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FACILITATING A KINDERGARTEN CHILD TO MAKE SENSE OF NUMBER PATTERN AT HOME: A CASE STUDY

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ABSTRACT

This research aims to explore the mechanism of making sense number patterns at home, because of local pandemic COVID-19 outbreaks during the enforcing of the conditional motion control order (CMCO). The new mechanism framework is based on the blending of Skemp's understanding property, Tall's idea of compression, and Chin's supportive and problematic conceptions framework. The researchers employed a qualitative case analysis study design, and a purposive sampling method was used to obtain a sample of one kindergarten child and one parent. Data were gathered in semi-structured parent interviews, direct observations, and analysis of documents such as worksheets and journal entries were performed to gain a comprehensive picture of a child's making sense of number patterns. Results demonstrate that the mechanism was potential successful for helping the kindergarten child in making sense the number patterns. The child was able to make sense and recognise various number patterns at the end of this study.

Keywords: number pattern, early mathematic, home learning

INTRODUCTION

Mathematics is everywhere, and it is a significant part of our everyday lives (Knaus & Featherstone, 2015). People use mathematics in their daily life without realizing it. For instance, students purchase two coconut leaf rice (nasi lemak) at the school canteen, drink half bottle of lemon *syrup* (one kind of southeast Asian famous drink), and plan to buy five movie tickets as well. These explanations demonstrate that mathematics makes our daily lives simpler and more convenient (Lucangeli, 2020). Learning basic numeracy skills is crucial in mathematics learning (Sousa, 2015). What is mathematics? Primary teachers advise us that mathematics is about shapes and spaces, time, money, basic operations, etc. Somehow in our high school days, we reveal a particular subset of mathematics as we generally hear of algebra, geometry, trigonometry, and calculus. At university or college, we learn more deeply about mathematical concepts and mathematical axioms and proof. In general, Reys et al. (2019) look at mathematics in a few ways: 1) mathematics is a way of thinking. 2) Mathematics is an analysis of patterns and relationships. 3) Mathematics is an art. 4) Mathematics is a language that uses carefully defined words and symbols. 5) Mathematics is a way to solve abstract and functional problems in the physical world. In this study, we focus on mathematics is an analysis of patterns and relationships.

Patterns in quantity, patterns in space and shape, and patterns in relationships mount the core concepts of mathematics, and they form the heart of any curriculum (Thiel et al., 2020). Clements and Sarama (2014) defines that patterning is the search for mathematical regularities and structure. More specifically, Minetola et al. (2013) indicated that patterns could be described as repetitions, sequences, and relationships. Examples of these include a sequence of sounds or shapes, an arrangement of beads on a necklace or bracelet, the sequence of seasons in a year or the days in a week, the quantitative change in height or weight as one grows, and the relationship of one number to another in a number pattern. In detail, a number pattern is a list or series of numbers connected by a rule; we need to recognize the gap in a number pattern and see how it is built up (Biggs, 2016). There are some special number patterns such as square numbers, cube numbers, triangular numbers, Fibonacci sequence, and so on (Biggs, 2016). Identifying and applying patterns may help young children order, predict, and make a generalization to seemingly unorganized data (Clements & Sarama, 2014). Hence, it is significant to expose kindergarten children to learn number patterns as a prerequisite of learning number patterns or subitizing in pattern shapes. Exploring patterns is a key opportunity to develop reasoning or thinking as the pattern with variety for children to develop recognition strategies and supports children's mental representation development (Taylor & Harris, 2014). Furthermore, Rivera (2013) describes if children can perform pattern generalization, which means they can combine their perceptual and symbolic inferential abilities to build and reasoning their structure or pattern.

COVID-19 local outbreaks in Sabah occurred in October 2020 (MOH, 2020). Within weeks, Sabah had reported the largest rise in COVID-19 infections in Malaysia (MOH, 2020). The Malaysian government had rapidly adopted a cautious approach to breaking the pandemic chain. On 7 October 2020, the Malaysia education ministry has announced that all schools in districts classified as red zones, which included Schools in Klang, in Selangor, and Sandakan, Papar, and Tuaran in Sabah, will be closed from Oct 8, 2020, to Oct 23, 2020, aimed at monitoring the viral outbreak (MOE, 2020). The unforeseen COVID-19 pandemic created a new norm that had drastically altered the lifestyles and social relationships between the people and the education sector. Various factors will influence a child's difficulties in learning basic numeracy skills, especially in the sense of a new norm of education triggered by the COVID-19 pandemic. This study aims to explore 1) how a parent teaches number pattern to a kindergarten child at home during the COVID -19 pandemic. 2) What are parent's perceptions regarding teaching number patterns? And 3) To what extent does the learner achieve the intended learning outcome, which is being able to recognise the number pattern within 1- 100?

LITERATURE REVIEW

Mathematics education's ultimate purpose is to help learners make sense of mathematics (Chin et al., 2