ratings were consistent between both rounds. Whereas, a *z* score above -2.00 implies a significant difference between experts' opinions in Round 2 and 3.

Finally, items with high consensus (IQ value ranging from 0 to 1) and high level of agreement (median value of >3) among the panel were considered as final design recommendations for the CREPES module based on consensus of experts.

Design of the initial module. Based on expert consensus on the CREPES module design, an initial module was designed by the researcher. In order to implement the module in actual practice, it is crucial for teachers to first acquire holistic understanding of the creative play approach. Hence, design of the initial CREPES module began with a section of introduction to enable users to get a clear picture of what the module is about and its expected outcomes. Aside from using the recommendations of the Delphi panel in designing the CREPES module, all decisions were made with the purpose to achieve the module's intended outcomes. The module was to play its role as an instructional support tool for teachers as well as enhance preschoolers' creativity through implementation of creative play activities.

On top of the introduction part, one of the key parts in the module is the suggested creative play activities. Through these activities, preschool teachers could familiarise themselves with the creative play approach and be better equipped to implement the activities in practice. Prior to designing the CREPES module, the topics and specific activities to be included in the module were ascertained. This was done based on a thorough review of the Malaysian syllabus and common themes used in preschool science, supported by findings in the needs analysis phase and Delphi findings.

The suggested activities for the module were based on two familiar topics on the material world, namely 1) sink and float, and 2) magnets. Both topics are common science topics that are taught at the preschool level. Learning standards of these topics can also be found in the NPSC under the science and technology strand on "investigation of materials" (Ministry of Education, 2017). Yet, many Malaysian preschool teachers seem to be unsure about how to teach these topics in ways that can effectively stimulate preschoolers' creativity. In addition, most teachers possess insufficient and inaccurate scientific knowledge, some even have misconceptions on these topics. One most common example of teachers' misconceptions on the topic of sink and float as pointed out by several Delphi panel experts was that all light objects float, whereas all heavy objects sink.

Hence, both of these topics were most appropriate in this research context. They present ample opportunities for development of creativity through active and hands-on explorations. Considering the time limitation, only two topics were chosen. Furthermore, two topics were reasonably sufficient as an introduction and preliminary implementation of the creative play approach by preschool teachers. On the other hand, it enabled adequate understanding and in-depth learning for both teachers and preschoolers on both topics and the science concepts involved.

Following selection of topics, the activities for each topic were planned and drafted. Design of the activities incorporated were guided by features of activities agreed upon by the Delphi panel. These features included hands-on, open-ended, interactive and integrated across various domains among others. In addition, the SEA model was also used to guide the design of the activities in order to ensure that creativity is effectively infused into the module activities. All the activities were also considered in terms of their practicality to be implemented in the Malaysian preschool context; such as its compatibility with the NPSC, availability of teaching resources, and teachers' abilities to effectively carry out the suggested activities to achieve the intended outcomes. Each activity was arranged systematically based on a fixed template designed by the researcher to ensure that the module design is consistent and user-friendly.

Besides that, theories that support the module, tips for implementation, a guide on teachers' reflections and activity sheets were also included to enrich the module and provide extra pedagogical support for teachers.

In relation to the NPSC (Ministry of Education, 2017), the CREPES module was designed in accordance with the curriculum which established play as an effective medium for preschoolers' learning and development, and creative thinking as one of the intended outcomes for early science learning. This module complements the implementation of NPCS as it provides concrete guidelines as a reference for teachers in facilitating preschoolers toward achieving the learning standards through hands-on, creative play early science activities. Furthermore, information provided in the module and its suggested activities support teachers in terms of pedagogical and scientific content knowledge. Specifically designed as an instructional tool on early science, it is believed that this module is an effective platform for teachers to incorporate creative play activities, through which preschoolers develop their creativity.

Review of the initial module. Design of the initial module was followed by the development of the module prototype, which involved a thorough review of the initial module. Review of the CREPES module allowed the researcher to make appropriate amendments on the module content according to reviewers' feedback prior to its implementation. The review process helped to improve the overall design and content of the module so that its expected outcomes could be achieved more effectively.

As shown in Table 3.7, the CREPES module reviewers included two groups of participants; 1) content experts, and 2) preschool teachers who are the prospective module users. A letter of appointment as module reviewer was sent through email

(Appendix K) and the expert agreement form was filled in upon reviewers' acceptance of the appointment (Appendix L).

All five reviewers were selected purposively based on their expertise and willingness to participate in the review. They consisted of three content experts, including two experts on early childhood education and one on scientific creativity and instructional design. In addition, two preschool teacher reviewers possess teaching experience of at least ten years in the field of ECE. Both teachers had experience in teaching early science in their respective settings. This ensured the provision of constructive and useful opinions on the initial module, which focuses specifically on early science.

Table 3.7

Information of CREPES Module Reviewers

Reviewer		**Expertise**	**Highest Qualification**	**Years of Experience**
Content Expert (CE)	1	Scientific creativity, instructional design, STEM education	PhD in Education (Instructional Design and Technology)	27
	2	Early childhood education, teacher training	Master in Early Childhood Education	15
	3	Early childhood education, teacher training	Master in Education (Human Development & Psychology)	22

Table 3.7 *(continued)*

Preschool Teacher (PT)	1	Practice of preschool teaching and learning, curriculum development	Master in Early Childhood Education	18
	2	Practice of preschool teaching and learning	Bachelor in Early Childhood Studies	10

Selecting both content experts and teachers as reviewers of the CREPES module allowed a comprehensive module evaluation encompassing both theory and practical aspects before its implementation. This in turn enabled the development of a valid module prototype which caters to the needs of its users who will implement the module including teachers and indirectly preschoolers.

First, written comments were collected from the reviewers guided by an open-ended module review form (Appendix M). These comments enabled comprehensive review of the module; including but not restricted to its overall design, content and suggested activities. This method was selected as it provided greater depth and width for constructive comments that could practically contribute to improving the CREPES module, in comparison with a survey based on Likert scale. It also allowed more time for reviewers to go through the module and review it at their desired time, compared to an interview; hence increasing the response rates for the module review.

In addition, any clarifications on the given comments were made through online interviews by email. The unstructured interviews enriched the data by allowing further and thorough discussions on specific written comments made by the reviewers before its implementation in the following phase. Online interviews were selected over face-to-face interviews in light of reviewers' preferences for their convenience as well as the limitation of time.

Recommendations from the reviewers were then transcribed and analysed qualitatively into themes for the revision of the initial module. Changes were made as appropriate based on the recommendations given by the reviewers to effectively cater to the research context. Following the amendments made, a prototype of the module was developed and ready to be implemented in the next phase.

Phase 3 Implementation and Evaluation

The last phase in this design and development research (DDR) study encompassed 1) module implementation, and 2) evaluation of the module's usability. This phase is considered paramount as it involved testing out the module in an actual setting. Limited products and tools used in practice have been tested and validated by empirical means (Richey & Klein, 2007). Therefore, this study sought to address this gap by implementing and evaluating the usability of the CREPES module as a means to provide empirical evidence for the module. Figure 3.9 shows the process involved in Phase 3.

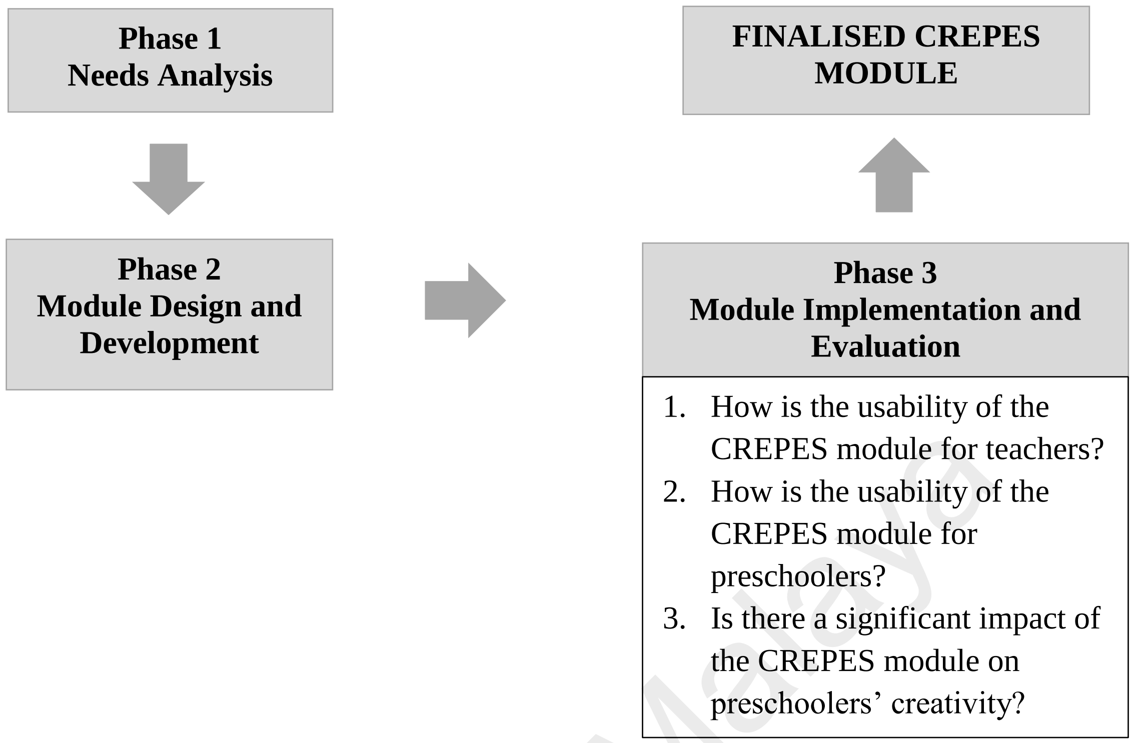


Figure 3.9. Phase 3 and its research questions.

Module implementation. Prior to evaluating the CREPES module, the module prototype that has been reviewed in Phase 2 was implemented. The purpose of implementation of the module prototype was to enable the evaluation of the module for both teachers and preschoolers.

A selected private preschool Z in the Klang Valley was selected to be the implementation site for the CREPES module. Implementation of the module in an actual setting enabled data collection in a naturalistic environment. This in turn enabled the researcher to identify practical issues regarding the use of the module in practice, and to ascertain areas that could be further improved. Preschoolers' development in creativity is also more effective and authentic in a natural setting. Hence, the accountability of the module developed would be affirmed, which provides solid empirical evidence for effective future implementation of the module.

Implementation of the CREPES module began by gaining consent from the setting. This was done through the gatekeeper for consent to implement the module within the premise (Appendix N). In order to accommodate to time limitations due to concert practices and year end assessments in the setting, the period of module implementation had to be compressed to three weeks upon request from the preschool management, i.e. two activities per week, instead of six weeks as initially proposed. However, it is important to note that the number of module activities implemented remained the same.

Parental consent for preschoolers' participation in the module activities and evaluation was also obtained (Appendix O). In addition, selected teachers' consent to participate in the study were also gained. Teachers were selected based on their willingness to participate in the module orientation session and to implement the module for a period of three weeks. They should also possess at least five years of teaching experience in the field of early childhood education. This was to ensure that these teachers have adequate understanding about the module and competencies to translate the module into practical teaching in a real setting.

Prior to implementing the CREPES module, an orientation session was held to introduce the module and the details of its implementation to both teachers. After being equipped with adequate knowledge on the module and competency to implement the module, the teachers implemented six module activities with their preschoolers over the span of three weeks. The average duration for each activity is around 30 to 45 minutes.

The six implemented module activities were on two different topics, namely 1) sink and float, and 2) magnets. Activity 1 to 3 were on the first topic, whereas activity 4 to 6 on the latter. Brief description of the module activities is as shown in Table 3.8.

Table 3.8

CREPES Module Implementation Schedule

No.	Activity	Description
1	Module Orientation (Teacher Training Session)	• Thorough briefing on module background and things to know. • Discussion / testing out activities.
2	**Activity 1:** Introduction for Sink & Float	Preschoolers hunt for things around the classroom that they predict will sink or float, then test whether their predictions are right.
3	**Activity 2:** Does Clay Sink or Float?	Preschoolers explore how to make clay float.
4	**Activity 3:** Making a Boat from Recyclable Items	Preschoolers design a boat using recyclable items, followed by a boat race between class.
5	**Activity 4:** Magnet Maze	Introduction to magnetic and non-magnetic things. Completing a maze using magnets.
6	**Activity 5:** Art with Magnets	Making art using magnetic attraction on magnetic things.
7	**Activity 6:** Magnet Car Race	Preschoolers explore how to make a toy car move with magnets.

Infusing creativity in the preschool classroom begins from a creative teacher (Eckhoff, 2011; The National Center of Quality Teaching and Learning, 2012). As the CREPES module emphasises on development of creativity through implementing open-ended activities, minute details concerning the module activities were decided by the preschool teachers involved based on their professional judgement. Several aspects for consideration include grouping of preschoolers, and teaching aids or materials to use. This empowered teachers with freedom to make decisions while infusing creativity in their classrooms, and provided teachers with pedagogical flexibility to modify the activities as appropriate based on the needs of preschoolers and available resources.

Context of preschool setting. This module was implemented in preschool Z, a premise in a two-level shop lot situated in a suburban town in the Klang Valley. It is a private preschool setting with around 120 children ranging from three to six years old. Most children are from lower to upper middle class families. Being a shop lot premise, preschool Z has no outdoor play area. Its physical environment includes an administration office, a mini indoor play area with basic playground equipment, an assembly hall for music and movement activities, and a sleeping room.

As the research focus is on preschoolers of the age of six, there is a total of 31 six-year-olds placed in two different classes in the setting. Class A has 17 preschoolers, while class B has 14. Each class has one main teacher, simultaneously both classes share one assistant teacher. The main medium of instruction is Chinese, as most of the six-year-olds are prepared to be enrolled in Chinese vernacular primary schools. Other languages such as the Malay and English language are rarely used, except during respective language lessons. Teacher-centred approach is generally used in the teaching and learning of the setting. Workbooks are used for every subject. Preschoolers, especially six-year-olds are required to read and write in most of the lessons.

Participants. Two teachers in preschool Z were involved in the implementation of the module activities. Teacher Mun (pseudonym) is the teacher for class A, while teacher Kat (pseudonym) leads class B. Teacher Mun who is in her early 50's is an experienced preschool teacher for the past 25 years. She also had experience managing a private preschool as a principal. Her highest qualification was a Bachelor Degree in Early Childhood Studies. Teacher Kat, in her early 30's has a Diploma in Early Childhood Education with seven years of teaching experience. Both teachers had prior experience in teaching early science. Their qualifications and experience in preschool settings greatly enhanced their competence in understanding the module content and its purpose, as well as translating the suggested module activities into actual lessons during implementation.

Module evaluation. Richey and Klein (2014) stressed on the crucial role of evaluation in DDR. In this study, evaluation of the CREPES module involved addressing two key aspects of the module, namely its usability and its impact on preschoolers' creativity. Figure 3.10 illustrates an overview of the CREPES module evaluation. Evaluation of the module's usability focused on the creative process during the implementation; whereas evaluating its impact involved measuring the outcome or product of creativity brought about by the module. Since this study emphasises on the creative process rather than the product, findings on the module's impact through quantitative means complemented and consolidated data on module usability.

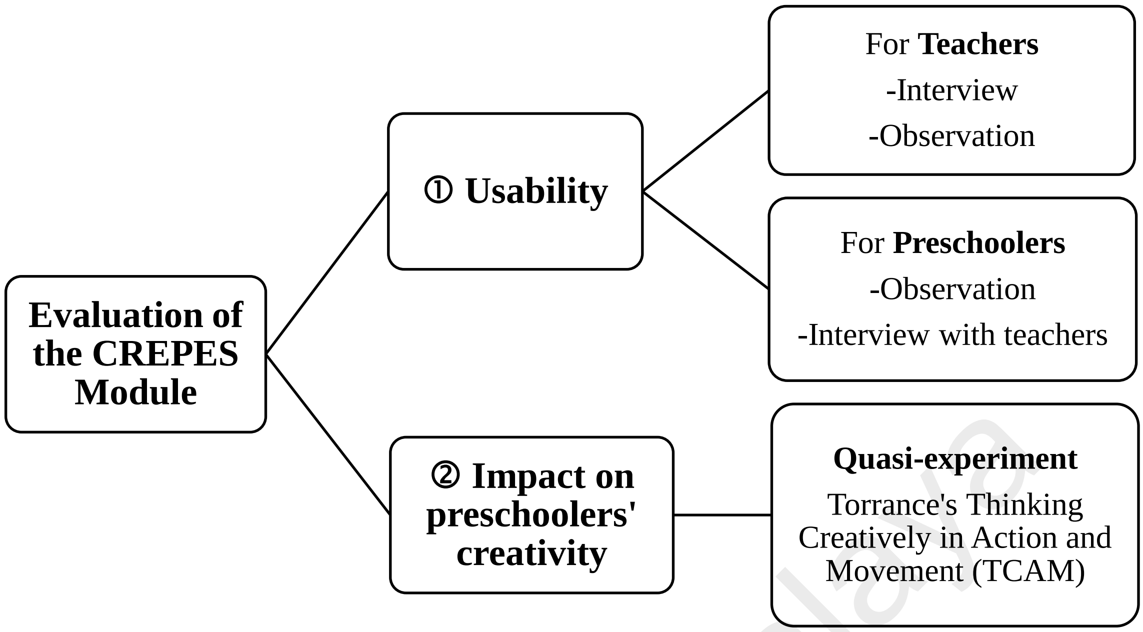


Figure 3.10. Evaluation of the CREPES module.

A usability test aims to ascertain how a product could facilitate the user in achieving certain objectives though a structured process (Sandars & Lafferty, 2010). One of its main objectives is to inform product design by determining and improving on existing loopholes before its finalisation (Rubin & Chisnell, 2008).

In the context of this study, the usability of the CREPES module was determined to ascertain how far was the module useful in achieving its intended outcomes through qualitative methods. Employing qualitative methods allowed in-depth and rich data to be collected from the actual setting. Qualitative methods could better answer the research question on the CREPES module's usability which focused on the process of preschoolers' creative development. Moreover, it would be difficult for preschoolers' complex and dynamic nature of development to be holistically captured through quantitative measurement alone.

Module usability for two different user groups was determined. The two groups included 1) teachers who implemented the module, and 2) preschoolers who were also the indirect users of the module. Both groups represented the prospective module users which enabled the collection of concrete evidence to evaluate how far has the CREPES module achieved its intended objectives. Based on data gathered from these two groups of users, relevant revisions were made to the module design and content to ensure its efficacy towards preschoolers' creativity, and its general practicality to be implemented in preschool settings.

In order to evaluate the impact of the module on preschoolers' creativity, a test of creativity was conducted through a quasi-experiment. Creativity of preschoolers who had undergone the intervention of CREPES module activities and another group under the conventional approach of early science instruction were compared. It is important to stress that this quantitative measure was employed primarily as an indication of the impact of the CREPES module and the creative play approach, rather than a representation of preschoolers' level of creativity per se.

The collective findings from evaluating the module through qualitative and quantitative measures respectively enabled its holistic evaluation. In addition to the quantitative data, qualitative data were also collected as suggested by Zachopoulou et al. (2009). This combination also parallels with the feature of DDR that such studies employ "an assortment of…research methods and strategies" and many are considered as "multi-method research" (Richey & Klein, 2014, p. 142). The researcher firmly believes that the fluidity of young children's creativity makes it inappropriate for the measurement of their creativity solely through tests. Moreover, quantitative test scores alone would not accurately reflect and evaluate the impact of the module on preschoolers as young as six. Therefore, the quantitative findings acted as a support and complement to the qualitative data. This ensured strong, valid and reliable evidence as a measure of evaluation for the CREPES module.

Based on the data collected as a whole, the module was finalised as appropriate prior to its release.

Module usability for teachers. As the key users of the module, teachers' feedback on the usability of the module was crucial. After the implementation of six different module activities for three weeks, a semi-structured interview was conducted with both the teachers. Data were collected regarding the ways the CREPES module has helped them in conducting creative play activities; as well as the challenges they encountered as they implemented the module.

By employing interview as a method for data collection, in-depth data about teachers' experiences of implementing the module were elicited. This enabled the researcher to perform a comprehensive evaluation on the module and identify potential aspects of the module to be improved. An interview protocol was used to guide and structure the interview (Appendix Q). Part of the interview questions were developed based on the items for reflections which were included in the CREPES module. This enabled teachers to be more prepared to answer the questions along with support from observations during the module implementation. The interview protocol has been validated by two subject experts prior to data collection.

With two teachers being interviewed together, the interview was conducted in a similar nature with a focus group interview. Compared to individual interviews, the advantage of including both teachers at once was that it stimulated discussions and additional responses from the participants upon hearing each other's feedback. Furthermore, teachers also discussed further and learned from each other about the implementation of the module in their respective classes. This also motivated the teachers to further extend the module's application to benefit more preschoolers in the near future.

In addition, observations conducted during the entire period of module implementation were also used to support the data collected. Observations could comprehensively capture first-hand how was the module implemented as teachers conduct the creative play activities. Besides fieldnotes, video records were also taken to ensure that the entire process of how teachers implemented the module could be captured. As Merriam (2009) aptly put it, combining data from both observation and interview data enables "holistic interpretation" (p. 136) of the topic under study.

The researcher's stance during the observation was mostly of a participant as observer (Merriam, 2009). The researcher was involved by actively helping the teachers in conducting the module activities. Compared to being a complete observer or observer as participant, this stance enabled teachers who were implementing the module to be more comfortable with the observer's presence and to focus on their tasks better during the observations conducted. This enhanced the trustworthiness and authenticity of the data collected.

Finally, data collected from observations and interview were respectively transcribed, analysed and sorted into themes.

Module usability for preschoolers. Preschoolers are the indirect users and ultimate beneficiaries of the CREPES module. Hence, besides teachers' evaluation of the module's usability, preschoolers' responses toward the module implemented were also taken into account. During the implementation of the module activities, naturalistic observation was conducted in two different classes to evaluate the usability of the module for preschoolers.

Observation was selected as a data collection method as it enabled the researcher to gather first-hand data at the actual setting (Creswell, 2012). Moreover, it is the most appropriate method to study preschool children's responses as they may not yet possess sufficient cognitive processing and verbal communication skills to clearly express their thoughts or ideas. The observations were guided by an observation protocol (Appendix R) to evaluate the role of the module in enhancing preschoolers' creativity. Fieldnotes were also recorded during observations in order to capture important moments and verbatim responses of preschoolers during the activities, including questions asked, responses to questions, their interactions with teachers and peers, as well as discussions.

Throughout the period of observation, the researcher was actively involved in the activities together with the preschoolers while taking notes; most of the time taking the stance as a participant as observer (Merriam, 2009). This stance enabled preschoolers to be natural and to get involved in the module activities in a more relaxed atmosphere during the observation.

Simultaneously, video cameras were used in both classes to capture video records during the module implementation. Hatch and Coleman-King (2015) acknowledged the advantage of video recording for research in early childhood education. Video records throughout the implementation of module activities were effective as minute details such as classroom disruptions, or teachers' classroom management skills that an on-site observation might miss could be captured and taken into account. More importantly, as the module activities were mostly hands-on and involved a great deal of action through active participation of preschoolers, the use of video records enabled detailed observation and analysis of preschoolers' body language, verbal expressions and engagement with the module activities.

In addition to observation data, teachers' views on the usability of the module for preschoolers were also taken into account as an additional method for triangulation. This allowed the acquisition of richer data as perspectives and observations of teachers as implementers of the CREPES module could be used as a complementary and essential data source. After the implementation of all six module activities, an interview with both teachers were conducted based on the interview protocol (Appendix Q). The interview was audio-recorded. Data collected were analysed qualitatively by identifying similar patterns. These emerging patterns were then sorted into themes.

Module impact on preschoolers' creativity. In addition to the qualitative data obtained from interviews and observations, quantitative means was used simultaneously to obtain strong empirical evidence on the impact of the CREPES module in achieving its intended outcome, which was to enhance preschoolers' creativity. Quantitative data also acted as a support to the qualitative data gathered.

Quasi-experimental non-equivalent two-group pretest-posttest design was used, as randomisation could disrupt the existing learning process in the preschool settings. An analysis of covariance (ANCOVA) was conducted to determine whether there is a significant difference between preschoolers' creativity scores in the control and experimental group with CREPES module as the intervention.

The control group consisted of 27 preschoolers aged six from a private preschool setting A in the Klang Valley. The control group was sampled from two classes in the setting. Consent was obtained from preschool A (Appendix P). This setting was one of the selected observation sites in the needs analysis phase. Observation from the first phase revealed that the setting uses the conventional teacher-centred approach with minimal emphasis on play and creativity in teaching early science. Hence, this setting was selected as the control group in order to provide a point for comparison and contrast with the creative play approach implemented in the experimental group.

Meanwhile, the experimental group initially comprised of 31 six years old preschoolers from preschool Z. These preschoolers underwent the intervention through the implementation of six CREPES module activities. However, two preschoolers dropped out of the research study due to their absence from school as well as participation of the module activities; leaving a total of 29 preschoolers in the experimental group. All 29 preschoolers took part in the entire process of module implementation, which ensured the reliability and validity of the findings for the module's impact on preschoolers' creativity.

Six year-old children were selected as subjects in the evaluation of this module, as they are generally more competent at comprehension as well as conveying their thoughts and ideas whether in verbal or non-verbal ways compared to the younger age groups of four and five. This enhanced the validity and reliability of the findings. In addition, statistics revealed that preschool enrolment for children aged six in Malaysia stood at 92% in 2014 (PEMANDU, 2015). Children of this age group constitute the highest percentage of preschool enrolment compared to other age groups. Therefore, it is hoped that the selection of preschoolers aged six as subjects of this study could impact a large number of children of this age group.

Torrance's Thinking Creatively in Action and Movement (TCAM). The creativity test "Thinking Creatively in Action and Movement" (TCAM) by Torrance (1981) was employed to evaluate the impact of the CREPES module. It was used to test if the module implementation had any significant impact on preschoolers' levels of creativity.

This instrument was selected instead of other creativity assessments due to its age-appropriateness for young children in their early childhood. Moreover, this test does not necessarily require verbal and written responses, rather it elicits physical responses. This is in line with preschool children's development and principles of DAP. It is also employed worldwide with proven reliability and validity (Kim, 2007).

Prior to the administration of the test, permission to use the instrument was sought and granted by its publisher from the United States (Appendix S). To the researcher's knowledge, this instrument has not been used in the Malaysian preschool context thus far. Therefore, the reliability of TCAM was measured in a preliminary study of test-retest reliability. The test was administered twice, three-weeks apart between both assessments. It involved 30 Malaysian preschoolers who were six years of age in a private preschool in Klang.

Subsequently, a Pearson's correlation was computed to assess test-retest reliability of the overall creativity scores obtained by TCAM, r (30) = .80. Exceeding the cut-off point of .70 (Leech, Barrett, & Morgan, 2011), this indicates high correlation of the two sets of scores. The specific reliability coefficients for each of the four activities were: Activity 1 = .46; Activity 2 = .71; Activity 3 = .29; and Activity 4 = .64. Although only Activity 2 had a correlation score which showed satisfactory reliability, Torrance (1981) contended that the overall reliability should be the emphasis, as young children's responses in each activity of the instrument may fluctuate and vary.

Despite TCAM being an established and validated instrument to measure creativity, a test of discriminant validity was also performed as preliminary findings. The correlation coefficients between Activity 1 and other activities are tabulated in Table 3.9.

Table 3.9

Discriminant Validity Findings for TCAM

Pearson correlation, *r*	Activity 2	Activity 3	Activity 4
Activity 1	.73*	.66*	.34

*$p < .01$

In terms of discriminant validity, all four activities are considered valid as the inter-correlation between activities are less than the benchmark of .85 (Garson, 2001). Therefore, this indicates that discriminant validity for TCAM has been established for this study. In accordance with the available evidence on TCAM's reliability and validity, both the reliability and validity findings showed that TCAM is appropriate to be employed in this present study.

In the context of conducting research with young children, Irwin and Johnson (2005) stressed the importance to build solid rapport and trust with children prior to conducting a study. Since the researcher was responsible for the entire administration of TCAM throughout the evaluation, attempts to get to know and interact with the preschoolers were made for them to be familiar with the researcher's presence in their preschool settings before the data collection process. After establishing a sense of trust, they are more likely to feel comfortable with expressing their ideas to the researcher. Torrance (1981) also stressed on the importance of familiarity and trust of children with the examiner. Nevertheless, preschoolers' participation is voluntary. No coercion for their participation in any form was used in this study.

Procedures of administering TCAM were based on the test manual (Torrance, 1981). The procedures outlined were fully adhered to in order to ensure the authenticity of the evaluation and optimal performance of preschoolers. Several aspects that were highlighted by Torrance (1981) include:

a) Tests should be administered individually
b) No specific time limit for the test but the normal range is around 15-30 minutes
c) Testing room should not restrict preschoolers' movement
d) Examiner should be informal, spontaneous and enthusiastic to effectively elicit preschoolers' creative responses
e) Preschoolers should be given sufficient time for warm-up and motivation

Before conducting each test, warm-up activities which were familiar to preschoolers were carried out. In one of the warm-up activities, preschoolers were asked to draw their favourite thing(s) on paper. Another activity was playing and building with playdough. Through these activities, the examiner attempted to engage in conversations with the preschoolers, such as talking about the picture or playdough formation they made. This was to ensure that preschoolers would be less anxious as though sitting for a formal examination, but rather create a conducive environment for them to be comfortable in eliciting creative responses to the examiner.

Following the process of obtaining permission, a pretest was individually administered to all preschoolers in both the experimental and control groups. After the three-week intervention through the implementation of the CREPES module on the experimental group, posttest was again individually administered to all preschoolers in both groups to test their creativity levels. Scores were given according to the TCAM Scoring Manual (Torrance, 1981). The researcher was responsible for administering and scoring the tests for all the preschoolers involved in both control and experimental groups. This ensured the consistency of scores given to each preschooler for both groups, hence enhanced the reliability and validity of findings.

An analysis of covariance (ANCOVA) was then performed to determine if there were any significant differences in the creativity scores between preschoolers in the experimental and control group. Since the experimental and control groups were found to be inequivalent, ANCOVA was employed to control the effect of the covariate, which in this case was the pretest scores.

However, it should be stressed that the TCAM scores obtained by each preschooler in this present study were not considered as accurate representations of their level of creativity per se. More importantly in this context, the scores represented the impact of the CREPES module on the creativity development among preschoolers in the experimental group in comparison with their control group counterpart.

Summary of Data Collection

Table 3.10 summarises the research questions, data collection techniques and the sample involved in each phase of the study in the form of a research matrix. An overview of the research procedures involved throughout the study is illustrated in Figure 3.10.

Table 3.10

Research Matrix

Research Questions	Method	Participants
Phase 1 Needs Analysis		
1. What are the needs in the teaching and learning of preschool science?	Semi-structured interview Observation	7 preschool teachers 3 preschool classes
Phase 2 Design and Development		
2. What is the appropriate CREPES module design according to experts' consensus?	Delphi technique - Round 1: Structured interview to build survey - Round 2 & 3: Survey questionnaires	14 experts
3. How do experts and teachers review the initial module?	Open-ended questionnaire and unstructured interview	3 experts and 2 preschool teachers
Phase 3 Implementation and Evaluation		
4. How is the usability of the CREPES module for teachers?	Semi-structured interview Observation	2 preschool teachers 2 preschool classes
5. How is the usability of the CREPES module for preschoolers?	Observation Semi-structured interview	2 preschool classes 2 preschool teachers
6. Is there a significant impact of the CREPES module on preschoolers' creativity?	Quasi-experimental non-equivalent two-group pretest-posttest design using ANCOVA	56 preschoolers (29 in experimental and 27 in control group)

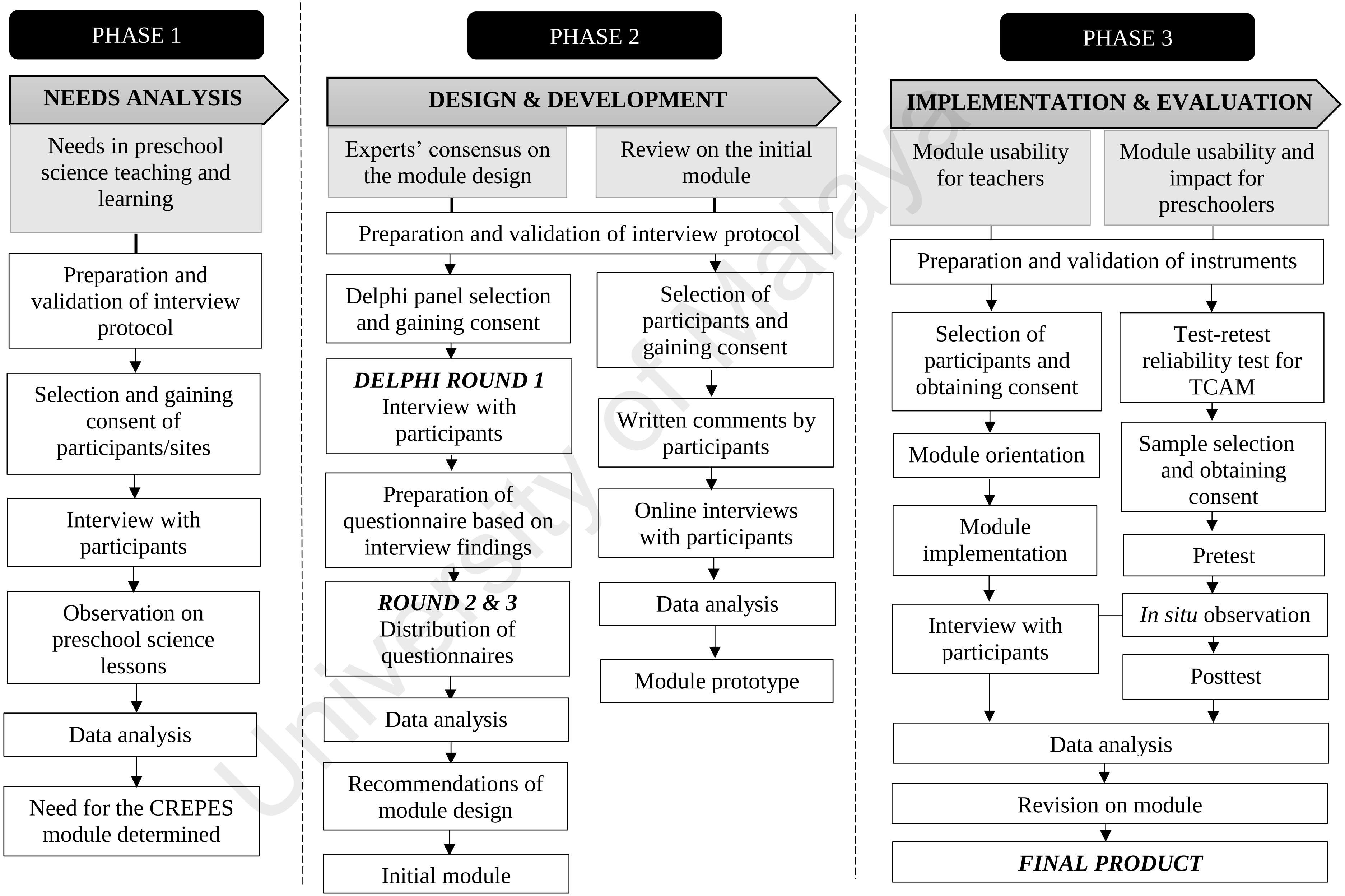


Figure 3.11. Overview of the research procedures.

Reliability and Validity

Ensuring the trustworthiness of a research study requires deliberate planning and effort. Similarly, strategies had been employed in each phase of this design and development research study to ensure that the findings are valid and credible, hence resulting in the development of a module that is valid.

First, all interview and observation protocols are validated by relevant subject experts prior to collecting data. Interviews reduced the probability of misinterpretations of questions, and enabled in depth discussions for accurate interpretation of data as compared to surveys. Since the study involved mostly qualitative data, special care was taken to ensure that data gathered were saturated and rich. This was achieved by spending sufficient time to gather information from each participant.

Furthermore, mutual trust was established with participants and the settings involved by clearly conveying information on the study, their rights in participation and expectations required of them. Qualitative findings collected were described specifically and in details, as well as in light of the context of the study as one of the strategies to increase validity and reliability (Merriam, 2009).

Selecting a wide range of participants from heterogeneous backgrounds and utilising expertise of different professions also helped in consolidating the findings of the study—which Merriam posited as “maximum variation” that enhanced the applicability of the data for the target groups in the study (2009, p. 229). Member checks, as recommended by Merriam (2009) were also done with the participants to ensure the accuracy of the data collected prior to and during analysis.

Careful selection of the experts based on stringent criteria in the Phase 2 Delphi study helped ensure that the module is practical, usable and able to fulfil the needs of its users. Review of the initial module was also meticulously conducted with experts who fulfilled the preset criteria before implementing the CREPES module in the actual setting. This allowed the content of the module to be thoroughly checked and potential concerns to be identified before the module's implementation, which helped optimise its practicality and effectiveness during implementation. In addition to content experts, teachers as prospective module users were also involved in reviewing the module. This especially enhanced the module's accountability to cater to its users' needs, hence exponentially increasing the validity and reliability of the data collected in this phase.

In Phase 3, TCAM was used as a measure to evaluate the CREPES module's impact on preschoolers' creativity. Fair amounts of international evidence on the validity and reliability of this instrument are available. Nevertheless, the instrument has not been employed in the Malaysian preschool context. Hence, a preliminary study was conducted using the TCAM prior to the implementation of the module in Phase 3. This was to further ascertain its reliability and validity through test-retest reliability and discriminant validity as fundamental measures of instrument validation in the context of this present study.

During the administration of TCAM with preschoolers, care was taken so that preschoolers did not feel excessively pressured or anxious during the tests. This was done through allocating adequate time for warm-up activities familiar to them before each test, as recommended by Torrance (1981). Only one examiner was involved in administering and scoring the tests for all the preschoolers in both control and experimental groups. This established the examiner's familiarity with the instrument and with the preschoolers throughout the testing period. More importantly, involving one examiner also ensured the consistency of administration and scoring for preschoolers across the groups; further enhancing the reliability and validity of the findings.

A researcher in DDR is often both the designer and the evaluator of the intervention developed (Plomp, 2007; Richey & Klein, 2014). Triangulation of different methods could help address this issue and increase the validity and reliability of this study (Plomp, 2007; Richey & Klein, 2014). Hence, multiple methods of data collection were used for module evaluation. Combining both quantitative and qualitative methods is common in DDR studies (Richey & Klein, 2014). While qualitative methods were employed to evaluate the module's usability, quantitative data were collected concurrently to determine the impact of the module on preschoolers' creativity. As primary methods of data collection, observations and interviews were also supported by data collected from the quantitative quasi-experiment. Evaluating both usability and the impact of the module on preschoolers' creativity allowed in-depth exploration, rich data and ensured the trustworthiness and credibility of the findings.

Chapter Summary

This chapter has explicated in detail the research design, data collection methods, participants, the procedure and data analysis processes involved in this study. This study is classified as a design and development research (Richey & Klein, 2007) based on its primary intent to develop a Creative Play Early Science (CREPES) module. It consists of three different phases: 1) Needs analysis; 2) module design and development; and 3) module implementation and evaluation. Each phase has its respective data collection method to achieve its objectives. Findings for each phase will be discussed in the following chapters.

Chapter 4

Findings of Phase 1: Needs Analysis

This chapter presents findings for the needs analysis phase through themes in order to address the research question pertaining to the needs in the preschool science teaching and learning. In this phase, qualitative data were obtained through semi-structured interviews and observations. Findings will be presented in three categories, namely 1) current practice, and 2) needs in the preschool science teaching and learning. Based on the needs identified, the third category pertaining to the implications on the design and development of the Creative Play Science Module is explicated, so that findings could effectively contribute toward actual practice in the preschool context.

Current Practice in Preschool Science Teaching and Learning

The development of the CREPES module began with an analysis on the needs in the teaching and learning of early science in the context of study. The first step towards determining the needs in preschool science teaching and learning was to ascertain the actual practice of preschool science in the context of study. Through the process of coding, qualitative data collected from interviews and observations converged and resulted in two themes which will be discussed consecutively, namely 1) excessive structure in teaching and learning, and 2) inadequate emphasis on early science. Subthemes under each of these themes will be explicated with support of excerpts acquired from interviews and observations conducted.

Excessive structure in teaching and learning. Findings indicated excessive structure in the delivery of early science in the context of study. While a certain degree of structure is beneficial, an excessively structured preschool science lesson restricts the creativity of both teachers and preschoolers, resulting in curriculum rigidity and little pedagogical flexibility for teachers.

Three subthemes emerged through the process of data analysis. These subthemes collectively reinforced the theme pertaining to the excessive structure in the teaching and learning of preschool science. They include 1) procedural delivery of preschool science; 2) limited opportunities for preschoolers' creative development; and 3) insufficient involvement of preschoolers. Each subtheme will be discussed subsequently in the following.

Procedural delivery of preschool science. Data revealed that teachers were excessively bounded by fixed and structured procedures in their science lessons. Science lessons were found to be structured strictly according to the topics outlined in the syllabus. Findings also implied that the primary focus of teachers was completing and fulfilling the syllabus required through following a fixed set of steps for every science lesson. When asked about how are science lessons conducted, Participant 2 described:

> "*We have the textbook. We will read the lesson with the children, then do the experiment with the children. Then read the conclusion part. Then teacher will ask the children to write the date, tick what they have seen. Teacher will mark and 'chop' [stamp]. Sometimes we review the questions with the children also, what they learned for the particular experiment…Teaching and learning materials are given by the syllabus."*
>
> (P2: 5-9)

Similar to Participant 2, Participant 7 explained her experiences in teaching preschool science by listing a set of procedures as well as the time allocated for each step.

> *The lesson will start with introduction. We call it set induction. We have 5 minutes. So, after that 5 minutes, then we will go on to the experiment, or any other things to be done. We will show them and then we go to the book after that. We tell them what to do in the book. Actually, within the 40 minutes, 5 minutes for the induction, and then 10 minutes we have got the experiment. After 10 minutes, we ask them questions, share with them. Another 10 minutes for the workbook. After that we got 5 more minutes to go. After they do the workbook everything, we call them back to do the revision part. So that we will know whether they understood what we teach. So it's about 40 minutes.*
>
> (P7: 19-28)

All participants stated that they were required to follow the syllabus fixed by the preschool management. Participant 1 described her approach of teaching preschool science as: "*You just follow chapter by chapter because the lessons are given by our HQ. So they just send us the plan and we follow*" (P1: 26). This implied the teacher's rigid act of translating what was provided into actual practice, which could be an obstacle toward implementing a flexible science curriculum that is child-centred with sufficient room for further explorations.

Although Participant 1 admitted the rigidity of following the textbook, she noted the conventional obligation to adhere to the given syllabus: "*... in every school they just follow most of it. It's like a norm thing to follow. They will come out with a textbook to follow. They don't plan their own, I didn't come across any school like that*" (P1: 115-117). When asked about the obstacles that impede the implementation of an effective science lesson, Participant 2 reasoned: "*The way the lesson is given, we have to follow the given syllabus*" (P2: 54). Adding to these, Participant 5 emphatically expressed her disagreement on the requirement to adhere completely to the lessons provided by the preschool system provider Y. She also expressed her concern that science was "put in a box" and taught in a prescribed manner:

> *For Y, you follow only Y stuff. Any extra materials that you bring in it will be considered not Y stuff. Strictly speaking, Y need us to follow 100%. They don't really encourage to bring extra materials which I don't really agree. You cannot* ***put science in a box****.*
>
> (P5: 122-124)

These findings suggested teachers' frustration and powerlessness for being constrained or obliged to follow the lesson plans given. With this structure, little consideration of preschoolers' interest and needs in the science curriculum was taken into account. The extent to which preschoolers could learn optimally under an environment that is unresponsive to their needs is therefore questionable.

In addition, findings indicated a heavy reliance on textbooks or workbooks in the teaching and learning of preschool science. All three observations saw a similarity, whereby preschoolers were observed completing their workbooks after teachers taught the prescribed content. As noted by Participant 1: "*After they've done everything, then they take out their [work]book. And then I will tell them page what, then I will say: 'Just now did teacher show you this? Teacher show this? What do you see?'. I recap with them*" (P1: 57-59).

Limited opportunities for creative development. Due to the highly structured preschool science curriculum, another subtheme identified from the findings suggested that few opportunities were available for preschoolers to develop creativity in science lessons. This was shown explicitly through the responses of Participants 1, 3 and 6:

> *Probably a very small percentage show creativity during the lesson because we follow steps. Only one or two will ask questions.*
>
> (P1: 92-93)

It's all directed and procedural. And the emphasis is to follow instruction.

(P3: 42)

Quite little opportunities for children to develop their creativity because they follow the syllabus. The experiment will be fully based on the syllabus, so they won't have the chance to think or use other materials aside from those in the book.

(P6: 25-30)

As pointed out by the participants, the factors that hinder the development of preschoolers' creativity in science teaching and learning include the syllabus itself. Participants also noted that time allocated and size of the class could also influence the development of creativity in the science classroom. Participant 4 for instance stated, "*We have limited time for them to ask questions, I have to move on. Let's say I have smaller groups they will have more time. They will start thinking how and why this happens*" (P4: 99-101). In such teacher-centred environment with limited time, preschoolers seemed to be deprived of opportunities to formulate ideas and exercise their imagination to develop in their creative potential. Hence, this indicated that preschoolers' abilities to develop various dimensions of creativity including fluency, originality and imagination are largely neglected in early science lessons.

Teachers play a crucial role in creating an environment conducive to the development of preschoolers' creativity and integrating creativity into early science lessons. Participant 1's response implied that besides time constraint, the teacher could also be a possible barrier that inhibits preschooler's creative development. When asked how did preschoolers demonstrate creativity during science lessons, she related creativity to preschoolers "*doing their own thing*" (P1: 99) during experiments. However, she openly acknowledged her limitation in her response to these children*:*

"Normally as teacher we will say NO, NO, NO, NO, NO! So maybe that's our limit" (P1: 100). She supported her claims with reasons including *"time constraint"* and implicitly expressed her concern to remain in control over the class: *"if I allow the child to do that, then what about all the rest?*" (P1: 100-101).

Data also pointed out teachers' inappropriate expectations and excessive demands toward children such as overly imposing preschoolers to "*follow instruction*" (P3: 42) during science lessons. Even when preschoolers express their own ideas, teachers' responses to these ideas did not seem encouraging. This is supported by an instance during an observation on a 6 years old preschool science lesson led by Teacher Jes (*pseudonym*) in Preschool B. It was a lesson about health and hygienic practices at home. After observing a piece of bread with mould, the children were sitting at their tables to complete their workbooks to draw the result of their observation. Child D made little dots and lines that represent mould with a pencil. He then started colouring the crust of the picture of the bread in brown colour. While checking the children's work, Teacher Jes said to child D in a voice audible by the whole class: "No, no, no brown! I want all yellow". Child D looked at the teacher, and then without saying anything, he tried to erase the brown part and recolored the rest of the crust in yellow (O2: 15-20). The work sample of Child D is as shown in Figure 4.1.

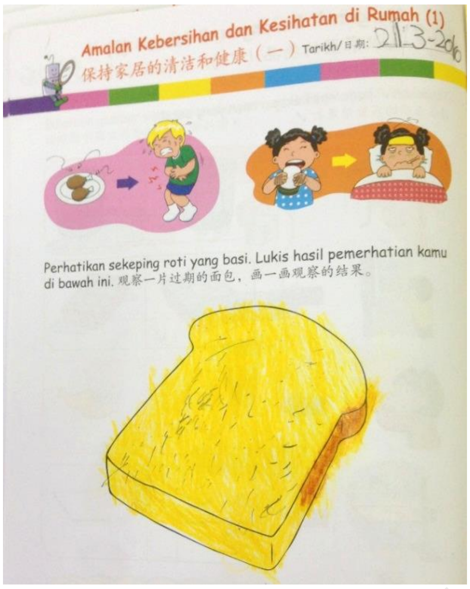


Figure 4.1. Child D’s work sample.

Meanwhile in the same observation, the researcher also observed and photographed a unique work sample of child K. Unlike other preschoolers in the class, he had interestingly drawn a fly on his workbook as illustrated in Figure 4.2. Child K’s work demonstrated a child’s creative expression, specifically his ability to formulate an ingenious and novel idea, termed by Torrance as “originality” (1964, as cited in Isbell & Raines, 2013). This is a clear evidence to infer that there is room for creativity development in an early science classroom.

Figure 4.2. Child K’s work sample demonstrating the originality of his idea.

The key issue lies in the way a teacher reacts to children's ideas which can either encourage or hinder any possible creative ideas. In light of the already limited opportunities of creativity preschoolers could exercise in a science lesson, it is paramount for teachers to be encouraging and open to accept all kinds of ideas children produce, especially novel and unique ideas.

Furthermore, observations conducted revealed that the type of questions posed by teachers were largely dichotomous or closed questions. Open-ended questions that are crucial in nurturing creativity among young children which could provoke children's divergent thinking and imagination were less evident. This further decreased preschoolers' chances to formulate ideas and exercise their imagination in response to teachers' questions.

Excerpts from observation in Preschool A recorded the form of questions used by Teacher Susi *(pseudonym)* during the science lesson about introducing the body parts of a cow. The questions asked included: "*What picture is this?", "What colour is the cow?", "How many colours?", "Only brown? Got blue colour cow? Got green colour? White colour?", "How many legs do cows have?", "How many eyes [do] cows have?", and "How many ears?* (O1:14-18). In the same lesson, Teacher Susi continued teaching the class on body parts of a bird. Most questions asked had standard answers, such as "*Bird can swim?", "Birds have horn or not?", "What do birds have? Bird got tail? Where is bird's tail*?" (O1: 53-55). Although questions were asked, they were less effective in encouraging creative thinking among preschoolers. In such teaching and learning environments, preschoolers lacked opportunities to imagine, think out of the box and involve in first-hand experiences and explorations.

Moreover, it was discerned that unexpected or novel answers from preschoolers were apparently less welcomed. This was indicated in the third observation which was conducted in Preschool B on the life cycle of mosquitoes. When Teacher Tan *(pseudonym)* asked the class where do mosquitoes come from, a child murmured an answer in a soft voice that sounded like "dinosaur". The teacher sounded displeased with the answer and repeated the question again to the class without asking the child to explain the answer further (O3: 12-13). This might suggest that children's opinions outside the expected answer were less valued, which in the long run could suppress children's creativity and discourage them from answering questions.

Insufficient involvement of preschoolers. The heavily structured preschool science lessons also resulted in the lack of involvement of preschoolers in their learning process. Findings from both interviews and observation revealed that hands-on experiences during science teaching and learning in preschools were inadequate. This contradicts with the basic prerequisite of an effective early childhood program, specifically in early science learning which requires ample time, resources and opportunities for play, discovery and exploration. The lack of preschoolers' engagement in hands-on explorations also indicated limited opportunities for their creative development, as creativity flourishes when children are actively involved in hands-on play experiences.

Interview data revealed the teacher-centred nature of the preschool science classrooms. Participant 3, a principal of a private preschool described science lessons for six years old preschoolers as "*not so much discovery. More teacher-centred,* *teacher-based, teacher-directed*" (P3: 20). She further explained the reason behind this and the need for a more discovery-based science curriculum:

> *What we lack is the time and the space to let the children do discovery. Basically teacher centred not children-centred. Not just Science, most of the subjects. But to me Science has more room for children to discover. For science it's a lot of observation, experimenting you know?*
>
> (P3: 28-32)

Participant 7 also rationalised several difficulties she encountered while attempting to involve children's participation in science lessons:

> *There are a lot of things for science you know? You have to do research, prepare the things. And then you have to get all the children to participate in it. Sometimes you don't have the time. Sometimes I'm lacking, I can tell you truthfully because it's 24 children. Sometimes I cannot entertain all of them.*
>
> (P7: 102-106)

Despite some of the challenges mentioned including time, space, and teachers' ability to manage the class, most participants generally acknowledged the importance of hands-on discovery in learning science. For instance, Participant 3 asserted the importance of discovery in preschool science:

> *Don't just tell the children, let them discover. And must be able to prick their curiosity. For example, we don't say: "This thing sinks, this thing floats. We can ask them to predict, what do you think? Will this float or sink?" So there's hypothesis. Then do it, observe- that's observation. And then conclusion. So these are actually scientific skills. But it can also be done in kindergarten level. And we should do it like that. Just don't tell them everything. Certain things we do have to tell, but try to let them discover. Then it will be more interesting, more engaging, and they can remember better.*
>
> (P3: 108-114)

Similarly, Participant 5 and 6 stressed the importance of children's first-hand involvement to stimulate their interest through science lessons. When asked about suggestions to improve the current science teaching and learning, Participant 5 expressed that: "*Children should explore their freedom through experimenting. They can learn much more through explorations*" (P5: 111). She continued to add that lessons are "*to be fun, not too heavy or boring. Most important part is fun. They need to have the joy. If they don't feel like it's fun, they will not [be] interested. Their job is to play*" (P5: 152-154). Meanwhile, Participant 6 noted that science experiences should allow children to "*touch and experience it themselves*" as "*hands-on is the most important*" (P6: 43-44). Participant 7 stated:

> *Normally if you just talk to the 6 year olds, they don't like it.* ***You*** *have to do some experiments or something with them. Hands-on. If* ***you*** *don't do that, they will divert somewhere else. Science lesson it's important that* ***I*** *do something.*
>
> (P7: 53-55)

Although the responses of Participant 7 could indicate her acknowledgement of hands-on experiences for preschoolers, the use of "*I*" and "*you*" as highlighted might indirectly reflect the participant's belief that the ultimate authority in a preschool setting lies within the teacher's control. Despite inconclusive, this could suggest the tendency of preschool teachers to incline toward teacher-centred science lessons, even when a certain degree of children's participation is involved.

Findings from observations reiterated that preschoolers lacked the opportunities to explore the delivered content first-hand, as lessons conducted were largely teacher-centred. The teacher was observed to be the main conductor in control of the entire lesson, whilst preschoolers were sitting and listening most of the time. The largely teacher-centred nature of science lessons also revealed a lack of authentic child-teacher interaction. The role of the teacher in the preschool science classroom appeared to be like a master at a higher level who possesses all knowledge, instead of a facilitator at the preschoolers' level who explores alongside them.

Despite activities conducted in all three observations were generally integrated, preschoolers were not given sufficient opportunities to explore the topics at a substantial scale. In the first observation in Preschool A, the teacher used the traditional method of repetition to introduce different body parts of a cow. This was supported by the excerpt taken from the researcher's fieldnotes:

> *Teacher Susi pointed to the body parts of the cow's picture, and asked children "what is this?". The parts introduced were horn, fur, ear, eye, leg and tail. For each part she said the word aloud and children repeated after her while spelling out the letters for each word. She asked the class: "How to spell fur?". The children spelled f*-u-r *and said the word aloud. She continued: "What do you call this?" while pointing to the eye. Children replied together: "Eye!" and spelled the word.*
>
> (O1: 30-35)

Children were then asked to go forward one by one to match the names of the animals' body parts with the picture on the blackboard (O1: 45). Moreover, it was astonishing that no questions were raised by the preschoolers during the period of observation.

The second and third observation in Preschool B involved children observing a piece of mouldy bread (O2: 12-15) and two potted plants in water to observe if there were any larvae in the pot (O3: 3-5) respectively. While preschoolers in the first and second observation appeared to respond enthusiastically during the activities, preschoolers in the last observation seemed distracted and unsure of what to observe for (O3: 8). It was uncertain how much had the lesson helped in developing a clear understanding on what a larva is and the life cycle of a mosquito among the preschoolers. Hence, the researcher questioned to what extent these activities could actually consolidate preschoolers' understanding and develop a firm foundation of the scientific concepts learned. In these cases, the main science process skill involved was solely observation. It is therefore questionable regarding to how far did these early science activities involve active learning among preschoolers.

Inadequate emphasis on early science. Despite the importance of science in early childhood education, the researcher found that when compared to literacy and numeracy, science was given lesser emphasis than it deserves in the context of study. Discussion of the findings will be delineated in two subthemes, 1) Time constraint, and 2) Lack of quality training.

Time constraint. Both interview and observation data showed that time allocated for science lessons were insufficient. This indicates the lack of focus on early science in the context of study. Participants expressed their concern over the time constraint they encounter in delivering their science lessons. Findings had shown that a maximum of 40 minutes were allocated for science per week in the selected preschools. Participant 4 explained that, "*our schedule is actually half an hour. Just half an hour. So we have to do it in half an hour*" (P4: 18). Meanwhile, Participant 1 reiterated and described the duration of her science lessons as insufficient, "*touch and go*" and "*quite rushed*" (P1: 55). Participant 3 shared similar view. When asked about the current effectiveness of science lessons in her preschool setting, she expressed that the lessons are "*very rushed*" (P3: 88).

Observation data revealed that limited amount of time for science explorations was further reduced by the requirement to complete science workbooks. All three observations conducted involved preschoolers occupying at least 15 minutes on their workbooks. Figure 4.3 shows a page taken from a science workbook during an observation in Preschool A.

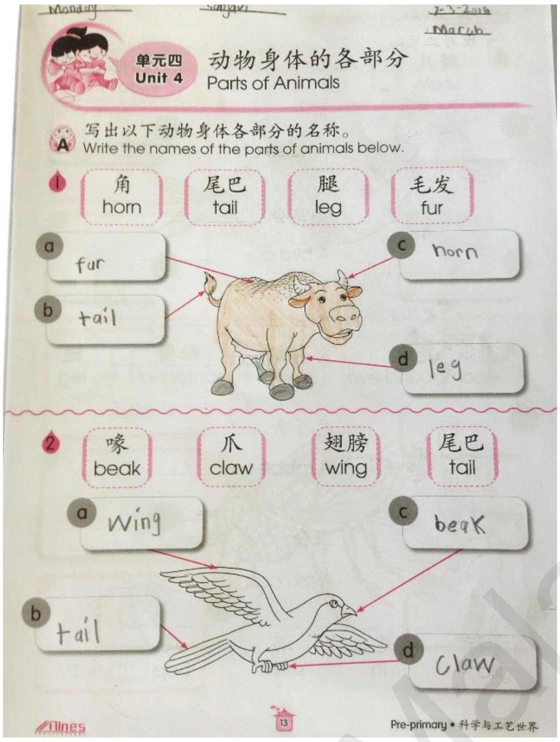


Figure 4.3. Sample page from a science workbook used in Preschool A.

Due to the lack of time, the depth and authenticity of preschoolers' understanding on the scientific concepts taught are questionable. Two participants mentioned the need for preschoolers to acquire more in-depth scientific understanding. As rationalised by Participant 5, the preschoolers "*don't understand what is going on. [We] can't cover [everything] in one topic. Because we only do it once so for them there's not enough exposure*" (P5: 48-49). Participant 3 also noted her opinion that preschool science should have "*less topics but more in-depth*" in order to make the content "*more enriching for children*" (P3: 89-90).

Besides having insufficient time to deliver science lessons, several participants also expressed their concerns about their lack of time for preparation. Participant 6 stated that he has "*no time to search for information on the topic*" (P6: 64-65) despite admitting his lack of knowledge and understanding on the science concepts in the syllabus. Similarly, Participant 7 expressed that she needs time to prepare her science lessons in advance, however she had to teach and prepare for many other subjects simultaneously. When asked about her perception of teaching science, Participant 3 voiced out her opinion that teaching science is "*a lot of work*", and that teachers must be "*willing to do the preparation*" (P3: 75).

One possible factor reason behind the limited emphasis on science was aptly stipulated by Participant 6. He pointed out that science is considered as "*extra knowledge*" in his preschool, implying that it is often viewed as an optional subject or content area. He reasoned that "*the focus is on BM [Malay language], BI [English] and Math*" (P6: 5-6). This could be the rationale behind insufficient training on science for preschool teachers, which will be explicated in the next section.

Lack of quality training for early science teaching. As many teachers in private preschools are not professionally trained, quality training is essential and will directly impact teachers' competence in teaching early science. Yet, findings revealed another key indication of limited focus on preschool science. The provision of science pedagogical training for teachers was found to be lacking in the context of study. Although private preschool teachers are required by the respective authorities and curriculum providers to attend professional development courses, specific training on early science teaching is often overlooked in these short-term courses. Participants 4, 5 and 7 openly stated that they were not adequately trained to teach science. Adding to that, a majority of participants including Participants 1, 2, 5 and 7 added that science was not a primary focus during the training sessions they attended:

> *When they do have the training, they just show us the science centre, and then the rules of the centre. It's not getting into how to teach, just more the rules. When the children come in, what must they do, where must they stand that kind of thing.*
>
> (P1: 130-132)

We go for training every year. There's one small part only on Science. From the whole book they only choose one item to teach us.

(P2: 45-46)

We have training but they don't really go in depth into the science part. They don't really emphasize on the experiments training. Only if they have time they train. They focus more on the core subjects like BM, Maths and English. For science it wasn't on the training last year. Nothing on science.

(P5: 105-108)

So far we don't have training for science. Even we went for courses, science was not focused much. It's more of languages and maths.

(P7: 124-126)

These excerpts further reinforced that the significance of early science is often overlooked in many private preschool settings compared to literacy and numeracy.

Although participants stressed that level of understanding is key to implementing an effective science lesson, findings also suggested that the teachers possessed insufficient understanding on the content and pedagogical approach to teach science effectively. They find it difficult teaching some of the scientific concepts of which they themselves are uncertain of. This could be a result of limited training for teachers on early science. Participant 6 gave an example of a science topic that he taught but was not familiar with, which was about DNA, family resemblance and genetic makeup. He also expressed his feeling of inadequacy in answering questions from the children. He reasoned that "*it's difficult for us as we ourselves are not so familiar to the concepts*" (P6: 47). Participants 2, 3 and 5 also reiterated similar thoughts:

Not all lessons teachers can [conduct effectively].

(P2:51)

Some of the topics the teachers themselves are not very sure.
(P3:96)

When I first taught science, when I see the subject it's like 'what'? I was shocked because there's some that are quite hard. For me it's quite hard because I don't like science. So I feel teaching science is hard.
(P5:53-54)

Teachers' inadequate scientific understanding could have resulted in low levels of confidence in teaching science. This could be reflected explicitly through Participant 7's response: "*Actually, my role is not as good. I am not a science person. But I try my best to do it*" (P7: 30-31). When asked how she would rate her own science lessons, she responded: "*For science, I'm not really on the "A" side. Maybe average*" (P7: 101). Being untrained in early science could have affected Participant 7's self-efficacy as an early science teacher.

In addition, inadequate pedagogical knowledge in science among preschool teachers might have led to their misperceptions on early science teaching. Participant 1 described science as "*a very simple operation*" (P1: 138). Participant 4 expressed a similar view: "*To me is very direct and straight-forward. Whatever [is in] the book, you just follow the book*" (P4:111-112). When questioned on how he viewed teaching preschool science, Participant 6 responded: "*If you follow the syllabus, then it won't be a problem*" (P6:46).

These responses indirectly indicated teachers' misconception on teaching science as merely following the structure and procedures provided by the syllabus. Findings implied that children's individual dispositions, interests and needs; teaching approaches and how best to deliver the scientific content to ensure in depth understanding of children, as well as how creativity could be integrated and developed through science lessons are unaccounted for. Moreover, it is uncertain to what extent preschoolers understand the taught concepts with teachers who lack quality training and adequate understanding on the teaching and learning of early science.

Needs in Preschool Science Teaching and Learning

Based on the findings on the current practice in preschool science, the needs in the Malaysian preschool science teaching and learning specifically in the private sector had emerged. Three key areas of needs were identified, 1) flexibility in the science classroom, 2) holistic integration of science with other developmental domains, and 3) rigorous teacher training in science. These identified aspects further contributed to implications for the design and development of the CREPES module.

Flexibility in the science classroom. Findings revealed an urgent need to establish a greater degree of flexibility in preschool science teaching and learning. In a science classroom where it is "*all directed all procedural*" and where the focus is "*to follow instruction*" (P3:45), there is little allowance for preschoolers to explore freely. This defeats the key purpose of preschool science. The excessive structure in preschool science classes often imply the use of direct instruction approach. Even when experiments are conducted, there tend to be minimal opportunities for hands-on involvement due to the lack of time and obligation to comply to the syllabus provided. If this is left unsolved, young learners' development of creative thinking and their innate curiosity to discover the world around them could be hindered.

Moreover, the structured approach in preschool science also suggested that preschoolers' individual levels and interests could have been overlooked. Participants stressed that an effective early science lesson should include activities that are appropriate to preschoolers' level and in line with their interests to ensure effective understanding among young learners. For instance, Participant 1 pointed out that preschoolers would love the effects of "*wow factors*" (P1: 111). She supported her viewpoint with an example of the experiment about volcano eruption which could stimulate preschoolers' interest and strengthen their understanding on the topic. Participant 2 explained that in her current science classroom, "*not all [lessons] are interesting and effective for children"* (P2:51). She repeatedly asserted the importance of science learning to be interesting for preschoolers:

> *As I said you must make the lesson **interesting**, must make it fun.*
>
> (P2: 19-24)
>
> *Get more **interesting** topics for the science lesson. Simpler and nice activities. Certain topics in the book they give are not **interesting**.*
>
> (P2: 34-35)
>
> *And then the lesson must be **interesting** to the child, at their level, child's level.*
>
> (P2: 48-49)

A greater degree of flexibility also means that there should be variations to the teaching and learning process in preschool science. This was emphasised by three of the participants:

> *Because you know, they're confined in the classroom too long, then suddenly you take them to a different place they're very happy, excited. They want something different, a different scenario.*
>
> (P1: 81-83)
>
> *I think if you come out with suggestion of activities or methods, don't just confine to the classroom, but take the children out to look at the leaves, look at the rocks. Go on field trips.*
>
> (P3: 105-107)

Furthermore, Participant 5 contended that: "*As years go by children need more interesting things*" (P5: 51). She suggested "*bringing in extra experiments for them to have different variations of items*" (P5: 85). As with Participant 3, she also suggested "*science-related field trips*" (P5: 112) and "*bringing children out to a new environment to conduct simple experiments*" (P5: 115) as this will arouse preschoolers' interest, excitement and stimulate more creative responses.

Hence, this calls for hands-on exploratory and play activities to be incorporated into the early science teaching and learning process in order for more flexibility in the early science classroom for young preschoolers. Unless child-centred play activities with ample opportunities for preschooler's involvement are incorporated, early science teaching and learning in Malaysian private preschools will remain rigid, excessively structured and incapable to effectively spark young children's interest and motivation in discovering the world around them.

Holistic integration of science with other developmental domains. In light of the current science teaching and learning in private preschool settings in the context of this study, the need for a more holistic integration of science with other domains was ascertained. Minimal integration of science with other domains was observed during the observations conducted. Although the Malaysian preschool curriculum has stressed the importance of integrated learning across different curriculum areas, the researcher discerned that this was not effectively implemented in the context of this study.

The data collected indicated that science in the Malaysian private preschools was more a standalone subject than a part of an interdependent and integrated system. Other domains such as creativity, social and physical dimensions were rarely integrated to support the teaching and learning of science. Teachers were mainly concerned about delivering the scientific content required of them in the syllabus and the completion of preschoolers' workbooks.

To further support the need for better integration, Participant 3 from the interview repeatedly asserted the significance of integration of science with other developmental domains.

> *Actually science is everywhere. But following the system that we're currently using in our kindergarten, it's very structured so only half an hour for science period. If we're using different system like integrated, more activity based, I think science then can be integrated into many different subject areas especially maths and even languages.*
>
> (P3:14-17)

> *For me science is everywhere. Science and Math have significant overlap. If we use integrated approach and activity-based things, we can bring in creativity, languages, science, math, more children-centred and so on. I think if it can be integrated in the other subjects in the kindergarten as part of their daily activities it will be more fun, and more engaging.*
>
> (P3: 47-51)

Similarly, Participant 6 pointed out the recent requirement in his preschool syllabus to integrate science with various subject areas, "*Now we integrate science into English and different subjects. We have to use science to teach many subjects now, even phonics and blending*" (P6: 13-15). However, he emphasised the difficulty he and his colleagues encounter in the integration of science with the other developmental domains. He stated that, "*when it's integrating science, we teachers headache"* (P6: 46). One of the factors behind this problem could be due to teachers' lack of exposure in integrating science with other domains through opportunities for professional development. This will be addressed in the next section on the need for more holistic teacher training for preschool teachers, especially those in the private sector to achieve holistic learning for preschoolers as envisioned by the Malaysian preschool curriculum.

Based on findings on current practice in preschool science teaching and learning, the researcher discerned a similar pattern which reinforced the need for creativity to be incorporated into early science. This is due to the excessive structure and limited allocation of time for early science that had significantly stifled preschoolers' opportunities to develop creatively. Therefore, it is affirmed that there is a need for holistic learning for preschoolers, where science is integrated within other developmental domains to enhance preschoolers' creativity development.

Quality teacher training on science. Findings also revealed that training for private preschool teachers often have limited emphasis on early science. In light of this, there is therefore an urgent need for more quality, rigorous and continual teacher training that involves explicit focus on the teaching and learning of early science. This is in order for teachers to develop sufficient understanding on the pedagogy and content of early science, hence strengthening their competencies to implement effective science lessons which would directly benefit the preschoolers.

Several participants acknowledged their need for more training on preschool science. As a majority of the private preschool teachers receive limited training, they are less competent in delivering a developmentally appropriate science lesson with preschoolers, especially one infused with creativity. This is supported by the data collected from observations in three preschool science classes, where there were limited hands-on experiences and involvement of preschoolers. When Participant 7 was asked about her view on having a guidebook with suggestion of activities in it, she responded positively about it and suggested it to be "*step by step, with pictures of* *how to do it. Because sometimes when they write, we cannot visualize what it is"* (P7: 128-129). Participant 4 reiterated:

> *As I said I'm not trained to do that. But I need to carry out the activity with them, so I learn from there. Training, of course I need it too to equip myself. I would be glad if [there are] any courses or any class to equip myself.*
>
> (P4: 81-83)

In light of the findings collected, the need for the development of the CREPES module to guide preschool teachers in teaching early science is evident. This module would be an important material appropriate to be used as a part of the effort towards establishing more rigorous professional development in early science.

Implications for Module Design

Data collected on current practice and the identified needs in preschool science teaching and learning ascertained the need for the CREPES module. This led to implications for the design of the CREPES module.

This interrelation between different categories from the findings of this phase is illustrated in Figure 4.4. It shows the continuity between data pertaining to current practice, areas of need, and the implications for the CREPES module design; and how these categories build upon one another. This ensures that the module produced is built upon the needs of the actual practice in preschool science teaching and learning acquired from data collected, hence able to improve the current practice in the context of study.

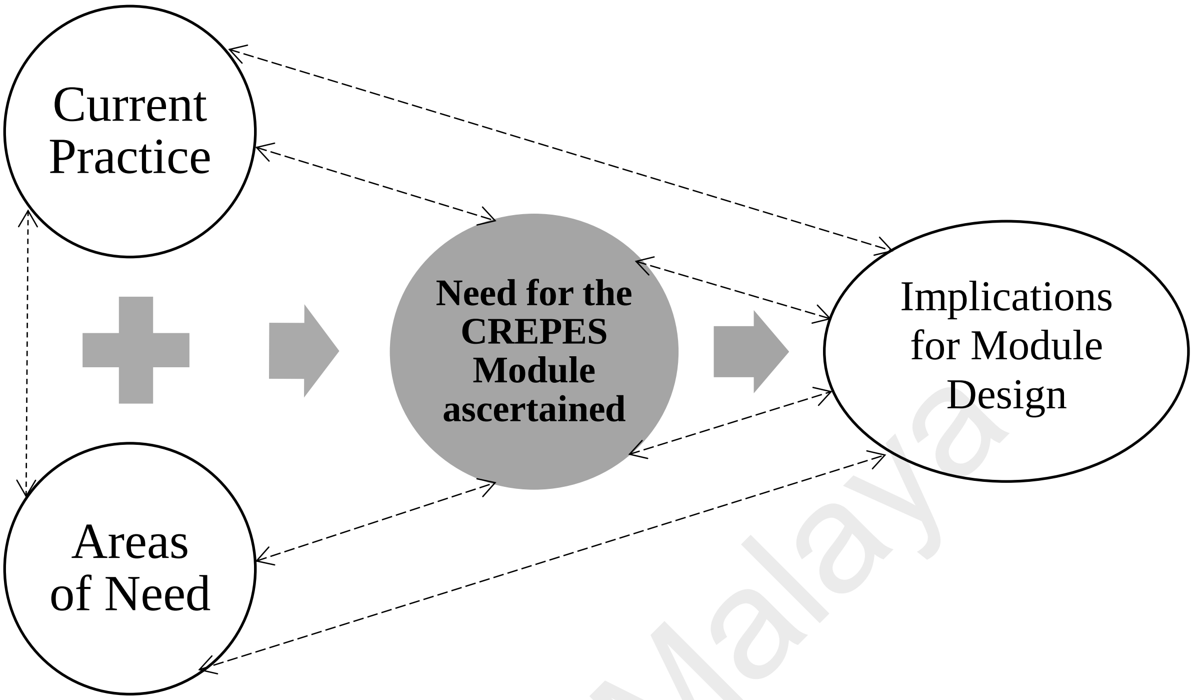


Figure 4.4. Interrelation and progression of findings in Phase 1.

Figure 4.5 shows a summary of findings for this phase, including the categories, themes and subthemes that emerged from the data. Findings from this phase essentially laid the groundwork for the next phase which is on designing and developing the CREPES module.

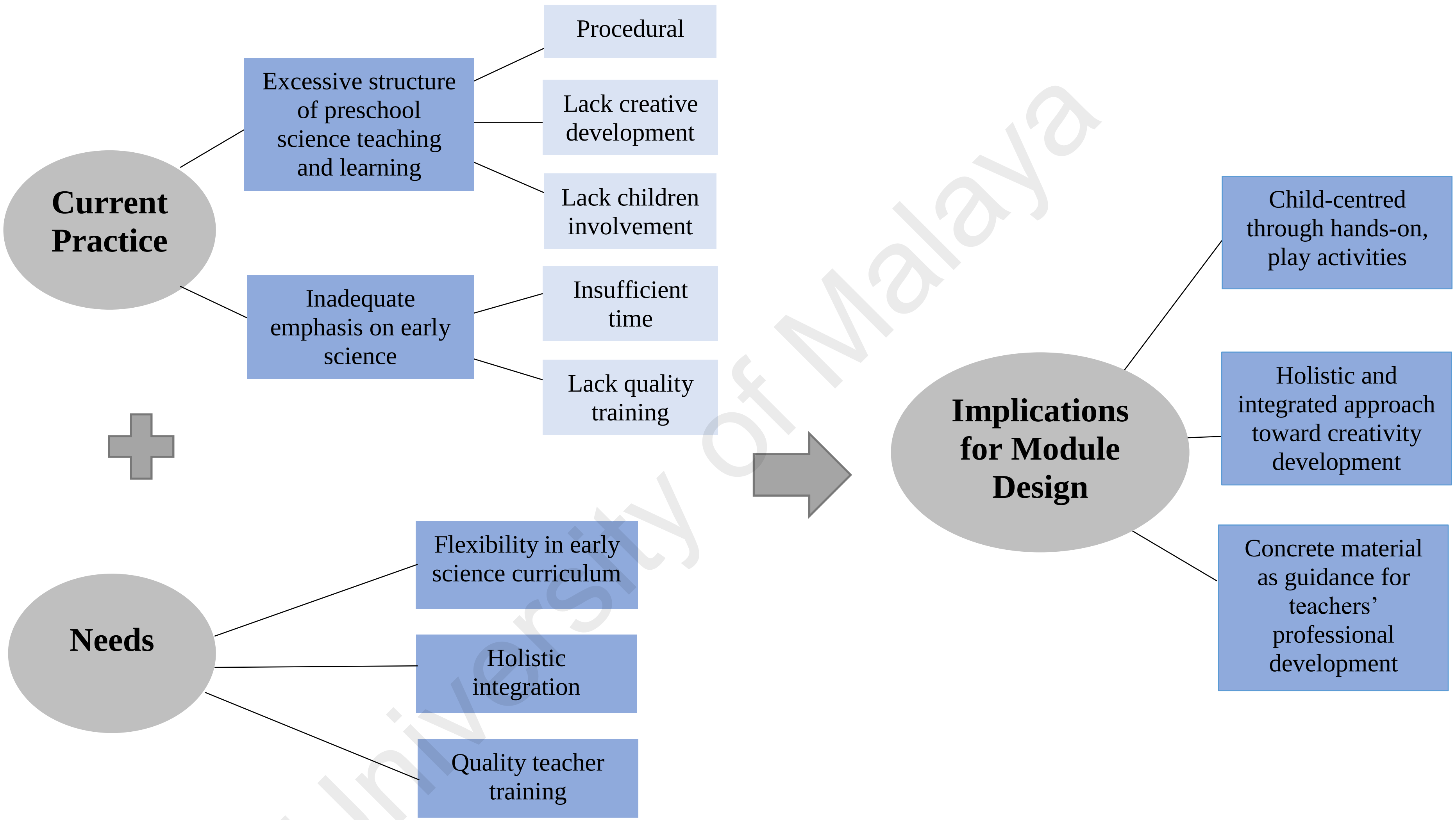


Figure 4.5. Summary of findings in Phase 1.

Based on Figure 4.5, findings in this phase were grouped into three categories. The categories include 1) current practice, 2) areas of need for preschool science teaching and learning, and 3) implications for module design. Three key implications for the design of the CREPES module were made based on the collective findings of the first two categories. These implications acted as the linkages of this phase and the next, as they formed the foundational principles for the design and development of this module. This ensured that the module could accurately cater to the identified needs based on the data collected, and thus effectively improve practice in early science teaching and learning in the context of study.

First, data from this phase implied that the module should be designed in a way that is less teacher-centred and less rigid. This could be achieved through the provision of activities which are developmentally appropriate and encourage active participation among preschoolers. Since play is the best vehicle for children's learning and development, it should be the foundational design of this module, in line with the national preschool curriculum. As children should be at the centre of the play approach, the module should take into consideration preschoolers' interests, levels, and home experiences in order to ensure optimum learning experiences.

With a greater degree of flexibility in the science classroom, preschoolers should be provided with space and freedom to explore freely through hands-on play activities in the module. The module should also empower preschoolers with the ownership and control over of their play and learning process. This implies the provision of choices, whereby young learners make their own decisions. The role of the teacher, therefore is to guide, facilitate, and explore alongside the children by intervening only when appropriate through thought-provoking questions and interactive discussions as preschoolers engage in play and hands-on discoveries.

Considering that early science is implemented as an isolated subject in the context of this study, the CREPES module should involve substantial integration between various curricular strands as required in the national preschool curriculum. This would help teachers to move towards viewing science as an integrated area instead of a fragmented subject area. Aside from science content knowledge, each science activity suggested in the module should encompass more than one integrated areas. Integrating various content areas in science lessons is hoped to motivate preschool teachers to deliver a greater variety of activities and alleviate their fear in teaching science, hence improving their self-efficacy in science teaching and learning. Besides, an integrated activity will most likely promote and nurture preschoolers' interest in science from a young age, as it provides ample avenues for young learners of varying dispositions to learn in their preferred styles of learning. This is in line with Gardner's Theory of Multiple Intelligences (1983), which advocates a conducive, wholesome environment where children flourish as they develop holistically in different areas.

Based on findings on current practice and needs in preschool science teaching and learning, this present study focused on the development of creativity among preschoolers which was found to be lacking in the context of study. Hence, the module should not solely help develop preschoolers in the science content area, rather holistically and in parallel with all other areas including physical and social domains; specifically toward developing their creativity.

Lastly, the module should provide concrete guidance and pedagogical support for preschool teachers to implement early science through play activities to stimulate preschoolers' creativity. This implication was made in accordance with preschool teachers' lack of exposure in the effective approaches of teaching and learning of early science and their inadequate understanding of science concepts. As the CREPES module would mainly focus on the science content area, it enables more emphasis on ensuring effective early science instruction in the preschool context.

In light of teachers' limited pedagogical knowledge in teaching science, the CREPES module would be a crucial contribution for teachers' professional development, especially pertaining to preschool science. The module aims to present teachers with a new pedagogical approach to deliver early science through creative play. This calls for the provision of clear and practical guidelines in the module for teachers to acquire in-depth understanding of this approach, in order to be equipped for its actual implementation. In addition, these guidelines in the module should be coupled with continuous professional development courses and training sessions for preschool teachers to be exposed and familiarised with the CREPES module. Introduction to the approach, how and why it should be implemented should be thoroughly addressed. With this knowledge, it is hoped that teachers will be equipped to improve in their implementation of creative play which help develop preschoolers' creativity through playful, active, and hands-on experiences.

In a nutshell, the first implication called for the incorporation of play in early science teaching and learning. The second implication established the need for creativity to be the essential outcome to be developed through the module, whereas the final implication illuminated the need for pedagogical guidance for teachers in the area of early science. Combining all three implications for module design ascertained the need to develop a Creative Play Early Science (CREPES) module which acts as a pedagogical tool for preschool teachers to develop creativity among preschoolers through hands-on, child-centred creative play activities.

The overall data obtained in the needs analysis phase was on 1) the current practice, 2) the needs in early science teaching and learning, followed by 3) the implications for the design of the module. As illustrated in Figure 4.7, the findings collectively reinforced the need to develop the CREPES module in order to improve the overall quality of teaching and learning for preschool science.

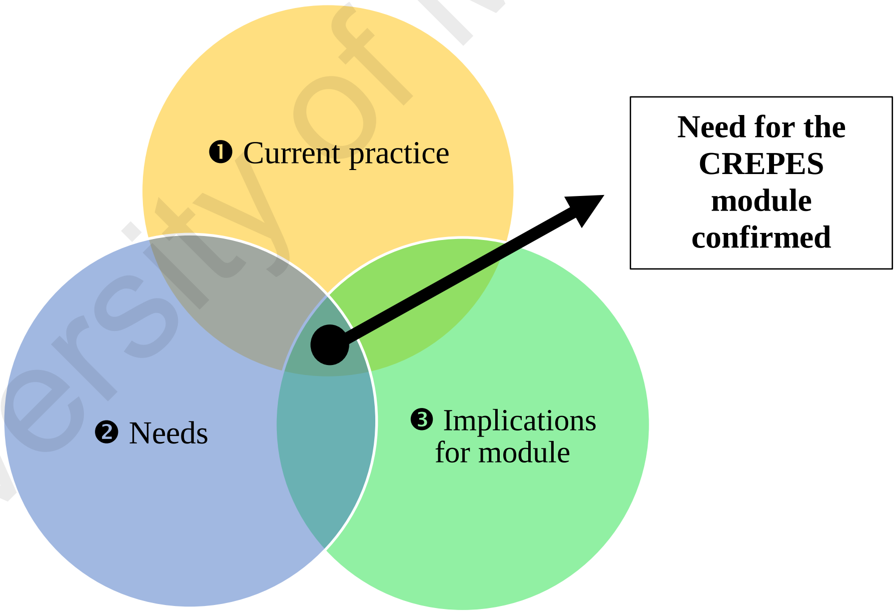


Figure 4.6. The need to develop the CREPES module was confirmed based on the collective findings for the needs analysis phase.

Chapter Summary

This chapter has analysed the data collected for the first phase of this study. Current practice of Malaysian private preschools in the context of this study has been described. Specific needs to ensure effective preschool science instruction have also been identified based on the data collected. In light of the current practice and needs in preschool science teaching and learning, implications were made for the module design and development. Hence, findings had reinforced the need for the development of the CREPES module. Data collected in this phase also established the foundation for the entire DDR study and ensured continuity with the next phase, which will be addressed in the next chapter.

Chapter 5

Findings of Phase 2: Module Design and Development

Following the first phase which identified the needs for the module, this chapter presents the findings for the second phase that concerned the process of designing and developing the CREPES module. This phase addressed two research questions. The Delphi technique was employed to address the first research question: “What is the appropriate CREPES module design according to experts’ consensus?”. Next, several experts and teachers evaluated the initial module through in-depth interviews and analysis of their written comments. Hence, this answered the second research question of this phase: “How do experts and teachers review the initial module?”.

Data Analysis for the Delphi Technique

In order to answer the first research question for Phase 2, a three-round Delphi was conducted to obtain consensus on the appropriate design of the CREPES module among the expert panel which consisted of 14 experts from multidisciplinary backgrounds. Three rounds of Delphi led to the finalisation of the items regarding the appropriate CREPES module design and production of the initial module.

Round 1 Delphi. The first round began by interviews with the expert panel on the appropriate design for the module. This included collecting experts’ suggestions of module content, appropriate creative play activities, teaching strategies, science concepts, resources and other suggested principles for an effective early science module. Experts’ responses were gathered and categorised thematically to form a questionnaire to be administered in the second round.

As with any qualitative data, the data analysis for this round began with open coding, i.e. formulation of initial codes after thorough and repetitive reading and understanding of the data. The codes were carefully worded to ensure that they accurately and specifically represent what was conveyed by the experts. These initial codes were then systematically refined by merging similar codes, rechecking and rewording the codes in order to maintain the originality of the data collected from experts. The items in the questionnaire were subsequently developed based on the codes. The codes were categorised into different themes. These themes formed the various sections of the questionnaire.

Following data analysis for Round 1, a total of 47 items, including 2 sub-items suggested by experts formed the questionnaire for Round 2. Each section and its respective items in the questionnaire are as shown in Table 5.1.

Table 5.1

Findings of Round 1 Delphi

Themes / Sections	Items
A) General module design	1. Pictures / graphics 2. Videos 3. User-friendly 4. Simple language 5. Practical to implement in actual preschool settings

Table 5.1 *(continued)*

B) Recommended module sections	1. Introduction of module 2. Introduction of creative play 3. Introduction of creativity 4. Introduction of preschool science 5. Guidelines to use and implement the module 6. Do’s and don’ts (Principles to follow) 7. Suggested activities a) In the form of lesson plans b) Related facts or science concepts on a certain lesson 8. Suggested questions to ask preschoolers 9. Observation and assessment tools 10. Self-reflection / self-evaluation for teachers 11. Additional references (e.g. books / websites) 12. Mind map
C) Module activities	1. Open-ended 2. Interesting to children 3. Include opportunities to problem-solve 4. Hands-on exploration 5. More child-centred, less teacher-centred 6. Relevant to children 7. Experiments 8. Cooking experiences 9. Constructing things 10. Water activities 11. Include science process skills 12. Thematic 13. Integration across the curriculum strands (*tunjang*)
D) Teaching strategies / techniques	1. Open-ended questioning 2. Provoke children to develop and ask questions 3. Allow freedom for children to explore 4. Less teacher-centred (teacher as the facilitator / guide) 5. Two-way interaction between teacher and children 6. Collaborative and group learning 7. Process-oriented over product-oriented 8. Observe children’s process of learning 9. Provide time to explore and extend learning
E) Module resources	1. Internet 2. Audio-visual 3. Recycled items 4. Open-ended materials 5. Natural resources from the environment 6. Books / children’s literature

The first round of Delphi resulted in the development of the survey questionnaire for the subsequent round. Based on interview data, five different sections of the questionnaire were developed. For each section, one additional item, i.e. “Others” was included for experts to add in extra ideas that they may have missed pointing out during the interview. A column was also provided for any constructive comments or advice for the design of the CREPES module.

Section A had five items on the general module design of the CREPES module in order for it to be effective in guiding preschool teachers to implement early science activities through creative play. Experts were to rate the recommended features of the module listed based on their importance on a scale of 1 (strongly disagree) to 4 (strongly agree). Next, Section B required experts’ ratings on recommended sections to be included in the module as a comprehensive instructional tool for preschool teachers. Section C listed various characteristics of activities that may be suitable to be incorporated into the module with the aim of developing preschoolers’ creativity. A brief definition of creativity in the context of study was provided for experts to gain a clear understanding of the terminology before rating the items.

For Section D, the questionnaire also required the Delphi panel to rate teaching strategies or techniques that could be applied in the module activities to achieve the desired module objective. The last section of the questionnaire sought experts’ responses on the suitable module resources to support the implementation of creative play science activities.

Round 2 Delphi. The second round of the Delphi technique involved the administration of the questionnaire developed in the previous round to the same panel experts in Round 1 (Appendix I). Experts were required to rate the items based on its importance toward the module design using a four-point Likert scale: 1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree. They could also add extra comments or other additional responses as preferred.

To analyse the findings for Round 2, mean, median and interquartile (IQ) range values for each item were calculated. Based on the mean values, the items were rearranged in descending order from the highest to the lowest mean before being distributed for the next round. The median and IQ range whereas, were used to measure the degree of agreement and how far has consensus been achieved for each item in the survey. Findings for this round are presented in Table 5.2 to Table 5.6 by section in the questionnaire. Additional items for each section were also specified and included in the tables.

Table 5.2

Analysis of Section A (General Module Design) for Round 2 Delphi

Item No.	General Module Design	Mean	Median	Interquartile Range (IQ)
3	User-friendly	4	4	0
5	Practical to implement in actual preschool settings	4	4	0
1	Pictures / graphics (e.g. supporting illustrations, cartoons, speech bubbles)	3.93	4	0
4	Simple language	3.93	4	0
2	Videos	3.36	3	1
6*	Real photographs instead of cartoons			

**Additional item suggested by expert(s)*

For the first section of the questionnaire on general module design as explicated in Table 5.2, all items achieved high consensus, represented by the with IQ range of 0 and 1. In terms of the median values, items 3, 5, 1 and 4 were strongly agreeable by the panel as reflected in the median values of 4. Meanwhile, item 2 ("videos") which had the median value of 3, implying that it was generally agreeable among the panel. One new item ("real photographs instead of cartoons") was suggested by one of the experts to be added to this section.

Table 5.3

Analysis of Section B (Recommended Sections for Module) for Round 2 Delphi

Item No.	Recommended Sections for the Module	Mean	Median	Interquartile Range (IQ)
5	Guidelines to use and implement the module	3.93	4	0
1	Introduction of module	3.79	4	0
2	Introduction of creative play	3.79	4	0
4	Introduction of preschool science	3.79	4	0
7	Suggested activities	3.79	4	0
9	Observation and assessment tools	3.79	4	0
3	Introduction of creativity	3.71	4	1
7(b)	Related facts or science concepts on a certain lesson	3.71	4	1
11	Additional references (e.g. books / websites)	3.71	4	1
6	Do's and don'ts (Principles to follow)	3.64	4	0
8	Suggested questions to ask preschoolers	3.64	4	1

Table 5.3 (*continued*)

10	Self-reflection / self-evaluation for teachers	3.64	4	1
7(a)	In the form of lesson plans	3.43	4	1
12	Mind map	3.36	3	1
13*	Expected module objectives / outcomes			
14*	Suggestions on resources / materials for teaching and learning			
15*	Tips on planning and implementing a creative play science activity			

**Additional items suggested by expert(s)*

As presented in Table 5.3, items 5, 1, 2, 4, 7, 9, and 6 in Section B regarding appropriate module sections obtained IQ range values of 0 and median of 4. This indicated that these items achieved a very high level of consensus among the panel and were highly agreeable by the experts. A majority of the experts also strongly agreed with items 3, 7b, 11, 8, 10 and 7a, which have median values of 4 and IQ value of 1. Although item 12 (“mind map”) had the lowest median compared to the other items, experts were generally in agreement with it as indicated by the median value of 3. As an IQ value of 1 was obtained for this item, a high consensus was nonetheless achieved. In addition to the existing items, the panel suggested three additional items for this section, namely “expected module objectives / outcomes”, “suggestions on resources / materials for teaching and learning”, and “tips on planning and implementing a creative play science activity”.

Table 5.4

Analysis of Section C (Module Activities) for Round 2 Delphi

Item No.	**Module activities**	**Mean**	**Median**	**Interquartile Range (IQ)**
1	Open-ended	4	4	0
3	Include opportunities to problem-solve	4	4	0
4	Hands-on exploration	4	4	0
5	More child-centred, less teacher-centred	4	4	0
7	Experiments	4	4	0
9	Constructing things (e.g. models, structures)	4	4	0
11	Include science process skills (e.g. comparing, classifying, observing, predicting)	4	4	0
2	Interesting to children	3.93	4	0
6	Relevant to children	3.93	4	0
10	Water activities	3.86	4	0
8	Food / cooking experiences	3.71	4	1
13	Integration across the curriculum strands (*tunjang*)	3.71	4	1
12	Thematic	3.50	4	1
14*	Project-based			
15*	Science, Technology, Engineering and Mathematics (STEM) related activities			
16*	Outdoor activities			

**Additional item suggested by expert(s)*

Regarding suitable module activities in Section C shown in Table 5.4, data analysis revealed that all items had median values of 4; which indicated that the experts were in strong agreement with the items. The IQ range of all items was either 0 or 1. This implied that high consensus was gained among the panel on what activities should be included in the CREPES module. Mean values for all items that were above 3.5 implied high average ratings in this section.

Table 5.5

Analysis of Section D (Teaching Strategies and Techniques) for Round 2 Delphi

Item No.	**Teaching Strategies / Techniques**	**Mean**	**Median**	**Interquartile Range (IQ)**
1	Open-ended questioning	4	4	0
2	Provoke children to develop and ask questions	4	4	0
3	Allow freedom for children to explore	4	4	0
4	Less teacher-centred (teacher as the facilitator/guide)	4	4	0
5	Two-way interaction between teacher and children	4	4	0
6	Collaborative and group learning	4	4	0
7	Process-oriented over product-oriented	3.93	4	0
8	Observe children's process of learning	3.93	4	0
9	Provide time to explore and extend learning	3.93	4	0
10*	Positive reinforcement for positive responses			

Table 5.5 (*continued*)

11*	Acceptance and recognition of children's ideas whether right or wrong			

**Additional items suggested by expert(s)*

According to Table 5.5, all items in this section about appropriate teaching strategies and techniques had unanimous medians of 4 and IQ values of 0. This indicated that all the items were strongly agreed upon with minimal difference in opinion among the experts. Two newly added items suggested by experts for this section include "positive reinforcement for positive responses" and "acceptance and recognition of children's ideas whether right or wrong".

Table 5.6

Analysis of Section E (Module Resources) for Round 2 Delphi

Item No.	Module Resources	Mean	Median	Interquartile Range (IQ)
4	Open-ended materials (e.g. blocks)	3.93	4	0
5	Natural resources from the environment (e.g. leaves, twigs)	3.86	4	0
6	Books / children's literature	3.86	4	0
2	Audio-visual (e.g. videos)	3.71	4	1
3	Recycled items (e.g. bottles, cardboard, newspapers)	3.64	4	1
1	Internet	3.36	3.5	1
7*	Expertise from parents and community			

**Additional item suggested by expert(s)*

As shown in Table 5.6, all items in Section E obtained median values of at least 3.5 and IQ of 0 and 1. This indicated that the expert panel was in unison in their ratings on the possible resources that could support the CREPES module. One item "expertise from parents and community" was added to the section for this round.

Overall, analysis of findings suggested that the panel was at a high level of agreement with each other for all items in all sections in Round 2. This was reflected through the interquartile range values for all items that were at either 0 and 1; and median values which ranged from 3 (agreeable) to 4 (strongly agreeable). Hence, this signifies the achievement of a high level of consensus on all items among the expert panel for this round. Nevertheless, to ensure consistency of the ratings and feedback for the additional items, another round of Delphi was conducted with the same group of experts.

Round 3 Delphi. Following data analysis for the second Delphi round, the items for each section were reshuffled according to the mean values. The IQ range and median values from the previous round were also included in this final round. A total of 10 additional items as suggested by experts in Round 2 were added in addition to the original 47 items. This last round of Delphi aimed to achieve a final consensus among the panel experts on the appropriate CREPES module design.

Similar methods of analysis were employed in this round, which included mean, median and IQ range. In addition, Wilcoxon signed ranks test was used in this round to determine whether there are significant differences in ratings of the expert panel between Round 2 and 3. The additional items were excluded as they were only rated once in Round 3. As suggested by Norfariza Mohd Radzi et al. (2015), a Z score below -1.99 indicates no significant difference between the ratings in Round 2 and 3; whereas a *Z* score above -2.00 implies a significant difference between experts' ratings in both rounds. The test was conducted for each item and as an overall measure to determine if there is a significant difference in the overall ratings between Rounds 2 and 3.

Table 5.7 to Table 6.1 presents the analysis of findings for this final round based on sections.

Table 5.7

Analysis of Section A (General Module Design) for Round 3 Delphi

Item No.	**General Module Design**	**Mean**	**Median**	**IQ**	***Z***
3	User-friendly	4	4	0	0.000
4	Simple language	4	4	0	-1.000
5	Practical to implement in actual preschool settings	4	4	0	0.000
1	Pictures / graphics (e.g. supporting illustrations, cartoons, speech bubbles)	3.86	4	0	-1.000
6*	Real photographs instead of cartoons	3.5	3.5	1	-
2	Videos	3.36	3	1	0.000

Referring to Table 5.7, median values ranging from 3 to 4 indicated that all 6 items about general design of the CREPES module were generally agreed among the experts. High consensus among the expert panel was also achieved for all the items in this section based on the IQ range values of 0 and 1. Items 3, 4, 5 and 1 were most agreeable by the expert panel with median of 4 and IQ range value of 0. Pertaining to the *Z* scores, all *Z* scores for the items in this section indicated no significant differences between the ratings of Round 2 and 3.

Table 5.8

Analysis of Section B (Recommended Sections for Module) for Round 3 Delphi

Item No.	Recommended Sections for the Module	Mean	Median	IQ	*Z*
1	Introduction of module	3.93	4	0	-1.000
2	Introduction of creative play	3.93	4	0	-1.414
5	Guidelines to use and implement the module	3.93	4	0	0.000
4	Introduction of preschool science	3.86	4	0	-0.577
8	Suggested questions to ask preschoolers	3.86	4	0	-1.732
10	Self-reflection / self-evaluation for teachers	3.86	4	0	-1.134
3	Introduction of creativity	3.79	4	0	-0.447
6	Do’s and don’ts (Principles to follow)	3.79	4	0	-1.342
7(b)	Related facts or science concepts on a certain lesson	3.79	4	0	-0.447
9	Observation and assessment tools	3.79	4	0	0.000
7	Suggested activities	3.71	4	1	-1.000
15*	Tips on planning and implementing a creative play science activity	3.71	4	1	-
7(a)	In the form of lesson plans	3.64	4	0	-1.342
11	Additional references (e.g. books / websites)	3.64	4	1	-0.447
14*	Suggestions on resources/ materials for teaching and learning	3.64	4	1	-

Table 5.8 *(continued)*

13*	Expected module objectives/ outcomes	3.57	4	1	-
12	Mind map	3.50	4	1	-0.816

Based on Table 5.8, analysis of findings revealed that all items for this section had scored a median of 4. This represents strong agreement of experts regarding these items. In addition, level of consensus of all items in this section was high, as represented by the IQ range values at 0 and 1. The *Z* scores which are below -2 indicated no significant differences from ratings in Round 2.

Table 5.9

Analysis of Section C (Module Activities) for Round 3 Delphi

Item No.	**Module activities**	**Mean**	**Median**	**IQ**	***Z***
2	Interesting to children	4	4	0	-1.000
3	Include opportunities to problem-solve	4	4	0	0.000
4	Hands-on exploration	4	4	0	0.000
5	More child-centred, less teacher-centred	4	4	0	0.000
6	Relevant to children	4	4	0	-1.000
1	Open-ended	3.93	4	0	-1.000
7	Experiments	3.93	4	0	-1.000
11	Include science process skills (e.g. comparing, classifying, observing, predicting)	3.93	4	0	-1.000
9	Constructing things (e.g. models, structures)	3.86	4	0	-1.414

Table 5.9 *(continued)*

13	Integration across the curriculum strands (*tunjang*)	3.86	4	0	-1.000
15*	Science, Technology, Engineering and Mathematics (STEM) related activities	3.79	4	0	-
8	Food / cooking experiences	3.71	4	1	0.000
14	Project-based	3.71	4	1	-
16	Outdoor activities	3.64	4	1	-
12	Thematic	3.5	4	1	0.000
10	Water activities	3.5	3.5	1	-2.236*

*p < .05

As shown in Table 5.9, all items in this section scored median values of minimum 3.5. This suggested high level of agreement on the items about module activities. Consensus among the panel was also high for all items, as indicated by the IQ range values of 0 and 1. Item 10 ("water activities") had a Z score of more than -2.000 (Z = -2.236, p = .03). This signalled a significant difference between experts' ratings in Round 2 and 3. Compared to the previous round, item 10 obtained lower mean, median and lower degree of consensus or IQ value in this round.

Table 5.10

Analysis of Section D (Teaching Strategies and Techniques) for Round 3 Delphi

Item No.	**Teaching Strategies / Techniques**	**Mean**	**Median**	**IQ**	***Z***
1	Open-ended questioning	4	4	0	0.000
2	Provoke children to develop and ask questions	4	4	0	0.000
3	Allow freedom for children to explore	4	4	0	0.000
5	Two-way interaction between teacher and children	4	4	0	0.000
7	Process-oriented over product-oriented	4	4	0	-1.000
8	Observe children's process of learning	4	4	0	-1.000
9	Provide time to explore and extend learning	4	4	0	-1.000
4	Less teacher-centred (teacher as the facilitator/guide)	3.93	4	0	-1.000
6	Collaborative and group learning	3.93	4	0	-1.000
10*	Positive reinforcement for positive responses	3.79	4	0	-
11*	Acceptance and recognition of children's ideas whether right or wrong	3.79	4	0	-

Based on Table 5.10, items in this section achieved the highest level of agreement and consensus among all experts as all items had median of 4 and IQ range of 0. Mean values for all the items were also high, ranging from a minimum of 3.79 to

4.0. No significant differences were found in the ratings between the two different rounds.

Table 5.11

Analysis of Section E (Module Resources) for Round 3 Delphi

Item No.	**Module Resources**	**Mean**	**Median**	**IQ**	***Z***
3	Recycled items (e.g. bottles, cardboard, newspapers)	3.93	4	0	-2.236*
5	Natural resources from the environment (e.g. leaves, twigs)	3.93	4	0	-1.000
4	Open-ended materials (e.g. blocks)	3.86	4	0	-1.000
6	Books / children's literature	3.71	4	1	-1.414
2	Audio-visual (e.g. videos)	3.64	4	1	0.000
1	Internet	3.43	3	1	-0.378
7*	Expertise from parents and community	3.36	3	1	-

*$p < .05$

As shown in Table 5.11, items in this last section on module resources were agreeable by the panel with minimum median values of 3, and high consensus was achieved with the IQ range values below 1. The Wilcoxon signed-rank test revealed that ratings for item 3 ("recyclable materials") were significantly different between Rounds 2 and 3 ($Z = -2.236$, $p = .03$). Compared to the previous round, the average rating and degree of consensus for item 3 were higher; as reflected by the mean and IQ values.

As a whole, high consensus has been achieved for all items of the Delphi questionnaire based on the IQ range values of 0 and 1. Out of all 57 items in the final Delphi round, 52 items had median values of 4 which reflected strong agreement among the experts. Median values for five other items namely, items 2 ("videos") and

6 (real photographs instead of cartoons") in Section A, and items 1 ("Internet") and 7 ("expertise from parents and community") from Section E ranged from 3 to 3.5, which implied that agreement on these items was nonetheless achieved.

For the Wilcoxon signed ranks test, only 2 items from all 47 existing items had *Z* scores more than -2.000, i.e. item 10 "water activities" from Section D and item 3 "recyclable items" from Section E. Meanwhile, other 45 items had *Z* scores less than -1.99 which represented no significant differences between their ratings in Round 2 and 3. An overall Wilcoxon signed ranks test also indicated no significant differences between the average rating in Round 2 and Round 3 ($Z = -.79$, $p > .05$). This implied that experts' ratings were generally consistent in both rounds.

Table 5.12 presents the overall descriptive statistics for the average rating of the expert panel in Rounds 2 and 3. Although no significant difference was found between both Delphi rounds, both mean and median values had increased from Round 2 to Round 3.

Table 5.12

Descriptive Statistics on Average Ratings in Rounds 2 and 3

	N	**Mean**	**Minimum**	**Maximum**	**Median**
Round 2	14	3.82	3.51	3.98	3.84
Round 3	14	3.85	3.53	4.00	3.91

Therefore, consensus for all the items of the Delphi questionnaire were achieved among the panel; hence appropriate to be applied as design guidelines for the CREPES module.

Design of the Initial Module

Based on the items agreed upon by the experts from the Delphi technique, an initial module was designed. The items acted as guidelines for the design of the initial module. This section presents snapshots of the initial module and how it was initially designed to achieve its intended outcome for the development of preschoolers' creativity.

First and foremost, in accordance to Delphi findings, a clear introduction of the module including definitions of the key concepts involved, expected module outcomes as illustrated in Figure 5.1 and sufficient explanation on creative play were incorporated in the CREPES initial module. This was to provide a comprehensive background of the module as an introduction to teachers to understand its purpose in order to implement the module effectively. As creative play is the key medium for module activities, its distinction with other types of play should first be clarified. Hence, emphasis was placed on explaining what creative play is in contrast with other types of play in the module introduction. Acquiring adequate understanding of what creative play is helps teachers implement the module effectively towards the expected module outcomes.

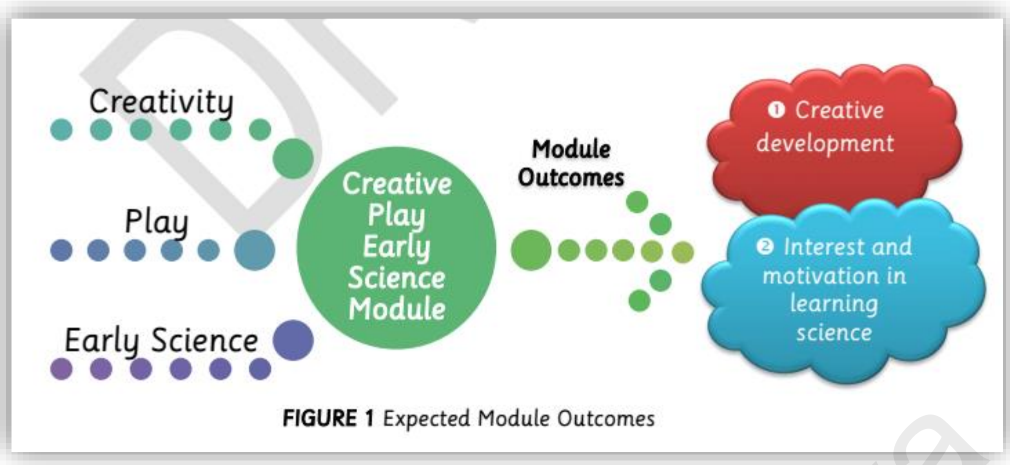
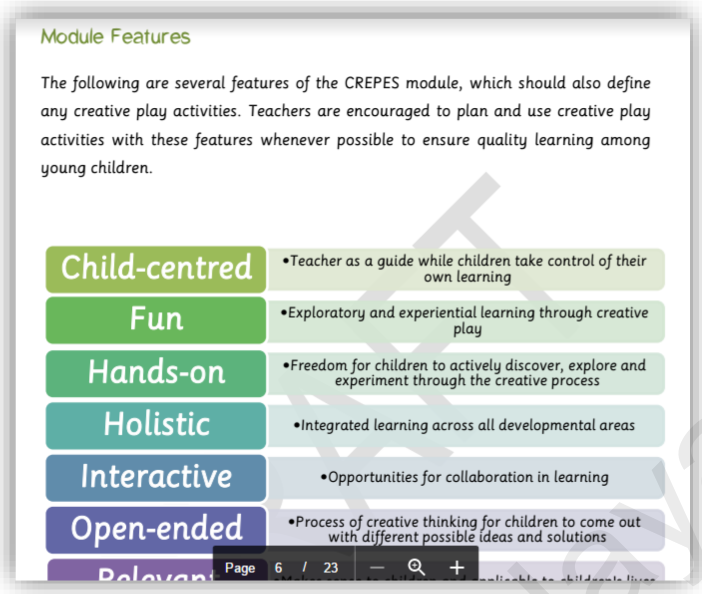


Figure 5.1. Expected module outcomes included in the initial draft module.

In addition, important features of the CREPES module were also included in the module introduction shown in Figure 5.2. One of the key features emphasised in the module is its open-ended nature which allows a certain extent of flexibility for teachers in planning their lessons, as well as preschoolers in their learning process. As repeatedly stated in the module, the role of the CREPES module is to be a guidebook that helps teachers in planning creative play science activities, instead of spoon-feeding teachers with every single detail to plan their lesson. This is so that preschoolers' interests, dispositions and their various sociocultural backgrounds could be taken into account by the teacher through planning and implementing the lessons according to children's needs.



Module Features

The following are several features of the CREPES module, which should also define any creative play activities. Teachers are encouraged to plan and use creative play activities with these features whenever possible to ensure quality learning among young children.

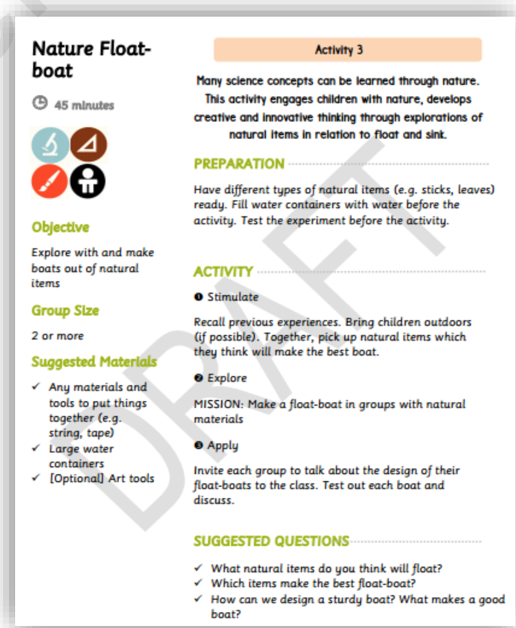
Child-centred	•Teacher as a guide while children take control of their own learning
Fun	•Exploratory and experiential learning through creative play
Hands-on	•Freedom for children to actively discover, explore and experiment through the creative process
Holistic	•Integrated learning across all developmental areas
Interactive	•Opportunities for collaboration in learning
Open-ended	•Process of creative thinking for children to come out with different possible ideas and solutions

Figure 5.2. Key features of the CREPES initial module.

Hence, the initial module activities were not designed with excessive details and structured step-by-step procedures. As stressed in the module, all module activities serve as general guidelines and reference on how creative play could be incorporated in early science. In the introduction of the CREPES initial module, reminders were given that the suggested activities are not to be strictly followed but could be modified to cater to the needs of preschoolers. At the same time, the module activities were designed to ensure that teachers are provided with adequate support to inculcate creativity in science teaching and learning guided by the SEA model. Following this model adapted from Torrance's Incubation Model of Teaching (1979), teachers are concretely guided by this three-stage model to stimulate preschoolers' creativity development through the suggested creative play activities. As creativity in this module emphasises on the formulation of ideas and exercising imagination to problem-solve, suggested open-ended questions were provided for each activity.

Combining play, creativity and early science, the module activities that were initially designed are based on the play approach, supported by the theory of constructivism. Play is incorporated in the module as a medium for hands-on activities that were designed to offer opportunities for active learning and exploration, as well as stimulate divergent, creative thinking among preschoolers. The module activities were designed in line with the features of play as stated in the definitions of terms in Chapter 1, which include pleasurable, meaningful and actively engaging. As a whole, these were incorporated into the initial module to help address the issues identified in the needs analysis phase, including excessive structure and lack of creative development in preschool science teaching and learning.

A section on theories that support the module was included and explained in the initial module to provide module users with adequate understanding on the theoretical foundation that supports the module. Figure 5.3 shows one of the snapshots of an activity page which was designed in accordance to the consensus achieved by the Delphi panel in this phase.



Nature Float-boat

45 minutes

Objective

Explore with and make boats out of natural items

Group Size

2 or more

Suggested Materials

- ✓ Any materials and tools to put things together (e.g. string, tape)
- ✓ Large water containers
- ✓ [Optional] Art tools

Activity 3

Many science concepts can be learned through nature. This activity engages children with nature, develops creative and innovative thinking through explorations of natural items in relation to float and sink.

PREPARATION

Have different types of natural items (e.g. sticks, leaves) ready. Fill water containers with water before the activity. Test the experiment before the activity.

ACTIVITY

❶ Stimulate

Recall previous experiences. Bring children outdoors (if possible). Together, pick up natural items which they think will make the best boat.

❷ Explore

MISSION: Make a float-boat in groups with natural materials

❸ Apply

Invite each group to talk about the design of their float-boats to the class. Test out each boat and discuss.

SUGGESTED QUESTIONS

- ✓ What natural items do you think will float?
- ✓ Which items make the best float-boat?
- ✓ How can we design a sturdy boat? What makes a good boat?

Figure 5.3. Snapshot of an activity in the initial module.

As agreed upon by the Delphi panel experts, an effective module should be a user-friendly tool for teachers. In effort to design a user-friendly module, a simple guide to use the module was included in the initial CREPES module to ease teachers' use and implementation of the module as shown in Figure 5.4. It includes a brief explanation of the features included in each module activity.

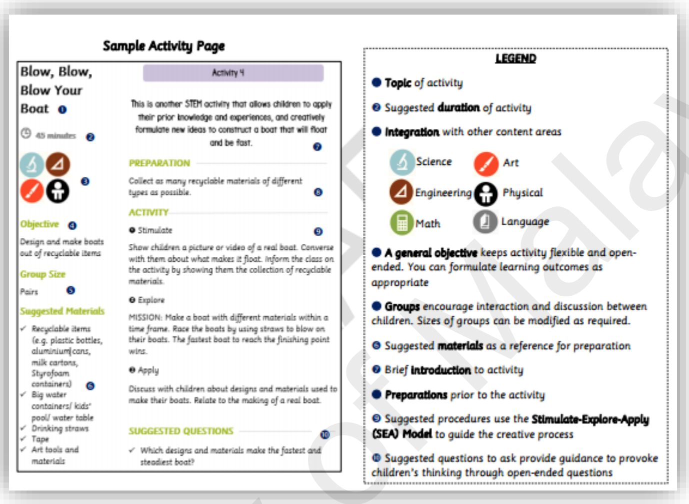


Figure 5.4. Features in the initial module outlined.

As shown in Figure 5.5, two special characters were also used in the initial module to help guide module users with related facts, address common misconceptions, and provoke them to think creatively. As teachers are provided with the necessary information about the topic and are stimulated to think creatively, implementation of the module is expected to be more effective.

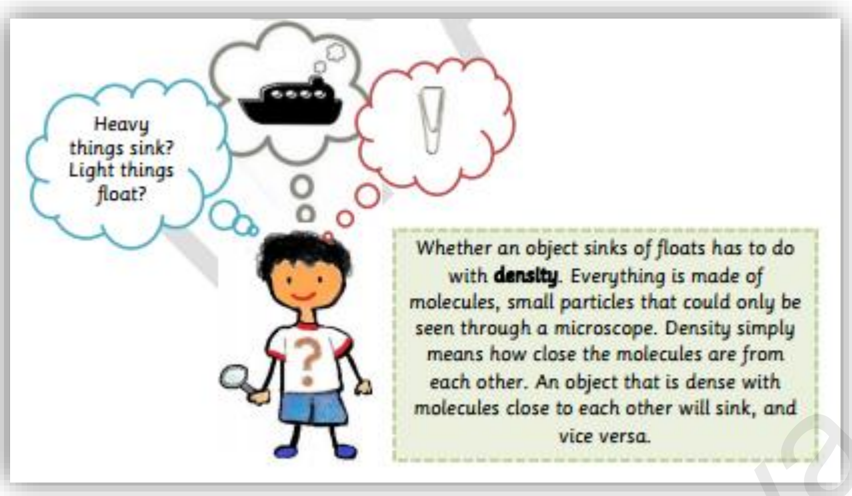


Figure 5.5. One of the special characters in the draft module activity.

With these features designed to instil creativity into early science and develop preschoolers' creativity, the initial CREPES module then reviewed.

Review of the Initial Module

This section addressed the third research question for the study which was: "How do experts and teachers review the initial module?". Following the completion of the initial module, the CREPES module was reviewed by experts and teachers as key module users. The purpose of this review was to conduct a thorough check and validate the module before implementing it in an actual preschool setting. Based on reviewers' comments, the CREPES module was refined to ensure that its expected outcomes could be achieved effectively. This led to the development of a CREPES module prototype which was subsequently implemented.

The module reviewers consisted of three content experts (CE) and two preschool teachers (PT). The review was done by collecting written comments from reviewers based on the Module Review Form (Appendix M). The CREPES module was evaluated specifically on but not limited to two aspects, including 1) its overall design and content, as well as 2) suggested activities in the module. Subsequently, unstructured interviews were conducted through email with each reviewer to further clarify and discuss specific comments made.

Based on the review, several aspects were raised: 1) module practicality for teachers, 2) terminology use, and 3) management of external factors. Each of these areas will be explicated as follows.

Module practicality for teachers. Since preschool teachers are the primary users of the CREPES module, the module should be practical for teachers to implement in actual preschool settings with the preschoolers. Teachers' competence is a key factor that affects how practical this module would be when implemented. In order to ensure that it is practical, CE2 and CE3 pointed out the significance for the module to consider the needs of a wide range of target teachers; from novice to experienced, as well as untrained to qualified preschool teachers. CE3 noted that the module is written with the assumption that teachers "*have certain concepts of curriculum, instruction and assessment*" (CE3: 9-10). In addition, CE2 suggested that simpler vocabulary and more concise sentences should be used (CE2: 4). Both reviewers emphasised the need for the module to be user-friendly and practical for a wider circle of preschool teachers from various kinds of settings and qualifications.

In addition, reviewers pointed out that the information given on various areas should be clearer and more specific in order to enable preschool teachers with various backgrounds to develop adequate understanding on the module. First, both teachers involved i.e. PT1 and PT2, and also CE3 stressed the need for clearer steps to conduct the module activities. For instance, PT1 explained that the ambiguous instructions in some activities affected her understanding of the module:

> *Explain in more details on the steps in the lesson plan. The problem now is your steps are too general and not in detail. That's why I can't see or read or understand how the whole experiment is being done, and how it helps to achieve your goal for this module.*
>
> (PT1: 12-15)

Similar to PT1, CE3 commented that the CREPES module is "*user-friendly enough for experienced teachers, but not specific enough with scaffolding blocks to guide new teachers to implement the ideas and activities*" (CE3: 2-4). She reiterated that how practical the module will greatly depend on its "*target group"*. She went on to suggest the module to be *"more specific with steps [for] young inexperienced teachers too*" (CE3: 10-11) and to include "*more details for more effective scaffolding for knowledge construction*" (CE3: 23-24).

Commenting from a scientific perspective, PT1 and PT2 added that other factors that might affect the results of the activities should be addressed. PT2 quoted an example from one of the module activities where children are to construct and design their own boats out of recyclable materials, and then race their boats in groups by blowing the boat with a straw:

> *Instead of using straw, perhaps using a fan or hair dryer to fix the speed of the air to be fair, as the activity is concerned about the materials they choose to make the boat and to find out how the materials affect how it floats; not how much or how strong is the air they blow to arrive at the ending point.*
>
> (PT2: 25-28)

Similarly, PT1 questioned about how "*the thickness of the cardboard or paper, or sizes of items affect the result of the experiment*" (PT1: 43) in the magnet maze activity.

The points raised by PT1 and PT2 are valid considering the CREPES module activities from a scientific perspective as formal science experiments, which requires a control variable to investigate the relationship between the manipulative and responding variables. However, as this module focuses on preschoolers' creativity development, it is largely open-ended and child-centred in nature. Hence, it is up to preschoolers to explore with the materials and formulate their own ideas toward achieving the desired outcomes. Standardising certain variables in the activities defeats the purpose of the CREPES module, as it could limit the various ways in which preschoolers explore with the materials. Teachers' creativity in leading the preschoolers to further exploration would also be restricted.

In addition, two reviewers also drew attention to the importance of sufficient explanation of science concepts in the module. They emphasised the need to ensure that teachers possess reasonable and correct understanding on the topic before implementing the module. PT2 commented positively on two cartoon characters in the module that were specially designed to present thought-provoking questions and stimulate creative thinking among teachers, and guide them with related scientific information. However, PT2 noted that there was a lack of these in the topic of magnets compared to the topic of sink and float. She suggested that there should be a balanced amount of these characters for activities in both topics as "*it helps teachers who are not so good in science with some of the science facts*" (PT2: 32). Therefore, in addressing this comment, this feature was sufficiently added into the module to enhance its use. One of the snapshots of the character added in the topic of magnets is as shown in Figure 5.6.

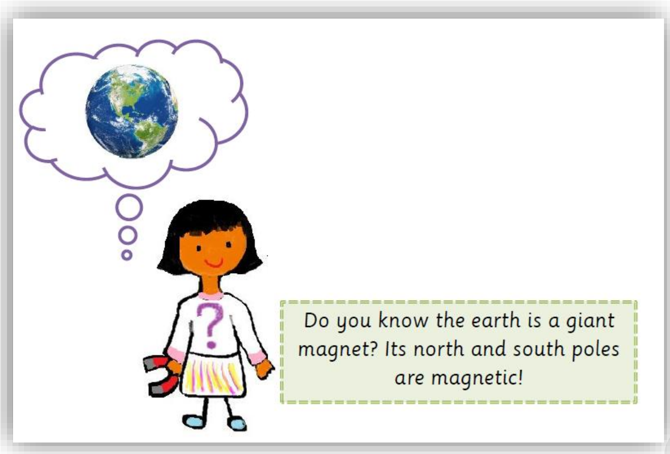


Figure 5.6. Snapshot of a cartoon character in the CREPES module.

Furthermore, CE3 noted that the topic of sink and float activities might easily "*pose confusion of understanding*" (CE3: 5) among many preschool teachers. To illustrate her claim, CE3 cited the example of a heavy ship that could stay afloat. She called for further and clearer explanation in a "*hierarchy of concepts from core concepts to subconcepts, to construct the right premises and properties of a science concept*" (CE3: 9-10). In addressing this, explanation of concepts as well as related resources were included explicitly in the module by adding introductory pages for each topic as in Figure 5.7. Not only did these act as separators for each topic, making the module more organised; they are also expected to help teachers deepen their understanding in the subject matter before implementing the module activities.

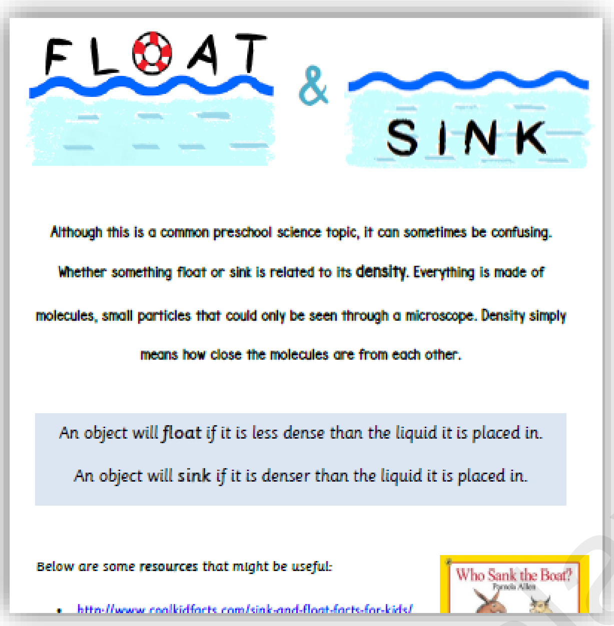


Figure 5.7. Clear explanation of core concepts and facts involved in the CREPES module.

In order for the module to be more practical, reviewers also suggested several aspects to be added to the module. As the initial module did not outline learning outcomes in the suggested activities, CE3 recommended that learning outcomes should be formulated to consolidate the learning objectives. CE3 also emphasised that the module should be "*facilitated with more specific open-ended questioning techniques*" (CE3: 31), as many teachers are not competent in asking open-ended questions to encourage creative thinking among preschoolers. In order to help teachers differentiate between closed and open-ended questions, specific guidance was provided on this aspect in the introduction part of the module as illustrated in Figure 5.8. This was also further explained during the module orientation session.

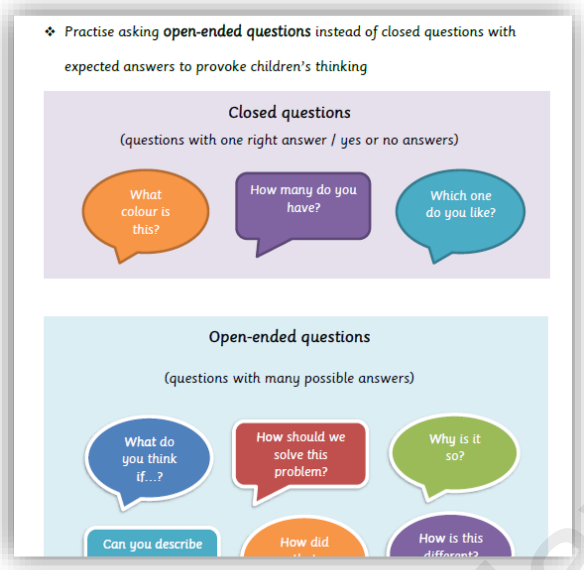


Figure 5.8. Comparison of closed and open-ended questions added into the CREPES module.

On top of that, CE1 suggested the provision of "*expected result or sample answers for... the activities or questions as an appendix*" in order to "*motivate teachers to carry out the activities as expected*" (CE1: 27-28). A suggestion to simplify the reflections part in the module was brought forth by CE2 as it "*seems difficult for teachers to fill in and may be challenging for most preschool teachers*" (CE2: 5-7).

The comments by CE1 and CE2 as above implied the importance of teacher training prior to implementing the CREPES module. As the CREPES module also aims to gradually foster teachers' creativity in teaching, "*expected results or sample answers*" as proposed by CE1 were not included in the module. This is in order not to set any standards or limits on the activities, and to allow open-ended and unrestricted freedom and creativity for preschoolers' explorations. Nevertheless, a module orientation session would be carried out to support and guide teachers to use the module effectively by providing a platform for teachers themselves to test out the activities which may be new to them. Clear explanation of how to conduct teachers' reflections as provided in the module would also be addressed during the module orientation session.

CE2 also voiced out her concern that despite the informative introduction of the module, some preschool teachers are "*not into spending time reading the background*" (CE2: 7). She recommended a "*short briefing*" (CE2: 8) covering the background information. Comments from reviewers provided pointers of what to include and focus on in the module orientation session. Coupled with a detailed teacher training session, preschool teachers would be able to acquire sufficient understanding of how to implement the CREPES module effectively in practice.

In accordance to the comments given by reviewers, appropriate changes were made to improve on the module. Reviewers' concerns were also taken into account in order to enhance the practicality of the module implementation. Considering the reviewers' comments presented a challenge to the researcher in terms of striking a balance between maintaining the pedagogical flexibility of teachers and at the same time providing sufficient information for teachers from various backgrounds to implement the module in their settings.

Measuring reviewers' feedback against the intended outcome of the CREPES module, a summary of the amendments and implications on module development based on this review is as follows:

1. More specific definitions and explanations on science concepts through suggested resources and fact boxes provided in the module
2. Clearer instructions on how to conduct the activities were outlined, yet care was taken to retain the pedagogical flexibility for teachers to implement the open-ended module activities using their own creativity

3. Learning outcomes for all module activities were formulated and added
4. A special section to guide module users on open-ended questioning was inserted in the introduction section of the module, by presenting a stark contrast between open-ended and closed questions with examples for each type
5. Teachers' reflection form was simplified, with examples given as guidance for teachers
6. Module orientation session to include:
   a) Detailed explanation of the background of the CREPES module which includes its main intended outcomes, using the SEA model and open-ended questioning technique;
   b) Specific guidance on how to carry out reflections using the teachers' reflection form;
   c) Testing out the activities to support teachers' implementation of the module

Terminology use. Data analysis on the comments made by reviewers also indicated concerns on the use of terminology in the initial CREPES module. Specifically, the concerns raised were pertaining to 1) clarity, and 2) consistency of the terminology used.

Regarding to the clarity of terminology, two reviewers, CE1 and PT1 drew attention to the ambiguity of the term "imagination" used in the introduction of the initial module. Both stressed on the need to provide a more specific definition for the term. PT1 emphatically expressed her uncertainty on the term "imagination": "*Imagine what? How to solve the problem or how to make or design certain things*?" (PT1: 22).

Similarly, CE1 further reasoned that defining the term more specifically would effectively "*help teachers to inculcate imagination among children*" (CE1: 8).

Besides the term "imagination", the researcher discerned some possible confusion and misconception among several reviewers on what "creativity" denotes in the context of the CREPES module. This was evident through the comments by CE2 and PT1. Creativity in the context of preschoolers' learning was defined in the initial module, which includes the aspects of fluency, originality and imagination. Nevertheless, both CE2 and PT1 contended that some activities in the module did not involve "creativity". For instance, PT1 stated: "*I don't see the creativity part for the children in this activity. They are just exploring, predicting*." (PT1: 37-38). When asked to comment about whether the module is attractive, she maintained that some of the activities were "new" and attractive to her, but "*few were just 'normal' because they were common activities*" (PT1: 6-7). CE2 gave similar remarks that a few activities "*don't really encourage creativity*" (CE2: 3).

Reviewers' comments indicated that their understanding of "creativity" were not in line with the module's definition of the term. The researcher reasoned that this could be due to the lack of clarity in the definition of "creativity" provided in the module. Alternatively, the definition might not have been sufficiently emphasised or reinforced in the initial module. As creativity is the key outcome to be developed among preschoolers through the module, its infusion in each activity should be more apparent to users.

On the other hand, it could also imply the lack of depth in the understanding of the term "creativity" among practitioners in ECE as well as in the education sector at large. Focusing on the visible creative end products, what most have neglected to grasp is the process of creativity development among young children, which involves idea formulation and exercising imagination. As educators, it is only reasonable to nurture preschoolers' creative abilities in accordance to their age and development whether in terms of cognitive, physical, aesthetics or social aspects.

Nevertheless, as a measure to address these concerns, the definition of creativity in relation of the CREPES module was emphasised and reinforced in the module as well as in the module orientation session. Moreover, the incorporation of creativity into each activity was made more explicit in the module. As creativity in the CREPES module focuses on the formulation of ideas and the use of imagination to solve problems, a new feature "Exploring Deeper" as shown in Figure 5.9 was added into each module activity to provide ideas for teachers to lead preschoolers further into deeper creative thinking and exploration.

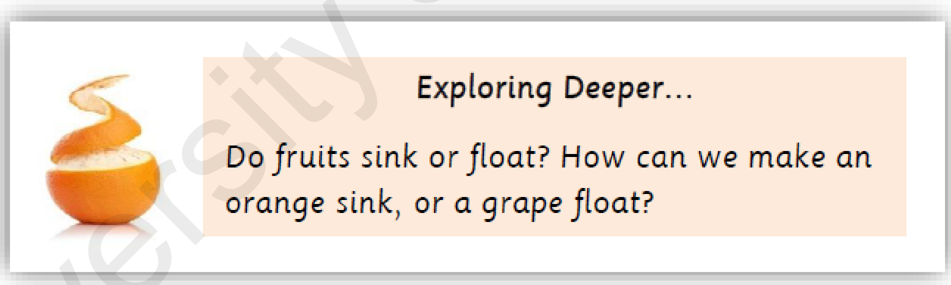


Figure 5.9. A snapshot of "Exploring Deeper" in the CREPES module.

Secondly, consistency of the terminology in the module was also one of the issues that emerged from the data. Two reviewers, CE1 and CE3 pointed out the interchangeable use of the terms STEM and STEAM in the initial module. Since this could pose confusion among module users, STEAM was selected to be used consistently throughout the module in recognition of the arts in developing preschoolers' creativity. This decision was made upon the basis that art is one of the crucial components incorporated in the module activities for developing creativity among preschoolers. Moreover, in light of the interdisciplinary nature of learning among young children, art is inseparable from preschoolers' early science learning. The integration of art into early science activities is also in accordance with the NPSC which acknowledges the use of integrated approach. Art, not restricted to drawing and painting is an undeniably powerful medium for preschoolers' creative development. Some module activities that involve art include painting with magnets and magnetic items, constructing with clay, and designing a boat with natural and recyclable items among others.

On the other hand, CE1 pointed out the importance in ensuring that all module activities conducted are completely consistent with the definitions of "creativity" provided in the introduction of the module. For instance, the first activity suggested in the initial draft of the CREPES module required preschoolers to "find a ***certain amount*** of" things that they predict will sink or float. CE1 maintained that the number of ideas preschoolers formulate should not be limited in the activity, instead she suggested the use of the phrase "*as many as they think*" (CE1: 33). CE1's argument was on the basis that the "*one of the main objectives of the activities is to inculcate the ability to come out with many different ideas (fluency)*" (CE1: 34-35). Amendment was made according to this suggestion as limits should not be imposed on preschoolers' formulation of ideas whether in terms of its quantity or quality; in order to encourage creative "out-of-the-box" thinking which should be done without predetermined boundaries.

Based on the reviewers' comments gathered, amendments were made on the initial module regarding the clarity and consistency of the terminology used. The following are a summary:

1. Clearer and more specific definition for "imagination" in context of the module
2. "Creativity" defined and infused more explicitly in the module, that creative process through formulation of ideas and imagination were the emphasis of creativity in context of the module
3. The term "STEAM" used consistently throughout the module in recognition of the role of art in preschoolers' creative development
4. No imposed limit on the amount of ideas in the module activities, rather preschoolers are encouraged to formulate as many ideas as possible

Management of external issues. Data also revealed several implementation issues that should be looked into. It was interesting to note that these issues were raised by the teacher reviewers. At the forefront of the field, preschool teachers are most familiar with the reality, especially grassroots issues pertaining to teaching and learning. Three issues that could possibly affect implementation and practicality of the CREPES module were brought forth by PT1 and PT2 including: 1) large class sizes, 2) lack or absence of outdoor space, and 3) child safety.

Large class sizes are a norm in many preschool settings in Malaysia. It also implied low teacher-to-child ratio. Both PT1 and PT2 expressed their concern over this issue. PT1 voiced out her concern that the amount of children in a class affects children's opportunities for hands-on experiences. Meanwhile, PT2 articulated that the module could be less practical in "*typical local preschools*" with "*larger group of* *children within classroom setting*" (PT2: 4-5). In addition, PT2 highlighted about the high level of guidance required for children in the construction activities. This is due to the need for "*a lot of fine motor skills to do some of the experiments like making boat*" (PT2: 26).

The next two issues were raised by PT1 whose expertise is in preschool curriculum development. She noted that the module could suggest alternatives for preschools without outdoor space to conduct certain activities. She also highlighted safety concerns on the use of small metal items in the module activities on the topic of magnets. PT1 suggested that this could pose safety risks for young preschoolers, thus is less appropriate for young children. This is related to the number of children in one class and amount of adult supervision needed to conduct these activities.

These interconnected issues were aptly pointed out in the module review. This allowed a thorough scrutiny by the researcher on how practical the module is and how could it be implemented effectively in light of these existing issues. Moreover, these issues vary from one setting to another. Since these are external issues that could not be immediately and easily addressed or controlled, several steps were taken to minimise the impact of these issues toward preschoolers' learning:

1. Number of children in each group for module activities scaled down, which implies preparation of more materials for all preschoolers
2. The suggestion that activities should be conducted with supervision and guidance from other adults such as teacher assistants, or capable preschoolers as group leaders was included in the module

3. Use of the outdoor area is encouraged but not obligatory. Suggestion to compensate to this has been included in the module, or based on teachers' creativity on the basis that development of creativity will not be stifled
4. Reminders on safety risks added in the module, especially with the use of magnets as shown in Figure 5.10

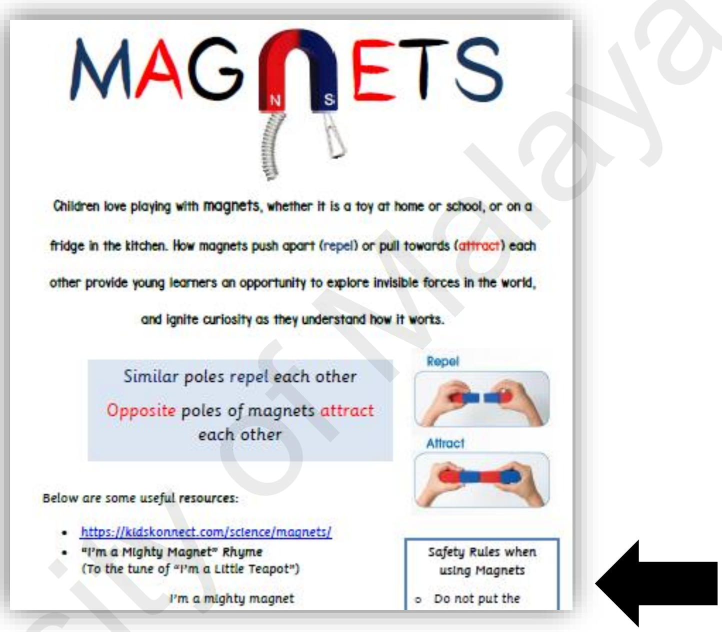


Figure 5.10. Safety rules when using magnets and small metal items.

Figure 5.11 summarises the key aspects that were elicited through the module review, leading to the development of the module prototype ready to be implemented in the following phase. A review of the CREPES initial module enabled appropriate amendments to be made prior to its actual implementation in the next phase. It also pointed out several issues on module implementation for the researchers' consideration in ensuring effective implementation of the module.

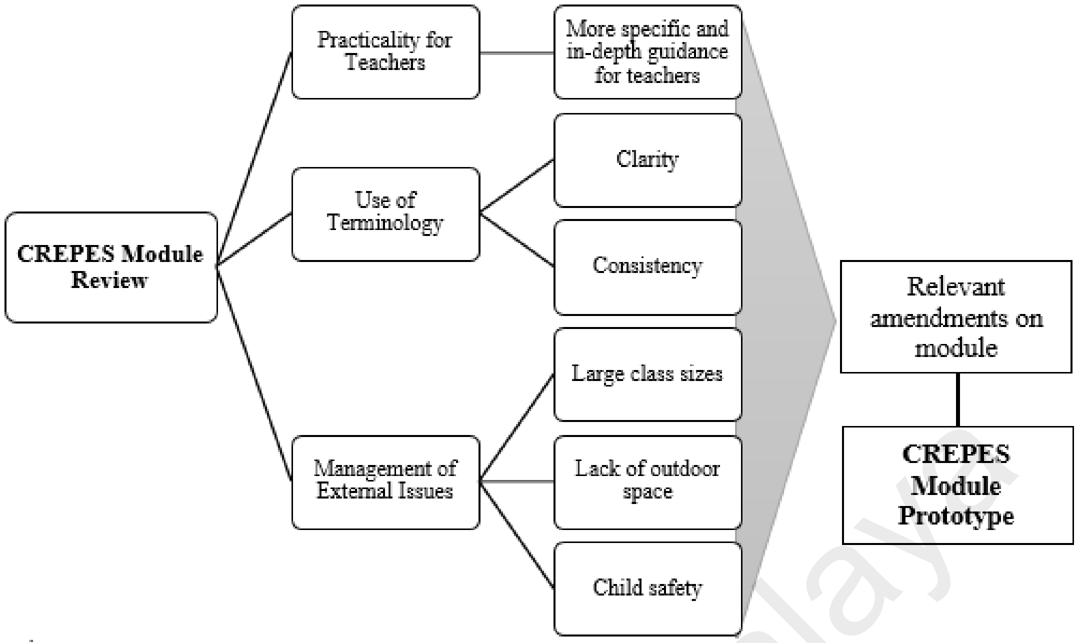


Figure 5.11. Summary of the aspects determined through module review.

Chapter Summary

This chapter presented the findings which addressed the research questions for Phase 2. The appropriate design for the CREPES module were determined according to experts' consensus through the three-round Delphi technique. After designing the initial module based on the items agreed upon by the Delphi panel, the CREPES module was reviewed by a team of experts and teachers through open-ended questionnaire and unstructured interviews. Relevant changes were made according to the suggestions made by the reviewers prior to implementing the CREPES module in the following phase. The next chapter will address findings from the last phase of the study on implementation and evaluation of the CREPES module.

Chapter 6

Findings of Phase 3: Implementation and Evaluation

Following the design and development of the CREPES module in the previous phase, the module was implemented and evaluated in this phase. This chapter outlines findings for the last phase of this study, answering the research questions regarding usability and impact of the CREPES module on preschoolers' creativity.

Two out of three research questions in this phase were on the usability of the module: 1) How is the usability of the CREPES module for teachers, and 2) How is the usability of the CREPES module for preschoolers? Meanwhile, the third research objective was to determine the impact of the module on preschoolers' creativity through the creative assessment TCAM. This addressed the third research question for this phase: 3) Is there a significant impact of the CREPES module on preschoolers' creativity?

Module Usability for Teachers

The CREPES module was designed and developed in light of the inadequate competence among preschool teachers to integrate creativity in early science. Hence, the teaching module aimed to equip and provide concrete pedagogical support for preschool teachers to be able to implement creative play activities in the early science curriculum.

After a three-week period of implementing the CREPES module, an interview session was conducted with two teachers who implemented the module, namely teacher Kat and teacher Mun (pseudonyms). The purpose of the interview was to determine how much had the CREPES module helped them in translating the suggested creative play approach into actual practice, as well as to identify challenges they encountered while implementing the module activities. Data from observations conducted throughout the period of implementation were also used as a method of triangulation to support data obtained from the interview.

Following the data collection process, data were transcribed and analysed. In line with the research objective, this section discusses the usability of the CREPES module for teachers from two distinct aspects: 1) How has the module improved practice, and 2) the challenges encountered as the module was implemented.

Improving practice. One of the prerequisites of an effective practice is teachers who are equipped with adequate knowledge, competent in various sets of skill and proper attitudes. Data collected had shown clear evidence that the implementation of CREPES module has comprehensively improved teachers' practice in general.

Creative child-centred pedagogy. First, this module enhanced teachers' skill in planning creative and open-ended early science activities. As explicitly stated by teacher Mun, the CREPES module "*broadened [her] mind in planning child-centred activities with open-ended outcomes*" (TM: 29). When asked about her views on the SEA model used in structuring the module activities, she positively claimed that the three-stage model presents a "*step-by-step procedure*" which serves as a "*guideline to achieve teaching and learning goal*" (TM: 47-48). She further affirmed that in her opinion, both the intended module outcomes had been achieved through the implementation of the module activities. She specifically mentioned that the exploration and application parts were helpful for her in terms of teaching and guiding the preschoolers in developing creative thinking.

Teacher Kat also reiterated that through the module she had learned more than the preschoolers. She highlighted that she has improved professionally as a teacher through the CREPES module, especially in terms of play, creativity development and lesson planning (TK: 8). She asserted: "*This module not only extended children's creativity, also teachers' creativity. It makes us think how to further stimulate their creativity. I really learned how to think out of the box*" (TK: 10-12).

The researcher's observations during the module implementation concurred with these findings. The module has stimulated both teachers to think of various ideas to stimulate preschoolers' creativity, lead them into exploration and application to extrapolate what they have learned into their daily lives. As the CREPES module is open-ended in nature, it does not provide rigid and exact lesson plans with detailed step-by-step procedures to follow. As a result, teachers had ample opportunities to be flexible in the planning and delivery of the module activities, hence developing their competence in creative teaching.

In the float and sink activities, teacher Mun was observed to ingeniously integrate various concrete objects to demonstrate comparisons between floating and sinking. She used several real objects for comparison including a plastic spoon versus a metal spoon; a glass container compared to a plastic container; and also an example of a floating boat versus a submarine that sinks. As these were not specifically written in the module, it shows her initiative and ingenuity in her preparation by thinking of new ideas to provoke preschoolers' creative thinking.

For the magnet maze activity, both teacher Kat and teacher Mun devised different ways to enhance preschoolers' interest in completing the maze with magnets. Teacher Kat prepared mazes with interesting cartoon figures and designs, for instance a kitten looking for its mother. Meanwhile, teacher Mun creatively added a small container which acted like a goal post at the end point of the maze in order to increase preschoolers' sense of accomplishment when they succeed in bringing their magnetic objects into the container by using a magnet.

In spite of large groups of children and insufficient resources, findings also revealed teacher Mun's creative resourcefulness in reusing and incorporating long rectangular plastic sticks into the magnet car race activity. As there were insufficient large magnets for each preschooler to hold, these sticks were inventively used as magnet wands after magnets were attached to both sides of the rectangular sticks. This idea from teacher Mun is an example of a creative teacher who successfully overcame the external limitation of resources with her own creative resourcefulness. These instances evidently revealed the CREPES module as an effective platform in stimulating teachers' creative teaching abilities.

Through the guidance of the module, it was also observed that teachers gradually improved in their skills in asking open-ended questions, which are crucial for preschoolers' creative development. Questions of this nature are rarely used in a teacher-centred setting. Hence, it was one of the emphases in the module orientation session where teachers were guided to discern the differences between open-ended and closed questions. As teachers implemented the module activities, they had shown constant attempts to involve the use of open-ended prompts and questions. Among the examples from the observations conducted are as follows:

What do you see from here? What other things?

(ACT2B: 52)

It's too heavy, think of a way to make it lighter.

(ACT3A: 21)

Now you think…how to use a magnet to move things?

(ACT5A: 10)

Which magnetic objects do you think make the nicest pattern? If tomorrow teacher let you do again, would you choose round ones, or will you pick sharp and long ones? Or small and tiny ones?

(ACT5A: 15)

Today you learned about how a magnet is used to push something and pull something. So children, besides that what did you see? What did you find out?

(ACT6B: 16)

Besides asking open-ended questions, teachers' skills in encouraging creative thinking through responding appropriately to preschoolers' answers were also found to be sharpened in the process of module implementation. Teachers were observed to be open and welcoming toward preschoolers' expression of ideas. After experimenting with various materials, teacher Kat did a recap with the preschoolers on the things that sink and float, as described in the following excerpt extracted from the observation fieldnotes:

Teacher	:	*What did you see just now?*
Child E	:	*I saw the ping pong ball floating up, because there is air inside it. [teacher listens and calls the next child]*
Child A	:	*Stone sinking down because it is heavy.*
Child M	:	*The bottle cover float because it is light! [children raising up their hands]*
Teacher	:	*See Pei (pseudonym), just now I saw you were trying with the plastic bottle with water. When you put it inside the water what happened?*
Child P	:	*When I put water inside it sink, didn't put water inside it float. Just now when I put it in, without water it will float up. Fill water it will sink.*

(ACT1B: 55-63)

Beginning with an open-ended question, teacher Kat listened and allowed different children to respond before intervening in the discussion. This stimulated different responses from preschoolers who stated the reason why certain items float and others sink without being asked specifically by the teacher. Teacher Kat then prompted and encouraged child P to respond by showing interest in child P's exploration.

In another similar instance, teacher Mun gradually led preschoolers to deeper thinking by asking open-ended questions while experimenting with several concrete objects.

Teacher	*:*	*Why do you think this plastic Tupperware float?*
Child T	*:*	*Very light.*
Teacher	*:*	*Let's find out this one. Why does this aluminium can float? Can someone tell me? Why does it float on the water?*
Child H	*:*	*Because it is light.*
Teacher	*:*	*What about this? [takes metal container with lid] Why does this float? How is it if I open? [Opens lid, and container sinks] Why?*
Child Y & J	*:*	*Water inside!*
Teacher	*:*	*How about this one? [takes glass cup and puts in water] Float and then sink. Why?*
Child Q, Z & R	*:*	*A lot of water!*
Child B	*:*	*Because it is heavy and also light.*
Teacher	*:*	*Oh! [nodded]*

(ACT1A: 34-40)

Based on the excerpt above, teacher Mun did not limit preschoolers from formulating their ideas but acknowledged their responses. Furthermore, she creatively used comparisons between various objects made of different materials to further provoke preschoolers to observe the cause-and-effect, think creatively and communicate their thoughts. This indicated that the CREPES module had provided an effective medium that stimulated teachers in formulating ideas to encourage creative thinking among preschoolers through open-ended prompts and questions.

Model of reference for a less structured curriculum. More freedom and flexibility in a curriculum imply more opportunities for creative development. The CREPES module has also acted as a model or point of reference to instill more flexibility into the preschool classroom. Through the activities, teacher Mun realised how "*traditional*" (TM: 202) she used to be in teaching and how this approach could affect preschoolers' inclination to explore. Due to being accustomed to the "traditional" approach, she drew attention to the first module activity where she, out of habit instructed the preschoolers to "*cross their legs, cross their arms and put their hands on their lap*" (TM: 202-203). Towards the end of the implementation, the researcher discerned that teacher Mun's approach became less rigid and more open in encouraging freedom to explore among preschoolers. In the last module activity, teacher Mun noted through her reflections that she "*did not give any instructions*" to the preschoolers when they explored how to move the toy car with magnets in pairs (TM: 39). Data from observation had also shown that she allowed and encouraged some preschoolers who came early to engage in free exploration with magnets before the lesson began.

Both teachers also realised that the child-centred module activities did not require teachers to focus on classroom discipline, which differs with the conventional approach. Teacher Mun further expressed her surprise at how the preschoolers were all orderly although she did not emphasise on the rules for the last module activity (TM: 62). Teacher Kat went on to note the irony between the CREPES module and the usual lesson plans: "*Normally in our lesson plans we must tell children the rules. But in this module, it seems like we don't really need to focus* [on rules]. *Plus, don't really need to demonstrate, instead let them explore. They learn more*" (TK: 65-67).

Teacher Mun described the module as "*creative and interesting*", as it "*provides a lot of contrasts and comparisons*" (TM: 17-18). She discerned and pointed out differences between the topics in the module; that float and sink activities involved generally bigger items and were more active and physical; while activities on the topic of magnets used mostly small metal items and were generally less active. She implied that the combination of activities which were different in nature was a practical introduction for teachers to increase the flexibility in their teaching and learning.

Teacher Kat described her experience of implementing the CREPES module with the metaphor of flying a kite. She stated that the module helped her learn the importance of knowing when to intervene, while at the same time allowing preschoolers the freedom to explore (TK: 10). The CREPES module has also helped teacher Kat to see the importance of providing freedom to preschoolers through child-centred activities. Teacher Kat contended that through the module activities she experienced the application of "learning through play" that she had studied about on textbooks. She realised how traditional teaching methods used in her preschool setting restrict children's learning (TK: 200). Instead of giving them precise instructions as she would normally do, teacher Kat described an instance during one of the module activities where she asked some preschoolers to arrange wooden blocks as race tracks without giving them any specific directions on how to arrange it. Upon seeing the crooked arrangement, the assistant teacher present said to the preschoolers: "*Why so crooked? Make it straight*!" (TK: 195). Teacher Kat described how it became evident to her there and then that roads must not necessarily be straight (TK: 196). She realised how much the conventional approach they have been using has entrenched their entire setting and even the teachers in rigidity by standard ways of doing things; and how easy it is for teachers to confine preschoolers within the limits of their own subjective ideas. The module activities had also enlightened her that it is unnecessary and even detrimental to children to place unreasonable limits over their learning (TK: 201).

After implementing the module activities first-hand, data collected implied that the module has brought about increased awareness among teachers that flexibility should be practised in the early childhood classroom and is more effective compared to the conventional teacher-centred approach.

Improved teacher competence. Data collected also suggested that implementation of the CREPES module led to an increase in teachers' competence, including their skills, knowledge and attitudes. As teachers allow a higher extent of freedom for preschoolers to explore through the largely child-centred module activities, findings indicated that teachers had acquired better understanding of the preschoolers. Teacher Kat maintained that the module helped her know more about her preschoolers. She also personally experienced how vast and limitless their learning capacities are as she had learned from child development textbooks. She specifically acknowledged child X's ability to figure things out even before she touched on a particular topic. She noted how she only realised child X's "*amazing*" (TK: 70) ability to come out with ideas after the module implementation: "*X was here since she was four, but I didn't realise this*" (TK: 15). It also became clear to her that it is crucial to give children the freedom to express their ideas. The implementation of the module also acted as a reflection upon her own teaching approach and its implications: "*It's like a mirror, it reflects on myself. Actually, many times it is not that they don't want to learn, it is me who is restricting their ability to learn*" (TK: 77-78).

Besides gaining enhanced knowledge about preschoolers, data had also shown evidence that the module helped teachers acquire more scientific knowledge. Despite her vast experience in teaching young children, teacher Mun openly admitted that she previously did not possess sufficient knowledge on the topic of magnets. She acknowledged the help of the module to have learned new scientific terms such as attract, repel and density (TM: 26). Besides enhancing her knowledge in early science, she further added that the module has also sharpened her "*skills in conducting creative activities*" and in developing "*positive attitude towards children's exploration*" (TM: 27). Similarly, teacher Kat admitted her limited knowledge in early science. She stressed that she learned more on the topics after implementing the six module activities, and that she "*gained more knowledge than the children, and even learned from them through their questions, ideas and imagination* (TK: 12-13).

Hence, these findings collectively asserted the role of the CREPES module as a powerful professional development tool in terms of enhancing preschool teachers' knowledge, skills and attitudes as a whole. Findings also suggested that through this short term implementation of the module, collaboration and network between both teachers were enhanced as they consistently discussed and helped each other with more ideas to implement the activities. As emphasised in the module, data also indicated that the module has guided teachers into the consistent practice of reflecting upon their own teaching and also preschoolers' learning, which would certainly help improve practice in the long run.

Challenges in implementation. Besides positive impacts, implementation of the CREPES module had also shed light on several challenges that teachers encountered in the process. These challenges led to suggestions and implications to make the CREPES module more practical in preschool settings at large.

Time limitations. One of the greatest challenges pointed out by teachers was time. This included time allocated for activity, preparation and discussion. Teachers discerned that time allocated for the module activities were insufficient due to the packed time schedules for academic learning. Sufficient time is a key factor that will enable preschoolers to engage in proper exploration, collaboration and expression of ideas. Adequate time is also required for teachers to ensure that module activities are effectively implemented according to the stages as stipulated in the SEA model.

When interviewed, teacher Mun pointed out her challenge of having insufficient time, especially for the topic of sink and float. As water was involved in these activities, more time for preparation and cleanup was required. This affected her time to conduct a proper closing during the application part of the activities (TM: 38). Due to this, teacher Mun also noted that there was insufficient time to listen to each of the preschooler's ideas one by one (TM: 47). She also emphatically emphasised that it would be a greater challenge to have time for discussion among teachers after the activities (TM: 91). She noted that discussions are especially beneficial for brainstorming and exchange of ideas, as well as boosting the morale and motivation among teachers to conduct creative play activities.

Observations indicated that limited time indirectly led to pressure and even anxiety among teachers. Both teachers were seen constantly checking the time during the activities. They also appeared to be rushing through the module activities, which were most evident at certain parts of the lesson, especially towards the end at the application part of the activity.

In relation to the time constraint, teacher Kat also pointed out that implementing these activities were exhausting for her: "*I feel like I have taught the* *whole day after I finish one lesson…takes time and energy*” (TK: 92-93). Comparing the module with the traditional workbook approach, she also highlighted the importance of proper prior preparation in order to implement effective hands-on activities, including understanding the content to deliver: “*You have to digest what is in the module to carry out in that activity*” (TK: 93). Teacher Mun echoed that: “*It is a lot of work. There is also cleaning up to do after that*” (TM: 95).

Good time management skills could help to compensate for the barrier teachers faced due to time. Nevertheless, teachers’ abilities to manage time effectively are highly dependent on their competence and practical experience. Due to time limitations, teachers may not have acquired enough exposure and guidance on the module prior to its implementation. As most parts of the module were designed to be simple to understand for teachers on their own independent study, the CREPES module orientation was conducted over a brief two-hour session. This short period of time for introduction might be insufficient for teachers to build adequate competence, understanding, and confidence in implementing the module activities.

Lack of self-efficacy. Although data showed that the module has improved teachers’ competence, teachers themselves felt a lack of competence as indicated through the interview. Even as a considerably experienced preschool teacher, teacher Mun stressed that she found the module “*very challenging*” to implement (TM: 20). She discerned the importance for teachers to have “*certain level of knowledge, skills and attitudes*” to conduct the module effectively (TM: 21-22). In response to that, teacher Kat cited her experience while carrying out one of the module activities, where she became upset with several of her preschoolers for not listening to instructions before the activity. She described that her negative emotions at that point initially affected her and made it "*hard to carry out*" the activity (TK: 84). Nevertheless, she explained that she was able to quickly adjust her temperament to continue with the activity as a reasonably experienced teacher. Hence, concurring to teacher Mun, she pointed out that teachers with less experience might not possess adequate competence to conduct child-centred activities as with those in the module (TK: 86). Teacher Mun went on to suggest that complete lesson plans with more detailed procedures could possibly help new teachers to carry out the module activities (TM: 77-78).

Teacher Kat also explained the struggle and contradiction between her own beliefs and actions as a teacher. She expressed her confusion of when to be academic and when to provide freedom for preschoolers to explore (TK: 62); when to intervene and when not to limit them in producing different ideas (TK: 64). In addition, she stated that it is "*funny*" that she herself seemed to be the one in the box, although she encouraged the preschoolers to "*think out of the box*" (TK: 66-67).

As the implementation of the creative play approach through the CREPES module was exploratory in nature and considered a new attempt in the context of study, challenges as discussed previously are bound to happen. In addition, the module activities are distinct and are on another end of the teaching and learning spectrum as compared to the usual approach practised in the setting. The researcher reasoned that challenges including time limitations and lack of competence emerged as the existing structure and teacher-centred curriculum in the setting do not adequately cater to or support flexibility in teaching. Preschool teachers are excessively acculturated to a structured system that focuses on delivering and fulfilling the prescribed syllabus, to the extent that many lose sight of the necessity for flexibility in the teaching and learning process. Again, this calls for an urgent revamp in the entire preschool curriculum to allocate sufficient time for creativity and play.

On the other hand, it is also important to note that these challenges were opportunities to train teachers by honing their skills including time and classroom management skills as they implement open-ended creative play activities. However, it is believed that preschool teachers would adapt better to using the module and the creative play approach given sufficient time for module orientation and implementation. With proper planning of the curriculum, as well as continuous support and collaboration between various preschool stakeholders, the researcher contends that these challenges could be addressed toward establishing a child-centred program with strong emphasis on play and creativity.

Module Usability for Preschoolers

The key aims of implementing the CREPES module were to enhance preschoolers' creativity through promoting their interest and motivation in early science. Investigating the usability of the CREPES module toward preschoolers helped in gauging how far has the module achieved these intended outcomes for preschoolers through its implementation.

The usability of the CREPES module for preschoolers was determined through observations of the implementation of the six module activities. Video records and fieldnotes were recorded during the module implementation which was conducted twice weekly for a period of three weeks. In addition, a semi-structured interview was also conducted with two of the teachers who were involved in implementing the module activities. Data collected were transcribed and analysed into themes to ascertain how is the usability of the CREPES module for preschoolers.

How useful and practical the module was for preschoolers during its implementation are discussed based on three themes derived from the data: 1) Hands-on exploration, 2) Formulation of ideas, and 3) Interactive partnership. Besides pointing out the positive aspects of the module, areas of weakness or concern were also identified in each theme to further improve the practicality of the module in actual preschool settings.

Hands-on exploration. Active and hands-on explorations are the best means for creative development among young preschoolers. The CREPES module has provided ample opportunities for first-hand exploration and experimentation among preschoolers. This was evident through all six activities that enabled preschoolers to actively explore together, instead of being instructed and spoon-fed by the teacher.

For instance, in the activity introducing magnetic and non-magnetic objects, all preschoolers had opportunity to experience first-hand the attraction of magnets to magnetic objects. Each holding a magnet, they independently experimented whether the items would be attracted by a magnet. This presents a stark contrast with the conventional approach where preschoolers are required to complete their workbooks on magnetic or non-magnetic objects with limited chances to experiment with a real magnet.

Multidimensional exploration and application. Through the activities, preschoolers also actively learned, explored and experimented, and most importantly put the knowledge to use. After learning about the concept behind the terms sink and float, they explored and experimented with things that could possibly sink or float in various ways. This experience was further extended by an activity of constructing a boat using recyclable materials. In order to make a boat that floats, preschoolers need to have adequate knowledge on the content area to be able to apply the principles they have learned. Some of the factors to consider include the type of materials used to make the boat sturdy and waterproof, size and structure of the boat and the weight it could hold.

Comparing the module activities with the current approach used in her setting, teacher Kat contended that the module provided new areas of hands-on exploration for the preschoolers:

> *These 6 lessons are a new exploration for children. And we really create the environment for them to actively explore and hands-on. Based on what we're doing normally, they only do that sometimes. In contrast, in these 6 lessons they do it very often. I see that they really enjoy through these explorations.*
>
> (TK: 5-8)

An authentic and engaging exploration would certainly involve trial and errors with different ways of experimenting. Despite these activities being a new experience to the preschoolers, data revealed a variety of novel ways that they used in their explorations. When experimenting whether certain objects sink or float, the preschoolers attempted different ways to explore with the materials provided. After putting an aluminium can into water and found that it floated on the surface, child X did not stop there or proceed to try other items. She pushed the can into the water to fill it with water to experiment further (ACT1B: 51). In another similar instance, child Q tested whether a metal container with lid would sink or float (ACT1A: 77). He opened the lid, put it back into water to check if it still floats. Meanwhile, some children tried to put heavier items such as rock and marbles into objects that float to see if they would sink as a result.

While working with the magnets, several children did not only use the magnets with the materials provided to determine if the items were magnetic. They further explored with familiar things around them. Child Q tested his magnet on the window sill (ACT4A: 29), whereas M tried on the sides of the table (ACT4B: 68). In another instance, several children attempted to combine a few small metal items into a structure, holding the items together with magnets.

During the magnet art activity, child J was exploring with a magnetic marble and how to move it with a magnet without directly touching the marble. He tried to put the marble on paper and moved it with magnet underneath the paper in circular motions to create patterns. Then, J put the magnetic marble on the table top. Using his left hand to hold the marble; he quickly bent over with his right hand reaching underneath the table top to try moving the marble with a magnet (ACT5B: 27-29). This showed that child J was attempting to explore if the magnet would work the same way to attract the marble when separated by the table top and a piece of paper.

It was also interesting to note how child D explored with a bar magnet and a round magnet. He placed the round magnet on the floor with its magnet facing up, and tried to move his bar magnet around in circular motions. The round magnet spun around as a result of the magnetic field in between. Child D was observing and investigating the cause-and-effect of his actions by exploring with magnets of different shapes and sizes. During the interview, teacher Kat similarly pointed out that during the magnet car race activity, the children were "*trying the magnets from different* *angles, up and at the sides. So I thought, don't you see the magnet at the back, do you have to do that? But they really had started to explore*" (TK:85-86).

Heightened interest and motivation. The various strategies preschoolers devised to interact and explore with the materials provided and the environment around them illuminated their interest in the module activities. Preschoolers' interest was most clearly revealed through their body language and responses as they explored. Their verbal and non-verbal expressions revealed their experiences of pure joy and simple sense of wonder as they engaged in exploring the world around them.

Excerpts from observations explicitly illustrated their excitement about what they have discovered through their hands-on exploration. During the activity of exploring with clay, the preschoolers responded in excitement when they found that pieces of clay could float on water. When J found a big rectangle metal container, he put his magnet near it and found that they attracted together. He immediately took it to show teacher, saying: "*See*!" after overturning and holding it high (ACT4A: 28-30). In another instance, it was the preschoolers' first lesson on magnets. Child X was experimenting with two magnets. When she found out that they attract after being put together, she shared with her group members in a high-pitched voice by putting both magnets together: "Look, both of my magnets stick together! Look I have two magnets! Look! Look!" (ACT4B: 69-71). Teacher Kat echoed a similar observation where preschoolers explored with magnets: "*I saw that they had this reaction: 'oh! This is push and pull!'*" (TK: 85). Child J was amazed when he observed how a magnetic item could be moved using a magnet without any direct contact with it. He expressed his excitement to R sitting next to him, while saying: "*It's moving! It's really following [the magnet] and moving when you put something below*!" (ACT4B: 73).

In relation to preschoolers' interest with the module activities, both teachers agreed that the preschoolers looked forward to each activity (TK: 33; TM: 8). Teacher Mun highlighted:

> *For my class, I realise that they look forward to these lessons. This morning, when they realised that the magnets will attract and repel, they quickly showed it to me. Then they realize one magnet will attract to another one, they will try to use two magnets together…it motivates the child indirectly to explore more.*
>
> (TM: 8-10)

Improved focus and persistence. Data also revealed that the CREPES module motivated preschoolers to engage with and focus on the explorations. Preschoolers were observed to be absorbed in their tasks and persistent in solving problems. Child L broke his piece of clay into a smaller piece, puts into water; saying: "Sink again?" when it sinked. He continued to break the clay into smaller and smaller pieces. As he continued to observe, he discovered that some tiny pieces of clay floated. He exclaimed while pointing, "Eh? Float!" (ACT2A: 30-32). In the same activity, child Y was trying to make her clay float by reshaping her structure into different shapes for several times. She first made a flattened structure and tried it in water. When her clay sinked, she remade it again by pressing, kneading and flipping it one time after another. She then started to reshape her clay from a small rounded thick structure into a flatter one. She again tried to put it into water, but it sinked. She continued trying to fold up the sides of her clay into a longer rugby-shaped structure. She showed the researcher, then put it into the water; but it still sinked. She immediately turned back to her table and kept trying to reshape the sides of her structure. Again, she put her structure into the water and it floated for around five seconds before sinking. She took her structure out of water, continued trying to modify the shape of her clay till time was up (ACPT2A: 39-47).

Another excerpt illustrated how a child did not give up easily even when encountering a problem. Child R was preparing to race the boat she constructed. Her boat was made using a rectangle plastic food container, with an orange juice carton taped vertically in the middle. R was the last one to race her boat in her group. She put her boat in the water and tried to blow it. As she was blowing directly on the juice carton, the boat lost balance and fell on its side. Other children who were standing around to watch started laughing. R tried to hold the boat up again with two hands to stabilize it. She tried to blow and move the boat again. Teacher Mun noticed and said, "Never mind, a good try". Yet R remained squatted at her position, looking at her boat. The taped parts of her boat were detached and water had gone into her boat. Another child said, "It's leaking!". Teacher Mun asked the children to prepare for the next round of race. However, R was not affected by the distractions around her. She neither looked at her teacher nor her friends. She stayed put as she tried to put the parts of her boat together again (ACT3A: 33-42).

Interview with teachers also reinforced the persistence and concentration preschoolers displayed in the module activities. Teacher Mun pointed out that, "*so far I assigned so many tasks, I think they have completed them well. They really focused*" (TM: 36). She also cited the example of how the children tried their best to finish the car race using magnets by reaching to the flag, despite some having difficulties moving the car (TM: 35). Teacher Kat agreed with Teacher Mun, and noted that the preschoolers were "*on track after these six lessons*" (TK: 31). She pointed out that the preschoolers' concentration was better in the module activities compared to their normal lessons. She added that they could focus better if time for the activities were to be extended.

Disoriented without instructions. Besides the positive aspects observed in the implementation of the module activities, data has also indicated that several preschoolers were less able to carry out the explorations independently. They required extra guidance from adults, without which they became disoriented. This was supported by observations conducted.

As the class was making art by using magnets, one group of preschoolers were unsure of what to do. They waited and played around with their materials aimlessly, although instructions had been given to them to start exploring how to create art patterns using magnets. Child C was observed telling her group mates with a frown on her face, "*No teacher is teaching us how to do! We can't do it*" (ACT5B: 25). Her friend Y replied in a bitter and disappointed tone, "*They all (the rest of the groups) can do it so fast*" (ACT5B: 26). Only after a teacher told them that the magnet should be at the bottom did they start to do the activity by themselves. When time was up, C complained loudly, "*See! No more time*!" (ACT5B: 39). This implied that some preschoolers had not adapted to the free exploration approach. This could be due to the system that they are accustomed to, where instructions were given by teachers all the time without requiring them to think and explore in open-ended ways. Thus, open-ended activities without standard ways of doing things could have caused a certain extent of frustration and uncertainty among the preschoolers.

As such, some of the preschoolers resorted to purposeless play with little cognitive awareness of what they were doing and its relation with science concepts. While exploring with clay in relation to sink and float, some preschoolers were observed to be merely playing and making random things with clay, instead of experimenting with ways to make it float. This resonated with teacher Kat's statement, where she expressed that the children "*sometimes want to play rather than focus [on their task]*" (TK: 30). Despite positively acknowledging preschoolers' focus on the activities, teacher Mun reasoned that their concentration was affected by several factors. She highlighted their dependence on "*clear instructions about what they should do, and what they shouldn't.*" (TM: 36). She emphasised the importance to set a certain limit and relevant pointers for preschoolers' exploration, giving the example of the magnet art activity where she told them that they "*can't make the magnets dirty*" (TM: 37). She added that factors such as time allocation and peers around them could influence how much they focus on the activities.

External limitations. Moreover, the researcher's observations found that external factors in the physical environment also affected how long preschoolers could sustain in their hands-on explorations. Limitations in the physical environment especially space, time and resources available could restrict preschoolers from exploring fully and creatively. For the boat construction activity, having a large children's pool or outdoor space for boat race would have been ideal and most conducive for preschoolers involved to observe how well their boats could function on water. It also would have stimulated and allowed more meaningful explorations among preschoolers, especially in light of the large number of children. However, only two medium-sized storage boxes were used for two classes of more than 30 preschoolers. Furthermore, time provided for each child to test out their boat on water was also extremely limited due to the large number of children. As the setting had no outdoor space, the activity was conducted in a central hall area with children and adults consistently passing by. Distractions from the environment could have affected preschoolers' focus in their creative exploration to a certain extent. Given more time, sufficient resources and access to a larger or outdoor space with lesser distractions; it is believed that the module could have better impact on preschoolers.

To summarise, data have indicated that the CREPES module enabled preschoolers to actively explore and apply what they have learned, while developing their creativity. This opportunity to explore first-hand elicited more interest in early science among preschoolers. Through the module activities, they were also able to show greater focus on their explorations at hand; and not give up easily when they encounter problems but rather persist to solve them.

On the flipside, it was also revealed that some preschoolers were still adjusting to the open-ended nature and independent explorations of the module activities. Without appropriate and consistent guidance from teachers, they seemed to be disoriented and lose their focus on the task at hand. Nevertheless, this could be overcome by appropriate guidance and intervention by teachers. Given a longer period of time with sufficient support from adults, it is believed preschoolers would be able to adapt better to the creative play approach and to explore in infinite and open-ended ways.

Formulation of ideas. Data collected showed that the CREPES module also provided avenues for preschoolers to formulate and express their ideas. The module emphasised the important role of open-ended questions in stimulating preschoolers' creativity. As teachers practised posing open-ended questions through the implementation of module activities, the preschoolers responded with expressions of their ideas, which is in itself a trait of creative expression.

In this current study, creativity is defined as encompassing three dimensions. This includes 1) fluency (formulation of many ideas); 2) originality (uniqueness of the ideas produced); and 3) imagination (exercising imagination to produce ideas). All three dimensions were closely related to the formulation of ideas. This section explicates in detail how data collected exhibit the formulation of ideas among preschoolers.

Improved quantity and quality of formulated ideas. The module activities, along with teachers' continuous stimulation had provoked preschoolers to produce many different ideas. Following the SEA model to conduct the activity, teacher Kat began by stimulating the preschoolers with the question: "*What are the things you think will float*?" (ACT1B: 20) in the first activity. The preschoolers were keen to contribute their ideas based on their prior experiences. They raised their hands and answered with the objects they predicted will float, such as leaf, stick and paper (ACT1B:30).

Not only did the preschoolers produce a variety of ideas, some of their ideas were new, unique and unconventional. Preschoolers had produced unique ideas by using different materials to form intricate parts of the boat. One group also used straws as "propellers" of the boat they constructed. When asked, child X explained that its function was to "*move the boat*" (ACT3B: 83). Other groups used bottle caps at both sides of their boat, and some even constructed small parts including a television and driver's seat in designing their boats. In relation to this, teacher Mun echoed the unique ideas formulated by preschoolers in her class. She stated how child T made a tall sail for his boat with two pieces of polystyrene containers attached to straws, and also a child who thought of the idea to cut a line in the middle of his water bottle boat in order to make a sail and insert other objects into it (TM: 23).

Another explicit example saw how a particular child, X had the idea to use a common household unwanted item, i.e. empty egg shells to construct a boat. She prepared the egg shells at home before the activity and brought them to school for the activity. This suggested that child X had intentionally thought about what she wanted to use to make a boat, and how could the egg shells help her in constructing a boat. It also indicated the quality of this idea, considering that no child or even adults expected egg shells to be involved in boat construction. Moreover, this specific idea was out of the box and could be considered creative as it stood out from all the other ordinary recyclable materials. Teacher Kat related that X told her before the activity: "*I want to use these eggs to make a boat*" (TK: 21). She added that X already explored the materials beforehand at home; and told her that even when something was put into the shells, they could still float and did not sink. This may imply the motivation of child X in self-initiating further exploration at home. The egg shells were ultimately used on each side of the boat, which according to the child were the lights for the boat (TK: 22).

Other than using their ideas to invent and construct, data also showed that preschoolers produced ideas to solve problems in the creative play activities. As teacher Mun stimulated the preschoolers' thinking by asking them how to make a glass container that contains water float, they formulated ideas to attempt to solve the problem. Child A's solution was to add more water into the water tub. However, when teacher Mun demonstrated by adding more water into the tub, the glass container still sinked. Child B then produced the idea of emptying the water in the glass container (ACT3A: 13-16), which successfully made the container float.

In their attempts to make clay float, the preschoolers exploring with different ways and structures to make it float. Their ideas included breaking the clay into smaller pieces, flattening it like "*roti canai*" (ACPT2A: 34), making it like a bottle cap (ACPT2B: 56), and into different shapes such as snowman (ACPT2B: 57), pizza (ACPT2A: 35) and shark (ACPT2A: 37). In another instance, child H was initially observed to be flattening and widening her clay. When she found that the structure could not float, she quickly modified her idea by folding up the sides of her structure into a rectangular shaped boat. As she tested it in the water, it floated for around two seconds and then sinked. This observation illustrated child H's flexibility to refine her idea to solve the problem.

In addition, teacher Mun noted her observation during the magnet car race. She pointed out how some preschoolers had the idea of "*blocking the sides of the magnet to move the car when they realised that the force is strong at the sides of the magnets*" (TM: 86-87). Flexibility in modifying an idea is one of the dimensions in the framework of creative process by Torrance (1964, as cited in Isbell & Raines, 2013), although not specifically in the scope of this current research. Hence, the researcher maintained that as preschoolers formulate different ideas and flexibly refine them to solve problems, they were indirectly developing their creativity.

Inference and hypothesis formulation. Besides expressing ideas, it was observed that the module also provided preschoolers with opportunities to make inferences and hypotheses. Making inferences and predictions are science process skills as established in the NPSC. As preschoolers made predictions and inferences, they were indirectly developing their science process skills as well as creativity. Among the hypotheses and inferences preschoolers made on the reasons they predict certain things would sink or float are as shown in Table 6.1.

Table 6.1

Preschoolers' Formulation of Hypotheses and Inferences

Prediction of items that float/ sink		**Reasons**
Float	Leaf	"Because it is not heavy"
	Stick	-
	Paper	"Because it is light"
Sink	Water bottle (with water)	"Because fill a lot of water will sink it down"
	Rock	"Rock is weight" (gestured with palms downward)

(ACPT1B: 30-33)

After experimenting with the objects, the preschoolers also attempted to make inferences when asked to think about why certain things sink and others float. While a majority of preschoolers related an object's weight to whether it sinks or floats, Child N articulated a different perspective of why a golf ball sinks, as "*the water is very full*" (ACPT1A: 45); whereas child J expressed his idea that a ping pong ball floats as "*there is air inside*" (ACPT1B: 56).

During the activities for the topic of magnets, preschoolers similarly showed their ability to make inferences. Teacher Kat was demonstrating how a magnet attracts certain items. She randomly picked a pipe cleaner and asked the preschoolers to predict if it would be attracted by a magnet. When it was attracted by the magnet in contrast to what they had predicted, child B and M started to make inferences as to why it was attracted. Both of their inferences were in agreement, i.e. there is metal wire inside the pipe cleaner (ACT4B: 65). During the interactive discussion session, teacher Kat asked child M why did he think a whiteboard is attracted by a magnet. M reasoned that whiteboard is made of steel. As teacher Kat added that not everything made of metal is necessarily magnetic, M went on to elaborate his idea: "*Some things look like metal but magnet can't attract*" (ACT4B: 57). Child M's responses concurred to what Torrance termed as "elaboration" in describing the process of creative thinking (1964, as cited in Isbell & Raines, 2013), which denotes the ability to extend and expand on an idea.

Some of the inferences preschoolers made might not be fully accurate in scientific terms. However, preschoolers' keen responses and attempts to express their ideas were encouraging and should be welcomed by teachers regardless of its accuracy. Since preschoolers' acquisition of scientific content knowledge was not measured and explored specifically in this study, their responses were considered in light of creativity rather than evaluating and comparing their ideas against scientific principles or facts.

As this research study focuses on creativity, specifically in terms of formulation of ideas and imagination, every idea produced by preschoolers is noteworthy. Child X especially, was an evident example. Besides producing a unique idea of using egg shells to construct a boat, it is interesting to also draw attention to how X connected two of the topics covered in the CREPES module without being guided by the teacher. As teacher Kat was still introducing the topic of magnets through discussion with the preschoolers, X raised her hand to point out that: "*Magnets are heavy, they will sink into water*" (ACT4B: 59). Throughout the observations conducted, the researcher only discovered one instance where a preschooler expressed her idea by linking the current topic with a previously learned topic, or her prior learning experiences. When interviewed, teacher Kat likewise acknowledged child X's strength in formulating ideas. Teacher Kat specifically commended X for being "*outstanding*" and having ideas that "*amazed*" her (TK: 13).

Less keen and capable in idea production. On the other hand, despite these evidence shown in the data, it should also be acknowledged that not every preschooler had participated actively in the process of formulating ideas. Some preschoolers were less keen in expressing and sharing their ideas openly, they remained quiet and only responded when requested by the teacher. In the activities, teacher Mun attempted to involve all preschoolers in predicting and making inferences. She required them to respond to questions one by one such as why a certain object floats or sinks. While all of them could give a prediction as to whether an object floats or sinks, it was observed that only a few were able to further extend their ideas by explaining the reason behind their predictions.

When interviewed, teacher Mun noted of the possible language barrier among preschoolers that could have led to their difficulty in answering questions she posed. Nevertheless, she added that some preschoolers still attempted to answer through gestures (TM: 4). She supported her statement with an example of question she posed to the preschoolers during the "Apply" stage based on the SEA model: "What can we do with magnets?". While a number of preschoolers responded with answers such as using a magnet to pick up keys and magnets attracting one another, she found that some preschoolers were unprepared or unable to answer. A possible reason she suggested was that open-ended questions were considerably new to them: "*normally we don't ask all these [questions]*" (TM: 82).

Furthermore, data indicated that some preschoolers lacked their own original ideas. This was most evident when the preschoolers were exploring how to make clay float. After child R found that her clay floated when broken into tiny pieces, other preschoolers imitated in the same way and exclaimed that their clay had also floated (ACT2B: 59). In another instance, when the preschoolers were exploring with clay, child E was aimlessly looking around at her peers of the same group. She did not seem to have an idea of what kind of structure to make with her piece of clay. When she saw how her friend C constructed her structure, she imitated by making it into a similar design which was a long boat-like structure with the sides folded up (ACT2A: 40). Most ideas given by preschoolers were also similar as they tend to imitate one another. Likewise, teacher Mun reiterated that preschoolers who are "*not ready will observe and follow others*" (TM: 16). For instance, the most common inference preschoolers made as to why an object floats was that it is light and vice versa; whereas the most frequent reason given on why an object is attracted to magnet was that it is made of steel or metal.

There were also several instances where preschoolers were less capable to formulate ideas in order to solve problems. During the boat construction activity, child H tried to make a sail for his boat with a disposable food container and a straw. As the food container was too heavy for the straw, his sail could not balance. Despite his persistence in trying to balance it, he could not seem to come out with ideas or modify his existing idea to solve his problem. When it was time for the boat race, with a frown on his face, he held his boat helplessly and told the teacher, saying: "*Cannot*" (ACT3A: 23).

Nevertheless, data collected indicated the impact of the CREPES module in enhancing preschoolers' formulation of ideas, in terms of both quantity (fluency) and quality (originality). Besides that, in light of the data analysis, the researcher proposes that creative thinking also involves the confident expression of ideas, and making relevant connection or linkages between ideas. Moreover, the module has stimulated preschoolers to produce ideas, also to modify and refine them (flexibility), as well as elaborating and extending those ideas by making inferences and hypotheses (elaboration).

Although data also showed that some preschoolers were less confident or capable to produce ideas while exploring, teacher Mun suggested using "*stimulation*" (TM: 18) to guide these preschoolers in formulating ideas. She stressed that preschoolers would be able to formulate ideas eventually with proper stimulation and encouragement. It is believed that with appropriate adult intervention and support, coupled with consistent provision of opportunities to formulate ideas in learning; preschoolers would eventually improve in their ability of idea formulation and application.

As pointed out by teacher Mun, the CREPES module also enabled preschoolers to "*internalise the science knowledge without teaching them*" (TM: 72). Besides the internalisation of science content knowledge, data has also revealed evidence on the development of science process skills among preschoolers. Through the module activities, they had ample opportunities to make predictions and inferences. Indirectly, they also develop and strengthen their abilities to observe, classify and communicate. For instance, preschoolers observed and classified things that sink and float, as well as magnetic and non-magnetic things. They also learned to communicate and express their ideas during the creative play module activities. The following theme will discuss more in depth about the role of the CREPES module in developing preschoolers' communication skills within a social context in relation to their creativity.

Interactive partnership. Throughout the implementation of the CREPES module, the preschoolers had shown close collaboration with one another. The module activities were conducted in groups ranging from two to five preschoolers per group. As they work together, preschoolers exchange ideas with each other and stimulate more idea formulation, which is a part of the creative development process.

Enhanced teamwork and social interaction. Data revealed various evidence of preschoolers working together as a team while they engaged in group activities. While exploring with clay, child E did not seem to be working toward an idea. She turned and watched as her friend C, who was next to her working on her structure. Upon noticing that, child C was observed to immediately stopped what she was doing and helped E with her clay by folding up the sides. After that, she even helped to put her friend's clay into the water to test whether it would float (ACPT2A: 42). Although each preschooler was given a piece of their own clay, child C played her role as a part of the group to help her group member.

Data collected clearly revealed preschoolers' team spirit, especially during the magnet car race activity. As each child moved and raced their toy cars using magnets, others started to cheer together loudly for their friends. When it was child T's turn to race, his friends C and Y followed right behind him through the race to cheer and support him. When child T managed to move his car to the finishing point, his friends C and Y jumped up and shouted "*yay*" together with T (ACT6A: 12). Similarly, child E and P also stood at the side to support their friends. They cheered "*Faster! faster*!" for their classmates and also showed them how to move their cars in the right way (ACT6B: 47). These evidence suggested that the module activities stimulated preschoolers to interact socially with each other, hence honing their social skills.

Meaningful discussions. Data has also indicated that the CREPES module stimulated meaningful exchange of ideas among preschoolers. These discussions enabled preschoolers to learn from each other's ideas, and stimulate deeper learning as well as further idea formulation among them. A teacher's role is important to initiate two-way, interactive discussions and conversations with preschoolers through questions or demonstrations. When teacher Kat asked the class to think of objects that will sink, child X raised her hand and expressed her idea that a plastic water bottle would sink. Upon hearing child X's answer, child M quickly refuted that opinion; while child S interrupted: "*It should float on water*" as he gestured by holding his arm above the head. Child X then responded by an explanation on her earlier prediction: "*With water it will sink*" (ACPT1B: 69-71). Interactive and meaningful discussions as shown through the data collected provoked preschoolers to think and come out with valuable ideas within their social context, which helped in developing their creativity.

Another observation showed a child-initiated conversation that took place during the preschoolers' exploration. Child R shared her idea to structure her clay into the shape of a snowman to make it float with her friends. One of her friends, child A responded by saying: "*Snowman is heavy*" (ACPT2B: 57). When another child, B suggested again that they should try to make a snowman with clay, child R disagreed: "*Snowman cannot, it will sink. It's heavy, it's fat*" (ACPT2B: 58). This excerpt suggested how child R quickly modified her idea after communicating her idea with her peers.

An excerpt from the data collected clearly indicated how one of the module activities prompted preschoolers to discuss and communicate their ideas among themselves. During the boat construction activity, the preschoolers were discussing about the design of their boats after they completed building their boats with recyclable materials. As they were trying their boats on water, child L told his friend J:

> *L : The boat is leaking!*
> *J : Look at mine!*
> *L : Water didn't get into your boat?*
> *J : Because…*[*inaudible due to background noise, as J shows his boat to L*]
> *L : Mine is very heavy…*

The conversation between L and J were indirectly encouraging both preschoolers to formulate and exchange their ideas about boat construction as they learned from each other.

In the interview, Teacher Mun concurred that the module was "*not only active, also interactive*" as there were ample "*interactive sessions, Q&A and discussions*" (TM: 4-5). With respect to preschoolers being in groups, she emphasised: "*It is good because they talk to each other. When they explore, they discuss*" (TM: 36).

Inadequate group coordination skills. On the other hand, however, data also indicated frustration of several preschoolers as they worked in a group. Child K looked upset and expressed her anger as her group members were manipulating the magnet maze activity. She did not get sufficient chances to try the activity compared unlike her group members (ACT5B: 29). In another instance, during the magnet art activity, child C was trying to move a magnetic object while other children helped to hold the cardboard. When another child E attempted to try with another object simultaneously on the cardboard, child C expressed her dissatisfaction and unwillingness to share through her body language (ACT6A: 32). These underline the importance of establishing clear boundaries to the activities. Episodes of frustration could also have happened when there is insufficient explanation on the activity. However, teachers should intervene only when necessary to allow preschoolers to learn social skills as they deal with conflicts among themselves independently.

According to teacher Kat, her preschoolers lacked awareness on the need to work together as a group in the beginning of the module implementation. Teacher Kat claimed that even the assigned group leaders were less aware of their roles to initiate discussion with the rest of the group, that she had to keep reminding them of their responsibilities (TK: 71). She also pointed out the problems she noticed when preschoolers worked in groups: "*If one [child] gives up easily, another one will do the same. And some others are not willing to share*" (TK: 37-38). In contrast, at the end of the module implementation, teacher Kat stated how the preschoolers "*slowly started to be more motivated and become less easy to give up [when in groups]*" (TK: 39). She also positively recognised that the module activities "*stirred them to work together*" (TK: 46). Referring to the magnet car race and how the preschoolers cheered loudly as a team, she added: "*I find that they really work together, and as I stand at the side to watch, in my heart I really felt touched*" (TK: 48-49). Likewise, teacher Mun also specifically highlighted the preschoolers' teamwork when they were racing their toy cars. She was certain that they worked in a group: "*Whether two, three, or four in a group, or one entire group; they are one group, they work as a team. Look at how they race…their team spirit is not bad*" (TM: 43-44).

As six years old preschoolers might not yet have adequate competence to efficiently coordinate themselves in a group especially in the beginning stages, it would be helpful for teachers to emphasise, and even set the sequence of turn-taking between the preschoolers. This strategy was suggested and applied by teacher Mun in the magnet maze activity (ACT5A: 30). The researcher found the strategy of turn-taking effective as the preschoolers were able to work well in their groups and had equal opportunities to explore and engage in the activities together. Teacher Mun pointed out that at the end of the module implementation, the preschoolers had learned how to take turns indirectly through the activities (TM: 56). As preschoolers in the research context might not be accustomed to cooperative play activities; the researcher contends that with proper management strategies, reinforcement and sufficient support from teachers, preschoolers would develop increasing collaboration to work better in a group.

In a nutshell, the module activities enhanced preschoolers' abilities to cooperate and form mutual partnership with each other while working as a group. Data also affirmed the role of the CREPES module in providing opportunities for social and more in-depth learning among preschoolers through interactive exchange of ideas. As preschoolers discuss their ideas with each other, they are developing their communication skills which is one of the science process skills as established in the Malaysian preschool curriculum.

Summary. Despite the CREPES module being a module on early science, data analysis showed that it has played its role as an interdisciplinary module—where its focus is not only restricted to developing scientific content knowledge, but enhancing holistic development among preschoolers. Not only did the module enhance the development of social skills among preschoolers, their physical skills were also sharpened. In addition, teacher Mun highlighted how the module helped preschoolers in their language. She cited several examples of new vocabulary preschoolers learned, such as "*magnetic*", "*non-magnetic*", "*sinking object*" (TM: 54). Both teachers also agreed that the magnet song included in the module has helped preschoolers remember the function of a magnet better such as "*push and pull*" (TK: 83, TM: 84). Teacher Kat stressed that the module has also encouraged the use of music and movement with her preschoolers (TK: 59). This implies that the CREPES module is in line with NPSC which focuses on developing holistically through stimulating creative and critical thinking.

Besides encouraging preschoolers' active involvement throughout an activity, teacher Kat also noted that preschoolers had been very keen to help whether in preparing the materials and cleaning up (TK: 60). This could be supported by an excerpt where three preschoolers initiated to put the wooden blocks which were used to mark the race tracks back into the container. Together, they carried the container of blocks back to the classroom without being instructed by teacher (ACT6B: 67). Another instance from the data showed how child E took a piece of cloth and started to help teacher Kat who was wiping the table without being asked after a module activity (ACT5B: 29). Preschoolers' participation in helping teachers also fosters good moral values while indirectly heightening their self-esteem.

Pertaining to the focus of this research which is on creativity, data collected has consistently indicated creative behaviours among preschoolers, in line with Torrance's indicators of creative strengths (1977, as cited in Torrance, 2004). Some of these traits include generating unique ideas, making invention from common materials, motivation and persistence in exploring, and the ability to work together in a group. Based on data collected as a whole, it is adequate to establish that the CREPES module has helped foster preschoolers' creativity, which implied achievement of its intended outcomes.

Therefore, evidence from data collected had demonstrated and reinforced the potential of the CREPES module toward preschoolers' holistic development; as well as empowered preschoolers to learn science through active hands-on explorations by enhancing their interest and motivation, ability to formulate ideas, and to work together effectively as a group. With appropriate guidance from adults and sufficient time allocated for these activities, it is believed that the module could be an effective medium to help preschoolers achieve greater heights in their creativity development and learning as a whole. Overall, the CREPES module is in accordance to the NPSC (Ministry of Education, 2017), which emphasises on the role of play as an effective medium for preschoolers' optimal development, and creative thinking as one of the intended outcomes for early science learning.

It is important to note that this module does not, in a vacuum act as a panacea toward a more flexible and child-centred program. More effort must be put into implementing creative play in actual practice in the diverse field of Malaysian ECE. Nevertheless, in relation to the issues identified in the needs analysis phase, this exploratory implementation of the CREPES module had evidently helped in bridging the gap between the current practice and the ideal practice. Table 6.2 delineates how the CREPES module has helped in improving practice and addressing the areas of needs found in early science teaching and learning in the context of study.

Table 6.2

Role of the CREPES Module in Addressing Identified Needs from Phase 1

Identified Needs from Phase 1	Role of CREPES
Flexibility in early science teaching and learning	Module does not provide rigid step-by-step procedures to follow, rather loosely structured yet sufficient guidance for teachers to implement suggested activities according to preschoolers' interests, needs and available resources. All module activities are open-ended and allow preschoolers to freely explore and experiment with a variety of materials.

Table 6.2 *(continued)*

Holistic integration of early science with other domains toward development of creativity	Module provided STEAM activities integrated with art, physical, social and mathematics towards holistic and creative development among preschoolers. Creativity development is supported by the SEA model and open-ended questions.
Quality teacher training on early science	Module acted as a concrete instructional support tool that guides teachers to incorporate creativity into early science through creative play activities.

Module Impact on Preschoolers' Creativity

In addition to the qualitative findings as previously explicated, this section presents the data collected to quantitatively measure the impact of the CREPES module on preschoolers' creativity. This was done through conducting a quasi-experimental study. Quasi-experimental design was selected because random assignment of groups was inconvenient in the preschool settings involved, thus existing classes were designated as two different groups. This minimised disruption to the existing operation of the preschool settings. Using intact groups also ensured preschoolers' familiarity to the environment of study. With reduced anxiety and stress, they could participate naturally and perform better in the study with minimal impact from adverse testing effects.

The independent variable in this study was the program, which had two levels: the conventional science teaching approach (control group) and the CREPES module intervention (experimental group). Meanwhile, the dependent variable was creativity scores of preschoolers which was measured before and after intervention (pretest and posttest).

Since the pretest score of these two groups were statistically different, therefore to evaluate the differences between post-test score of creativity, analysis of covariance (ANCOVA) was used. A one-way ANCOVA was conducted with a total of 56 preschoolers (n = 56) in order to ascertain whether there are any significant differences in the posttest creativity scores among preschoolers between the control (n = 27) and experimental groups (n = 29), after controlling for differences between both groups in the pretest scores. Before conducting the ANCOVA, several assumptions were checked. They included independence of observations, normal distribution of the dependent variable, homogeneity of variances, linear relationships between the covariate and the dependent variable, and the homogeneity of regression slopes.

Preschoolers' creativity scores were obtained by administering Torrance's "Thinking Creatively in Action and Movement" (TCAM). The TCAM is a measure of creativity that is individually administered; yielding scores for three subscales of creativity, namely fluency, originality, and imagination. However, the overall creativity score would take precedence in this study compared to the subscales. The overall score is more reliable and valid, as preschoolers may differ in the distribution of creativity on different occasions (Torrance, 1981). For instance, a child may be more energetic while doing the first activity compared to the last activity while being tested. Preschoolers' relatively short attention spans and other external factors such as distractions around the environment could also affect their responses in different activities of the TCAM.

Nonetheless, results for each subscale are presented subsequently following the overall TCAM creativity score.

Overall creativity score. The overall TCAM score denotes the average scores of all three subscales of the assessment. It reflects the impact of the CREPES module towards preschoolers' creativity. A preliminary analysis including Levene's test and normality test indicated that all assumptions were met. When the pretest average creativity score was included in the model as a covariate, result from Levene's test was not significant, indicating that the variances across both groups were equal, $F_{(1, 54)} = 0.02$, $p = 0.90$. This shows that the assumption of homogeneity of variance was not violated. The assumption of homogeneity of regression slopes has also been met, indicating that the interaction between pretest scores (covariate) and programme (independent variable) was not significant, $F_{(1, 52)} = 1.30$, $p = 0.26$.

Findings of ANCOVA indicated that after controlling for the effect of pretest, a significant difference was found in preschoolers' posttest average creativity scores between the experimental and control groups, $F_{(1,53)} = 5.23$, $p = 0.03$, partial eta² = 0.09 (Table 6.3). The effect size of the module was found to be moderate, Cohen's *d* = 0.63.

Table 6.3

The Summary of ANCOVA for Overall Creativity Score by Program

	df	Mean Square	*F*	*p*	eta²
Pretest	1	7443.49	34.66	.00*	.40
Program	1	1122.05	5.23	.03*	.09
Error	53	214.74			

$^{*}p < .05$

Table 6.4 presents the means of overall creativity scores for both groups before and after controlling for pretest differences. These findings established that preschoolers in the experimental group who had participated in the CREPES module activities scored significantly higher in their average TCAM posttest score compared to the control group. In terms of percentage, adjusted creativity posttest mean scores among preschoolers in the experimental group were 10% higher than that of the control group. Hence, this indicates that implementation of the CREPES module was effective in developing creativity among six year-old preschoolers in the research context.

Table 6.4

Overall Creativity Scores for Experimental and Control Groups

	Experimental group (n = 29)			**Control group (n = 27)**		
	M	*SD*	*Adjusted M*[a]	*Mean*	*SD*	*Adjusted M*[b]
Average Pre	110.31	17.03		92.81	12.80	
Average Post	120.03	20.55	113.49	96.07	16.40	103.10

[a,b] Mean scores after controlling for the effect of pretest.

Creativity subscale score. This section specifically presents the ANCOVA results for three TCAM subscales of creativity, which include fluency, originality, and imagination. Specifically in context of the TCAM, fluency measures the number of ideas produced by preschoolers; originality denotes how unique and new the ideas are; whereas imagination has to do with the ability to imagine, imitate, engage in fantasies and role-plays.

For fluency score, all assumptions were met after being checked accordingly prior to conducting the ANCOVA. Findings from Levene's test indicated no significant difference between variances between groups, $F_{(1,54)} = 0.007$, $p = 0.93$. In addition, the assumption of homogeneity of regression slopes was also met, $F_{(1,52)} = 1.06$ $p = 0.31$. Findings revealed no significant impact of program on the fluency score of preschoolers in their posttest after differences in pretest scores were controlled, $F_{(1,53)} = 3.14$, $p = 0.08$, partial eta² = 0.06 (Table 6.5).

Likewise, for originality score all assumptions were fulfilled. Assumption of homogeneity of variance was not violated, $F_{(1,54)} = 0.03$, $p = 0.86$; whereas no significant difference was found in the interaction between the covariate and independent variable, $F_{(1,52)} = 2.46$, $p = 0.12$. ANCOVA results indicated a significant difference in the effect of the CREPES module on preschoolers' TCAM posttest originality scores, $F_{(1,53)} = 7.73$, $p = 0.01$, partial eta² = 0.13 (Table 6.5). Effect size was moderate, almost large; as reflected from the value of Cohen's $d = 0.77$. Hence, the experimental group performed significantly higher in their TCAM originality posttest score in comparison to the control group. The CREPES module was effective in enhancing preschoolers' ability to formulate unique and original ideas.

Furthermore, the result of the ANCOVA showed that there was a significant difference in the TCAM imagination scores between the two groups: $F(1, 53) = 6.70$, $p = 0.02$, partial eta² = 0.21 (Table 6.5). The partial eta² value implies a large effect of the CREPES module, Cohen's $d = 1.03$. Despite the identified significant difference between groups, it is important to note that the assumption of homogeneity of regression slopes was violated for this subscale, as a significant interaction was found between the covariate and independent variable, $F_{(1,52)} = 4.28$, $p = 0.044$. Since the p

value is close to the threshold of p = 0.05, it was considered negligible but acknowledged as a limitation for this evaluation. Nevertheless, all other assumptions required to conduct an ANCOVA were met. Moreover, as previously established, the overall creativity score would be the emphasis in evaluating the impact of the CREPES module. Hence, a significant impact could still be implied in the imagination score for the experimental group compared to its counterpart.

Table 6.5 presents the ANCOVA results for posttest fluency, originality and imagination scores after controlling effects of pretest scores.

Table 6.5

ANCOVA for Fluency, Originality and Imagination Scores by Program

TCAM Subscale	**Source**	***df***	**Mean Square**	***F***	***p***	**eta²**
Fluency	Pretest	1	12071.69	27.99	<0.001*	.35
	Program	1	1352.17	3.14	.08	.06
	Error	53	431.23			
Originality	Pretest	1	12986.32	31.30	<0.001*	.37
	Program	1	3208.09	7.73	.01*	.13
	Error	53	414.89			
Imagination	Pretest	1	3420.09	47.09	<0.001*	.68
	Program	1	447.88	6.17	.02*	.21
	Error	52	72.63			

*p < .05

Table 6.6 outlines the means for fluency, originality, and imagination scores for both groups before and after controlling for pretest differences. Data clearly revealed that the experimental group scored higher for all three creativity subscales in comparison with the control group. Based on the adjusted means of the experimental group, it can be concluded that the CREPES module has contributed to a difference of

10% for fluency scores, 16% for originality and 7% for imagination scores respectively as compared to the control group.

Table 6.6

Fluency, Originality, and Imagination Scores for Experimental and Control Groups

TCAM Creativity Subscales		**Experimental group (n = 29)**			**Control group (n = 27)**		
		M	*SD*	*Adjusted M* [a]	*M*	*SD*	*Adjusted M* [b]
Fluency	Pre	122.62	22.23		99.70	16.53	
	Post	130.31	27.44	121.92	101.48	23.07	110.49
Originality	Pre	118.14	23.63		98.37	16.92	
	Post	129.86	28.35	122.71	98.19	21.91	105.87
Imagination	Pre	90.10	14.73		80.48	12.85	
	Post	100.14	10.68	97.57	88.37	12.50	91.13

[a,b] Mean scores after controlling for the effect of pretest.

Therefore, findings generally indicated that the CREPES module was effective in developing the overall creativity among preschoolers. Preschoolers in the experimental group scored significantly higher in their overall creativity as compared to their counterpart in the control group. In terms of the creativity subscales, improvement in the scores of all three subscales in the experimental group was evident as compared to the control group; despite significant increase only being ascertained for two subscales, namely originality and imagination.

Chapter Summary

This chapter explicated the findings obtained for the last phase of this research study. Qualitative methods including interview and observations were used to ascertain the usability of the CREPES module for the teachers involved in implementing the module activities. In terms of teaching, findings had indicated that the module has helped improve actual practice especially in terms of creative teaching and lesson-planning. Challenges identified during module implementation were also consecutively discussed.

In addition, usability of the module for preschoolers, as well as the impact of the CREPES module on preschoolers' creativity was also evaluated. Observations and interview data found that the CREPES module helped preschoolers to explore actively, participate in the formulation of ideas and establish two-way interactions with their peers as well as teachers. Subsequently, an ANCOVA was performed to determine whether there is a significant impact of the CREPES module on preschoolers' creativity. Results found a significant increase in preschoolers' overall creativity scores after the CREPES module implementation as compared to preschoolers who were taught under the traditional approach. Their abilities to formulate unique ideas and to imagine were also found to increase significantly.

Discussion of the findings for all three phases in the study, their implications and suggestions for further research will be addressed in the following chapter to conclude the study.

Chapter 7

Discussion and Conclusion

Based on the findings for each phase, this chapter presents a summary and discussion of the findings collected for this research study. Findings will be discussed with appropriate reference to the existing literature. The next section explicates the implications of the study toward preschool stakeholders, followed by recommendations for future research.

Summary and Discussion

This research study was conducted considering the lack of implementation of play-based approach as well as the infusion of creativity in Malaysian preschool teaching and learning specifically in the context of early science. Due to deficiencies in the research areas of both play and creativity in the Malaysian early childhood education, the researcher integrated both elements into creative play approach in this study.

Despite the emphasis on play and creativity in the national preschool curriculum, the available resources that support Malaysian preschool teachers to inculcate play and creativity in practice remain deficient. This gap between theory and actual practice in the Malaysian preschool context drives the researcher's motivation to develop a module that acts as instructional support for preschool teachers to improve their competence to implement creative play in their settings. As the importance of early science is often underestimated in the research context, it was selected as the content area for this teaching module.

The design and development approach (Richey & Klein, 2007) was used to guide this study toward designing and developing a Creative Play Early Science (CREPES) module. The study was conducted in three distinct yet interrelated phases.

Findings for each phase are summarised in the following. Simultaneously, the key findings are discussed in relation to theory and available literature as appropriate.

Phase 1. The research study began with an analysis of needs on the teaching and learning of preschool science. The research question was: "What are the needs in the teaching and learning of preschool science?". Semi-structured interviews were conducted with seven preschool teachers, supported by observations on three preschool science classes.

Findings revealed the current teaching practices of preschool science in the research context. Preschool science was found to be implemented with excessive structure with little space for flexibility. Lessons were rigidly delivered according to fixed steps while following a standard set of lesson plans in the syllabus. Teachers generally played the role of "mere technicians" (Takaya, 2008, p.14) as they transmit the prescribed early science content from textbooks to preschoolers, instead of facilitating them in their own explorations of the world. Moreover, data indicated teachers' frustration and their sense of powerlessness over the requirement to adhere strictly to the syllabus provided. This structure reflects a "teacher-proof curriculum" (Kim, 2013) where teachers' voice over the teaching and learning process is limited. It also resonates with a curriculum planned in a vacuum, with the assumption that all preschoolers with their varying predispositions and needs would learn well in a pre-planned curriculum.

While this rigidity could be interpreted by some as systematic, it does not parallel with the fluidity of preschoolers' learning and development. According to Trundle (2015), this implies a traditional approach to early science instruction which is mainly teacher-oriented, didactic and relies heavily on books. While following a set of procedures is not wrong in nature, it is important to note that if these standard procedures result in rigidity of teaching and learning and deprivation of opportunities for explorations, children's quality of learning would be directly affected.

As teachers were constrained to follow a fixed set of curriculum, science has similarly been "put in a box" as aptly phrased by one of the participants. It is therefore of no wonder that findings also discovered limited creative development in the largely procedural delivery of preschool science lessons. This concurs with Cremin et al. (2015) who maintained that creativity is rarely considered by teachers during lesson planning and implementation of preschool science. Similar to the research study done by Hashimah Mohd Yunus and Nooraida Yakob (2014), findings from this phase also implied that active involvement among preschoolers was scarce during science lessons.

Findings went on to indicate several barriers that impeded preschoolers' creativity development in early science teaching and learning. They include limited time, large class sizes, as well as the stipulated syllabus that teachers are required to follow. These factors are in alignment with Cheung (2013) who discerned the same factors that restrict the incorporation of creativity among preschool teachers in Hong Kong.

Furthermore, findings also suggested that teachers could also act either as a barrier or catalyst in young children's creative development. Teachers' responses to preschoolers' ideas or answers were discerned to possibly limit preschoolers' creative potential. In two of the observed instances, teachers were found to favour standard ways of responding to questions and completing workbooks from preschoolers. This is in accordance with Cheung (2013) who similarly highlighted that preschool teachers in Hong Kong tend to prefer expected ideas instead of unexpected ones from preschoolers. Thus, the way a teacher reacts to preschoolers' ideas could either be a barrier that limits preschoolers' potential to develop creatively, or on the flipside stimulate their creative development and motivate them to further exploration.

On the other hand, despite limited opportunities for creativity development, data had indicated that traits of creativity were still present among preschoolers, albeit scarce in the largely structured science classrooms. As explained by Torrance (2000), all healthy preschoolers can demonstrate creative behaviours, and that they are "experts in creative learning" (p. 352). Even with limited avenues to unleash their creative potential in a structured learning environment, it is certain that preschoolers are capable to learn and demonstrate creativity. This asserts that there is ample room for preschoolers' creativity to be further stimulated in early science through age appropriate approaches, hence reinforcing the need for the CREPES module.

Among the purpose of introducing science to preschoolers include stimulating their interest and motivation to discover the world around them by taking advantage of their inherent curiosity and sense of wonder (Eshach & Fried, 2005; Greenfield et al., 2009; Hammer & He, 2014). This however, could be difficult to achieve in light of the current implementation of Malaysian preschool science as portrayed by findings from this study. Excessive structure in the current preschool science lessons implied its inappropriateness and ineffectiveness to develop a strong foundation in science among preschoolers in their early childhood years. This is in accordance with a plethora of researchers including Hashimah Mohd Yunus and Nooraida Yakob (2014), Saçkes et al. (2013), Trundle (2015), as well as Trundle and Saçkes (2012) who similarly emphasised the lack of effectiveness in early science instruction in many early childhood settings.

Data from this study also indicated that there was insufficient emphasis on the content area of early science in practice despite its importance. One way to determine why science is often neglected in practice involves identifying barriers faced by teachers as a key step towards supporting their teaching of early science, as suggested by Greenfield et al. (2009) and Mirzaie et al. (2009).

Evidence from this present study showed that one of the challenges teachers encounter in early science instruction includes time constraint in science learning as compared with areas of literacy and numeracy. This is in accordance with research findings from the international context (e.g. Nayfeld et al., 2011; Patrick & Mantzicopoulos, 2015; Saçkes et al., 2011; Saçkes et al., 2013). On the other hand, opportunities for professional development indirectly imply how much emphasis is directed toward early science instruction. However, findings also showed a lack of effective training for teachers in the teaching of early science.

Based on data collected on the current practice of preschool science, the research question pertaining to the needs of preschool science was addressed. In light of the rigidity and excessive structure in the science classroom, data indicated the need to infuse more flexibility in the teaching and learning of early science. "Increasing pedagogical flexibility" (Tee, 2015, p. 73) was one of the proposed areas for revamp in the Malaysian preschool education. Flexibility with a certain extent of freedom to make choices is paramount for creativity to thrive among preschoolers (Johnson, 2007;

O'Connor, 2014). Building upon this need, a child-centred module founded on active hands-on explorations was a major underlying principle pertaining to the CREPES module design.

Findings also illuminated the need for the integration of early science with other developmental domains to ensure holistic learning, as stipulated by the NPSC (Ministry of Education, 2017). The importance of creativity in the teaching of early science has been reiterated by researchers including Adzliana Mohd Daud et al. (2012) as well as Glauert & Manches (2012). Hence, creativity development should also be a focus in the teaching and learning of early science in the context of study, in line with the needs of this present era as well as in the NPSC. Another module design principle that emerged out of the data collected was the CREPES module should adopt a holistic and integrated approach to develop preschoolers' creativity.

The needs for more flexibility and holistic integration of early science can only be addressed effectively when preschool teachers are well equipped with competence to translate theory into practice. Thus, the need for teacher training on early science instruction, in terms of both quantity and quality has also been illuminated. This finding resonates with ample research highlighting preschool teachers' lack of competence in teaching science (e.g. Nilsson, 2015; Saçkes et al., 2013; Trundle & Saçkes, 2012). In addition, it is also consistent with several researchers who contended the importance of preschool teachers' professional development in the area of early science (Nayfeld et al., 2011; Piasta et al., 2014; Mirzaie et al., 2009; Saçkes et al., 2013; Trundle & Saçkes, 2012). Lack of quality training for teachers could directly affect children's development of creativity. This module, hence builds upon this need and acts as a tool of instructional support for preschool teachers to infuse creativity into early science.

By determining the needs in preschool science teaching and learning, the need for the CREPES module was therefore reinforced. It also led to implications for module design and development, which ensured that the module is in line with and could cater to the needs of the context of study.

Phase 2. After confirming the need for the CREPES module in Phase 1, the second phase of this study involved designing and developing the module in light of the identified needs in the previous phase. The first research question in this phase concerned the design of the CREPES module, i.e. “What is the appropriate CREPES module design according to experts’ consensus?”. The design of the CREPES module was founded upon the consensus of 14 experts, which was achieved through the Delphi technique. The Delphi technique was conducted for three rounds. The first round included interviews with each of the panel expert, followed by two subsequent rounds of survey questionnaires.

Based on experts’ consensus, findings from the three-round Delphi had contributed to 57 items on general module design, recommended module sections, features of module activities, teaching strategies and techniques in implementing the module, and suitable resources to support the module implementation. Guided by these items agreed upon by the panel, an initial module was designed.

Considering the general Delphi findings in light of existing theories and principles, experts’ consensus on the design of the CREPES module was generally in alignment with existing theories in the field of early childhood education. Experts agreed that the module activities should involve hands-on exploration and opportunities to problem-solve, be open-ended, interactive as well as less teacher-centred among others. These features were largely in line with theories of constructivists such as Piaget, as well as DAP that emphasises greatly on hands-on exploration through play for holistic development of children (National Association for the Education of Young Children, 2009). Katz (2010) reiterated that developmentally appropriate teaching and learning practices take into account the importance of first-hand and direct experiences in children's knowledge construction.

Furthermore, Delphi findings also contended the incorporation of open-ended questions in the module to stimulate preschoolers' cognitive processes. This is in alignment with Sharp (2004) who posited that encouraging exploration and open-ended questioning are strategies for preschool teachers to promote creativity among children. Furthermore, the Delphi panel acknowledged the importance of two-way interaction in the module activities. This is in line with Katz (2010) who highlighted that opportunities for direct interactions with people, materials and the environment are prerequisites for an effective pedagogical practice.

The Delphi panel also achieved a common agreement that the module should be integrated across the developmental domains, as recommended in the NPSC. Hunter-Doniger (2016) also asserted that it is useful to integrate various disciplines as it takes the "curriculum out of silos" (p. 35) and enhances children's learning and creativity.

Subsequently, a review of the initial module was conducted. This addressed the second research question in Phase 2: "How do experts and teachers review the initial module?". The review was done by potential module users including content experts and teachers in order to ensure that the module, with its design and content will be able to achieve its intended objectives. The issues raised by reviewers were concerning the practicality of the module for implementation, the use of clear and consistent terminologies and managing external factors during implementation.

The first issue raised by reviewers was on the practicality of the CREPES module in terms of implementation. In the heterogeneous Malaysian preschool context which still lacks coherence and uniformity, it is crucial to consider whether the module is practical to be implemented by teachers of various levels of competence. Ng (2010) highlighted the mismatch between the ideals as established by theories and curriculum, and the reality in practice. This mismatch can be minimised by making sure that the module design is user-friendly for a wide range of teachers with varying backgrounds and experience. Meanwhile, it also implies striking a good balance between spoon-feeding teachers with a compact module with extensive guidelines, and retaining teachers' pedagogical flexibility with an open-ended module.

In addition, findings also implied the misperception of the term "creativity" among some reviewers. First, "normal" or common preschool activities were perceived as not effective in developing children's creativity. However, it should be stressed that developing creativity does not necessarily have to be done through sophisticated activities or materials that are unlikely to implement in actual practice. Sherwood and Freshwater (2006) contended the effectiveness of a "simple" early science activity of marble painting conducted in their study, which was engaging and meaningful for the children; as well as holistic and addressed various areas of development. Sharp (2004) added that as long as children are actively engaged in their learning process, there will be room for creativity to develop.

Furthermore, findings indicated a shallow view on creativity among several reviewers, whereby creativity is viewed largely in light the end products; or merely related to art, without which it would not flourish. This concurred with findings from the research study of Azli Ariffin and Roselan Baki (2014) who similarly found that Malaysian preschool teachers perceived creativity as related to “art works”. The view that creativity is only restricted to the arts is a myth, as strongly asserted by Sharp (2004). In alignment with the views of O’Connor (2014), Saracho (2012) and Sharp (2004), the emphasis on young children’s development of creativity should be on its process, rather than the end product. Similarly, the researcher contends that subtle development of creativity among young children occurs through the process of formulating ideas and imagination while exploring actively, regardless of the content or subject area. The module therefore provides sufficient opportunities for preschoolers to engage in active exploration while producing ideas, in order to nurture their creativity. While the study of Hunter-Doniger (2016) infused creativity into mathematics through arts, this present study took it further by infusing creativity into early science through creative play.

This phase has determined the appropriate content of the CREPES module based on experts’ consensus. After a thorough review of the initial module designed based on the Delphi findings, a module prototype was developed to be implemented and evaluated in the next phase.

Phase 3. This last phase of the DDR study concerned the implementation and evaluation of the CREPES module prototype developed in the previous phase. After the module implementation, two aspects of the module were evaluated in this phase, namely the usability and its impact on preschoolers’ creativity.

First, evaluation of the module's usability focused mainly on the creative process. It addressed two different research questions: 1) How is the usability of the CREPES module for teachers; and 2) How is the usability of the CREPES module for preschoolers? During the implementation of the CREPES module prototype, observations were conducted in order to determine the usability of the module for teachers and preschoolers. In addition, as a method of triangulation, semi-structured interviews were also conducted with two teachers involved in the implementation.

On teachers' usability of the CREPES module, data has shown that the module was useful as a professional development tool that supports preschool teachers in terms of early science instruction, play and creativity. The module has also improved their practice, especially in planning and implementing creative play activities; as well as their overall competence as a teacher in terms of skills, attitudes and knowledge. The CREPES module enhanced teachers' abilities to carry out creative, child-centred activities. It also acted as a model of reference for a curriculum with less structure and more flexibility. Literature has repeatedly reinforced the link between curriculum flexibility and creativity development (e.g. Johnson, 2007; O'Connor, 2014). As the CREPES module activities similarly provided space for pedagogical flexibility and freedom, thus it is evident that the module has provided reliable instructional support on creative pedagogy for preschool teachers.

Cheung (2013) indicated that preschool teachers tend to discourage exploration of creative ideas. In contrast, implementation of the CREPES module had helped encourage teachers to be supportive of and even positively reinforce preschoolers' formulation of novel and new ideas. In addition, teachers' creativity and abilities to ask open-ended questions had also been strengthened by implementing the module.

This reinforced the finding of Sherwood and Freshwater (2006) that pointed out their improvement as teachers in terms of divergent thinking and creative teaching through planning open-ended science activities for young children. Moreover, the implementation of the module activities stimulated both preschool teachers to continuous reflections of their current teaching approaches and its implications.

On the other hand, they also highlighted several challenges they encountered through the process of implementation. In line with Eckhoff (2011), teachers pointed out the contradiction they experience in effort to strike a good balance along the spectrum of child and teacher-centred approaches.

An optimal environment for creativity to develop is the provision of sufficient time for children to explore without being rushed (O'Connor, 2014). However, one of the greatest barriers teachers brought up about the implementation of module was time. Time constraint in 1) preparation before implementing the module activities, 2) conducting during the activities, and 3) cleaning up after the creative play activities led to constant anxiety and pressure among teachers. Evidence from the study indicated preschool teachers found creative play activities cumbersome to be implemented, due to the preparation required. This finding is not uncommon in both the international and Malaysian preschool context. As posited by Cheung (2013) and Norsuhaily Abu Bakar et al. (2015), time was cited as one of the key challenges to incorporate play and creativity in preschool as a result of the obligation to formal academic learning.

In relation to that, the approach of direct instruction and the academic emphasis in the research context could be reasons behind the shortage of time in implementing the module, which is of a different nature altogether compared to the conventional approach adopted in the preschool setting. As the environment of the setting was not naturally prepared for child-centred and hands-on learning, deliberate work and planning were required in order to set up the environment including materials for preschoolers to engage in creative play activities. This took up extra time and energy from the teachers, as teachers were obliged to also carry out other duties simultaneously aside from implementing the module; such as completing the syllabus and marking workbooks or exam papers. With this burden and pressure to prepare preschoolers for formal schooling, it is not surprising that teachers consider implementing creative play activities to be an additional burden to their existing duties; when in fact play should be the natural work of children. As long as preschools remain obliged to the excessive pursuit of academic mastery for preschoolers, there will always be a shortage of time and space for creative play; which ultimately in the long-term could only bring disservice to the young generation.

Pertaining to the usability of the CREPES module for preschoolers, findings revealed that the module provided opportunities for preschoolers to engage in hands-on and active explorations by experimenting in various ways. Preschoolers also showed great interest and excitement during the module activities, which were evident through their concentration and persistence in the activities. As highlighted by Sharp (2004), experimentation and persistence are traits of creativity in children. Preschoolers' excitement was also demonstrated through verbal and non-verbal expressions when they discovered new things for themselves as they engaged in hands-on explorations. Data demonstrated how preschoolers responded to new discoveries by sharing it with people around them. This reinforces the statement by Torrance (2000) that children love showing and telling someone when discovering new things. As preschoolers demonstrated motivation, producing inventions from normal everyday materials and persistence through the process of exploration during the module activities; they exhibited traits of creativity according to Torrance (1977, as cited in Torrance, 2004). These evidence from the data collected implied that preschoolers' creativity was being developed through the process of hands-on explorations in the module activities.

The creative play activities implemented had also provided avenues for preschoolers to formulate ideas, both in terms of quantity and quality. As preschoolers participated in the module activities, whether in constructing or problem-solving; they had shown constant attempts to produce various different ideas, some of which were new and unconventional. This implied that the module activities stimulated their ability to produce many (fluency) and new (originality) ideas through the creative process.

Furthermore, evidence from the data also revealed that some preschoolers even took a step further to refine and elaborate the ideas produced. The abilities to refine (flexibility) and elaborate ideas (elaboration) are prominent indicators that ample opportunities for creative development were present in the CREPES module activities. These findings are in parallel with Garaigordobil and Berrueco (2011) that emphasized the role of creative play in stimulating young children's flexibility, improvisation and ability to solve problems. There were also evidence of preschoolers expressing their ideas in the form of inferences and hypotheses during the activities. Therefore, data collected had encompassed all four dimensions of creativity as proposed by Torrance (1964, as cited in Isbell and Raines, 2013). This established strong evidence that the CREPES module was effective and comprehensive in developing preschoolers' creativity.

Data also suggested the role of the CREPES module in encouraging preschoolers to work together as a team through group activities in the module. It was found that mutual partnerships were formed as they worked in groups. The module, with its interactive nature and emphasis on the use of open-ended questioning had also stimulated meaningful discussions among preschoolers by exchange of ideas. This exchange of ideas stimulated preschoolers to formulate and communicate their ideas in the group. The ability to work together in a group was also included as an indicator of creative strengths by Torrance (1977, as cited in Torrance, 2004).

However, not all preschoolers were observed to show the positive responses stated as above. Some preschoolers were found to appear disoriented when they were asked to explore on their own with no specific instructions were given to them. This is most probably because they have been accustomed to a teacher-centred environment with limited avenues for decision-making and free explorations. As the module activities are open-ended and involve independent critical and creative thinking, some young children may find it difficult to adapt to the child-centred activities without adequate guidance. Sharp (2004) posited the importance of adult guidance and stimulation in supporting preschoolers' creative development. She stressed that children's play could "become routine and repetitive" when they are "left entirely to their own device" (p. 10). In the process of developing preschoolers' creativity, while teachers strive to make their lessons less teacher-centred, it is nevertheless important to note that a good balance should be achieved at the same time. This would ensure that preschoolers may acquire adequate stimulation and support from teachers.

Pertaining to the physical environment, data has also pointed out several external factors that had a certain degree of impact on the implementation of the

CREPES module. Aside from the limitation of time, availability of resources and space also influenced preschoolers' explorations and creativity development during module implementation. This finding is in line with Sharp (2004) who similarly emphasised the importance of a conducive environment, specifically in terms of the classroom, outdoor setting, and materials used.

Nevertheless, overall findings on the module's usability for preschoolers established that the CREPES module had positive impacts on their creativity as well as holistic development. Evidence from data obtained consistently asserted the role of the CREPES module in enhancing preschoolers' creativity. Preschoolers' formulation of unique ideas, invention of things from common materials, motivation and persistence in exploring, and their ability to cooperate in a group were clear indicators of creative behaviours (Torrance, 1977, as cited in Torrance, 2004).

Meanwhile, the impact of the CREPES module on preschoolers' creativity was measured quantitatively using Torrance's creativity assessment TCAM. This addressed the third research question for this phase: "Is there a significant impact of the CREPES module on preschoolers' creativity?".

Evaluation of the module's impact showed statistically significant findings of the CREPES module on preschoolers' overall creativity. This reinforces and implies that creativity can be developed among preschoolers and enhanced through creative play activities. Several research studies revealed similar findings such as Garaigordobil and Berrueco (2011) who found significant effect of a play program on five to six year-old children's creative thinking. Likewise, Alfonso-Benlliure, Meléndez, and García-Ballesteros (2013) found that a creativity intervention program has positively impacted the overall creativity of preschoolers. Findings also reaffirmed the potential of early science as a powerful medium where creativity could be infused.

As a whole, the CREPES module has contributed to positive impact in terms of practice for teachers, as well as preschoolers' learning and development, especially in stimulating their creativity. It has also played its role as an effective instructional support tool for teachers in guiding them to infuse creativity into the preschool curriculum through creative play early science activities. Furthermore, the CREPES module has played an important and effective role in addressing the needs identified in the first phase, thus successfully improved actual practice in the context of study.

Figure 7.1 presents a summary of the findings by phase, leading to the product of the study i.e. the CREPES module.

DEVELOPMENT OF A CREATIVE PLAY EARLY SCIENCE MODULE

PHASE 1

- Current practice in preschool science:
  - Excessive structure
  - Lack of emphasis
- Needs in preschool science:
  - Flexibility
  - Integration with other domains towards creativity development
  - Teacher training
- Implications for module:
  - Child-centred activities
  - Integrated
  - Concrete pedagogical tool

NEED FOR CREPES MODULE CONFIRMED

PHASE 2

- 57 items obtained through Delphi technique as a guide for module design in terms of:
  - general module design,
  - module sections,
  - module activities,
  - teaching strategies/techniques
  - module resources
- Initial module review:
  - Practicality
  - Terminology use
  - Management of external issues

CREPES MODULE PROTOTYPE DEVELOPED

PHASE 3

- Module usability for teachers:
  - Improved practice
  - Challenges in implementation
    - Time
    - Energy
    - Low self-efficacy
- Module usability for preschoolers:
  - Hands-on exploration
  - Formulation of ideas
  - Interactive partnership
- Module impact on preschoolers' creativity:
  - Module activities significantly enhanced preschoolers' creativity, specifically in terms of *originality* and *imagination*

CREPES MODULE VALIDATED

PRODUCT: Creative Play Early Science (CREPES) Module

Figure 7.1. Summary of findings.

Implications of Study

This section explicates and discusses the implications of the findings in terms of theory, practice and instructional design, specifically toward the field of preschool education in Malaysia.

Theory and practice. First and foremost, this present study has provided concrete empirical evidence that creative play is effective in stimulating preschoolers' creativity, through the intervention of the CREPES module as an instructional support tool. Findings had further reinforced the impact of the play approach on preschoolers' creativity. In addition, in contrast to conventional belief that arts are the only effective medium through which creativity is developed, this study established that science as a systematic discipline, when delivered through hands-on creative play, could significantly contribute to the stimulation of creativity among preschoolers.

Findings of this present study reiterated the urgent need for a change in the approach used in many Malaysian preschools. To date, many preschools are still excessively entrenched in traditional teaching and learning approaches which are teacher-centred and academically inclined. As such, little time is allocated for the development of creativity through play. Teachers tend to view play only as an enjoyment or a "reward" for children during their free time after they complete what they are required to do. Developing creativity among preschoolers has also been neglected over the emphasis on academic mastery.

In order to ensure and establish the quality of preschool education in Malaysia, a paradigmatic shift is needed to move towards learning that is less rigid and child-centred. The researcher proposes that revamp should begin by gradually doing away with the chalk-and-talk approach in all Malaysian preschools. Since creativity could be developed and taught among young children, its importance to fulfil the coming needs of this rapidly changing technological era should not be underestimated. As highlighted by Hunter-Doniger (2016), being deficient in creativity may impact children's learning at a young age; however, the impact would be greater when they grow up to be unequipped to meet the demands of an era that values creativity and innovation. The focus should be more on developing holistic 21st century skills including creativity among preschoolers, instead of merely emphasising on academic skills. As long as the focus on academic mastery and excessive structure remains in preschool education, creativity development among preschoolers would definitely be jeopardised.

All preschoolers should be provided with equal opportunities to play creatively in order to develop their creativity. There should be no debate over the need to allocate sufficient time in preschools for preschoolers to play creatively and explore actively. Moreover, creative play should be used across the developmental areas, regardless of content areas in order to benefit preschoolers holistically. As this gradual process of change takes place, implementing the CREPES module would be much more practical for teachers; as time would be less constrained in a more flexible system.

Nevertheless, in order for these changes to take place effectively across the nation, the issue of quality and competence among preschool teachers should first be dealt with appropriately. This is because incorporating play and creativity with young children requires teachers to possess a certain level of competence, knowledge, skills and attitudes. As emphatically pointed out by Vu et al. (2015), although preschool teachers may generally recognise the value of play, it would be a problem for them to apply their beliefs into practice without being adequately equipped through professional development opportunities. Hence, continuous professional development and support should be provided for teachers through the gradual process of revamping the Malaysian early childhood education.

Meanwhile, this study has positively recognised the impact of the CREPES module in enhancing preschool teachers' competence to teach creatively. Since this module has been tested in the Malaysian preschool context, a key implication of this research study is that the CREPES module could be used by teachers as an instructional support tool and guidance to infuse creativity into the preschool curriculum. As a professional development material that acts as a guide, coupled with consistent support by relevant authorities; preschool teachers would be more equipped and prepared to implement the creative play approach in their settings.

In addition to the need for quality teaching among teachers, this study also establishes the importance for preschool teachers to have passion in working with young children. Preschool teachers, whether preservice or inservice should be passionate in providing a quality and conducive learning environment for preschoolers; while having children's best interest in mind at all times. Without passion, even the best teaching approaches would not be far-reaching and effective for children. This research study proposes that the importance of creative play be introduced and taught in preschool teacher training programs to adequately expose student teachers to its overarching benefits for preschoolers.

Theoretically, the researcher proposes a creative play framework based on the key elements assimilated from the CREPES module which had collectively contributed to its positive impact in fostering creativity among preschoolers. As illustrated in Figure 7.2, this framework could be a useful point of reference and guidance for preschool stakeholders and teachers about the creative play approach; and hence further implement it in their respective settings. Regardless of the content area, the creative play approach could be used in early childhood settings by incorporating five of these elements into preschool teaching and learning, with the specific aim to enhance preschoolers' creative development.

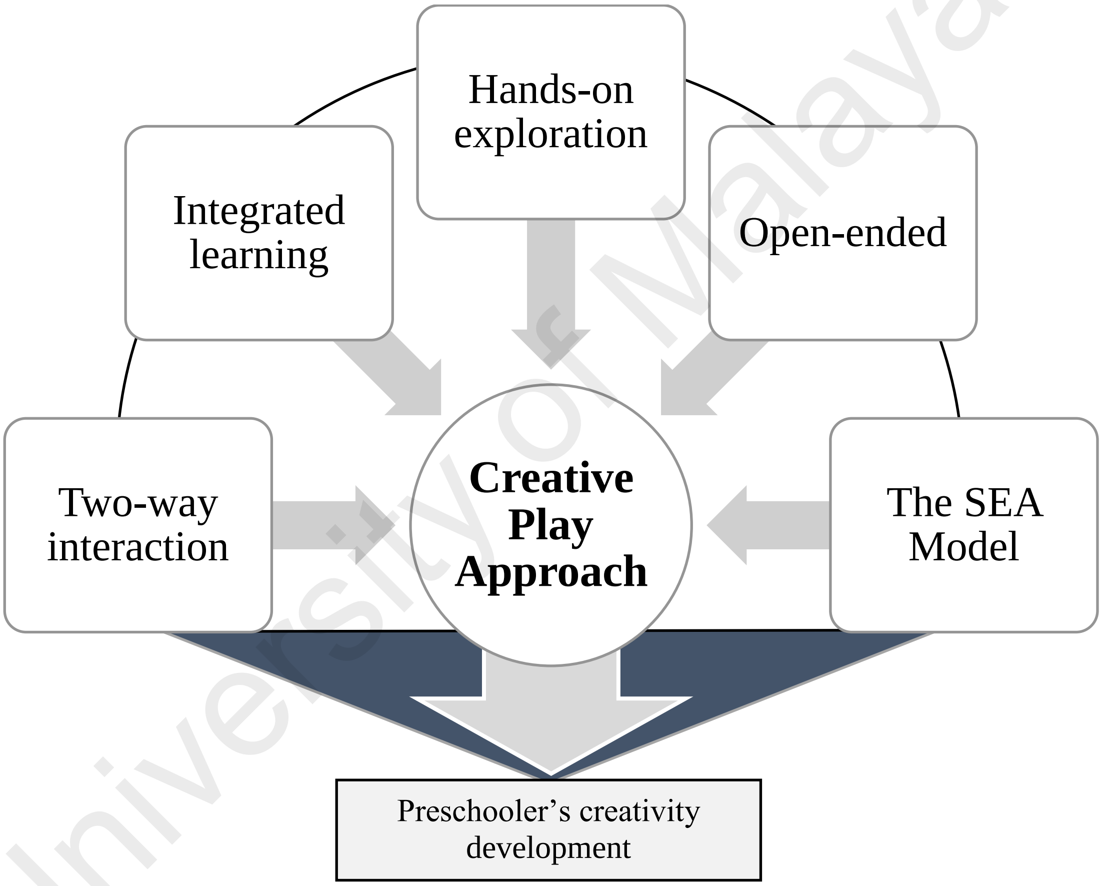


Figure 7.2. Creative play framework to infuse creativity among preschoolers.

In light of the context of this study, creative play encompasses five interconnected key elements. Each of these elements is briefly explained, with appropriate references to the CREPES module. To enhance creativity, two-way interaction is crucial as it provides opportunities for preschoolers to exchange ideas, and at the same time refine and improve on them. This has also been highlighted by

Malaguzzi (1993, as cited in Sharp, 2004) as one of the most conducive environment for creativity to flourish. In the CREPES module, preschoolers were often placed in groups for the module activities. This enabled them to learn from each other and to contribute in a group through social interactions. Aside from interaction between preschoolers, how teachers interact with preschoolers to stimulate their creativity is also essential. Concurring to Sharp (2004), young children require consistent guidance, stimulation and encouragement from adults to develop their creativity through play.

The integrated and holistic nature of the CREPES module has also helped stimulate preschoolers' creativity. The module activities involve and go across various developmental areas such as social, mathematics, art and communication domains. A creative play activity for preschoolers should be interdisciplinary and lead to holistic child development, employing multiple intelligences and engaging various sensory experiences in children.

Another crucial element that defines creative play is child-centred activities with hands-on explorations, where preschoolers actively involve and are in control of their own learning. As they take charge, formulate ideas and engage in creative problem-solving, preschoolers' interest and focus in learning would be enhanced; which would in turn maximise their learning and development through fun and meaningful ways.

In addition, the CREPES module has an open-ended nature which encourages young learners to exercise their problem-solving and creative thinking abilities to formulate their own unique ideas. To effectively foster preschoolers' creativity, creative play activities should be carefully structured to ensure that they are open-ended and could elicit various possible solutions instead of one standard solution. This is supported by open-ended questions that teachers pose through the creative process, which is paramount to stimulate preschoolers' thinking processes. It is important to stress that teachers should accept and value preschoolers' responses to their open-ended questions, whether they are in accordance to adults' perceptions or not (Sherwood & Freshwater, 2006).

Furthermore, implementation of the CREPES module activities had also demonstrated how the SEA model acted as a guide for teachers through a step-by-step and cyclical approach as they implement creative play. The cycle begins with "Stimulate", moves on to "Explore", and ends with "Apply", before reverting back to the first stage. Through this adapted model, development of preschoolers' creativity starts by stimulating preschoolers' interest on a topic, leading them to deeper explorations through interacting with materials, peers and environment, and finally applying the acquired knowledge and skills into everyday life. This process is most effective when bolstered by open-ended questions, through which teachers could better facilitate and enhance the development of creativity among preschoolers. This adapted instructional model could be generally applied to guide preschool teachers in planning a lesson using the creative play approach, specifically aimed to promote creativity among preschoolers.

Instructional design for ECE. Due to the scarcity of empirical-based design and development research in the field of ECE to date, the researcher discerns the need to outline the implications of this study toward the development of instructional tools for preschool education. This is hoped to encourage the emergence of more research of this type to produce more concrete tools in support of preschool teachers.

This study has affirmed the potential of creative play for preschoolers' holistic development. Hence, one important implication of this present study towards the future instructional design in the field of preschool education is that creative play could be one of the key mediums used for instructional tools.

Furthermore, due to the fluidity of preschoolers' learning and development as well as the diversity of the Malaysian preschool sector, it is crucial for all products and tools to be tested and piloted before its actual implementation. This would enhance the practicality of instructional support tools in preschools.

With the purpose of designing and developing a preschool science module based on creative play, this study employed the research design of DDR (Richey & Klein, 2007). This DDR study is made up of three interrelated research phases. Although each phase has its distinct objectives, it is important to note that all three phases should not be viewed as being separated from each other; rather a coherent and unified system; leading to the finished product. An overview of the process of instructional design is visualised in Figure 7.3.

As illustrated in Figure 7.3, designing and developing a product or tool is a systematic process. The product traces back to its process prior to its finalisation. The analysis of needs forms the foundation of the process, as it is crucial to first identify the needs in actual practice to acquire a general picture of the entire context. Based on specific needs in the field, the product is then drafted and reviewed by experts in the design and development phase. Finally, it is tested out and evaluated in one or more natural settings. Collectively, this entire process would lead to a finalised product which could be effectively practised and benefit its users in actual practice.

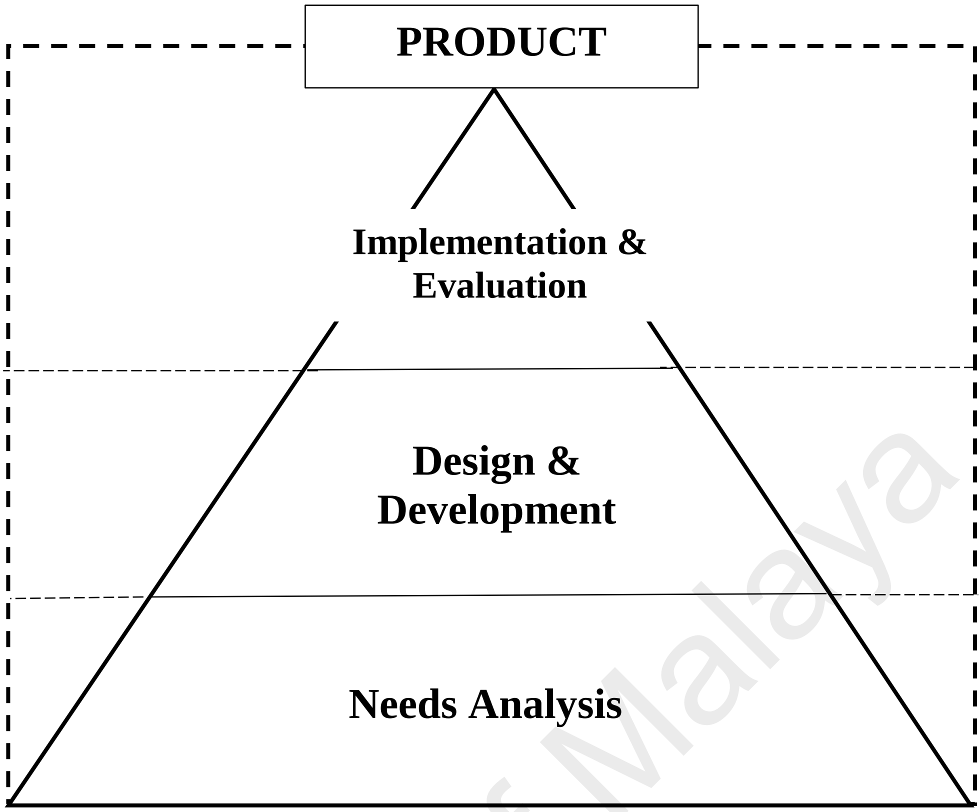


Figure 7.3. Flowchart of the DDR process leading to product development.

Following this general structure would ensure that the product developed caters to and is based upon the needs of users, that its principles are in line with experts' general consensus in the field, and is practical to be implemented in practice and achieve the intended outcomes. This could be applied in DDR research across all educational levels from preschool through tertiary education and beyond.

Table 7.1 outlines the details involved in each phase in a DDR study. These could act as reference for future research of similar directions.

Table 7.1

Phases in a DDR Study

Phase	Description
Phase 1 **Needs Analysis**	• Foundation and basis of entire process of product development • Acquires a general picture of the current practice and needs of specific group(s) of user in the research context • Confirms the need, purpose and intended outcome(s) of product
Phase 2 **Design and Development**	• Ascertains findings from research and existing literature • Incorporates expertise of professionals in the field in drafting product so that product is in line with experts' general consensus and practice • Expert and prospective users' review of product
Phase 3 **Implementation and Evaluation**	• Orientation of the product as introduction to users • Exploratory implementation of product in natural setting(s) • Evaluation of product including usability and measurement of intended outcome(s) • Includes measurement of predetermined outcome(s) • Explores possible areas for revision and finalisation of product as appropriate

Recommendations for Future Research

Research in the Malaysian early childhood education is considerably new, hence could be fragmented and inconclusive. Since research and practice should be in tandem with each other, there is a need for further research in the field for continual improvement in practice.

This study only involved selected Malaysian private preschool settings and six year-old preschoolers as its context and sample. Only 56 preschoolers were involved in the evaluation of the CREPES module. A research study involving a larger sample could yield different results. Moreover, more research can be done to ascertain the impact of the CREPES module on preschoolers from public preschools or those of another age group. Other variables, for instance whether the impact of the module differs due to preschoolers' gender, socioeconomic status or cultural backgrounds could also be studied.

Despite the module activities being integrated in nature, this study focused only on the content area of early science. Creativity should be infused across all developmental areas. Hence, further research can be done on the development of products which focus on infusing creativity into other content areas in order to enhance preschoolers' holistic development. In addition, creativity can be studied in relation to preschoolers' general learning and development as a whole, regardless of the content area in focus. Likewise, further research could also be conducted with different types of play and their effects on preschoolers' creativity. Several possible lines include investigating and comparing the impact of cooperative play, cognitive play or imaginative play on creativity.

Due to the limitation of time, the CREPES module was not implemented for a long period of time. Long term impact of the module, such as how long would preschoolers' creativity be maintained for was also not taken into account. More impact could have been obtained with a longer period of implementation on a greater range of topics. Future research could consider conducting a longitudinal research to determine the module's impact on children's creativity on a long-term basis. It would also be interesting to determine how impactful the module would be toward preschoolers' general learning and development, whether short or long term.

In addition, the impact of the CREPES module on other developmental areas or outcomes aside from creativity could also be looked into. How creative play would enhance the development of other crucial skills such as social, cognitive or self-regulatory skills could also be explored in future research studies to further contribute to the existing body of research. Developing 21st century skills among children in their early years is crucial to adequately equip the young generation for the coming challenges and demands. Therefore, a possible line of further inquiry would be exploring the potential of the creative play approach in developing other crucial 21st century skills such as critical thinking and innovation among young children.

In light of the importance of creativity in this present era and the coming years, the researcher proposes that more instructional tools of various types be designed and developed to guide and support preschool teachers to incorporate creative thinking in their practice. These tools should have a good balance of providing sufficient guidance for implementation yet allows pedagogical flexibility among teachers. To continually improve the quality of preschool education in Malaysia, creativity in the Malaysian early childhood education should be given due emphasis in research.

Conclusion

This study designed and developed a preschool Creative Play Early Science (CREPES) module to be implemented in preschools, based on the current needs in the teaching and learning of preschool science and experts' consensus on the appropriate content. Findings had positively acknowledged the role of the CREPES module in enhancing both teaching and learning among preschool teachers and preschoolers, specifically in terms of preschoolers' creativity. It has also helped address the needs found in the needs analysis phase and improved current practice in early science teaching and learning in the context of study.

This study had illustrated the need to deliberately infuse creativity into the preschool curriculum to stimulate preschoolers' creativity development in their early years. It had also pointed out an effective approach to do so, through the strong evidence on the impact of the creative play approach in enhancing preschoolers' creativity through implementation of the module. Several important elements that are vital for preschoolers' creativity development include the incorporation of two-way interactions through group activities; integrated learning across developmental domains; hands-on explorations; open-ended questions and activities which stimulate preschoolers' formulation of ideas and problem-solving skills; and the use of the SEA model as a practical guidance for implementation for teachers.

The need to incorporate creative play as a teaching and learning approach in preschools is strongly reinforced through this study. Nevertheless, the researcher maintains that incorporating creative play into the preschool curriculum requires consistent practice, reflection and the desire for constant improvement among teachers, especially in Malaysia where the field of ECE is still in its early developing stage. Undeniably, this process of change does not happen overnight and requires stakeholders' continuous support and encouragement for preschool teachers throughout the process, as emphasised by Cheung and Leung (2013). The implementation of the creative play approach in Malaysian preschools would only be possible with solid support and awareness from the public as well as stakeholders about the paramount importance of developing creativity among children from a young age.

At the same time, more research should also be conducted in this area. This present study could act as a point of reference for future research, especially for DDR studies in the field of preschool education. In order to ensure that all preschoolers are provided with a quality head start in life, creative play should be implemented in preschools to enhance preschoolers' motivation and interest in learning; hence grow up to be creative contributors and valuable assets of both the nation and the world.

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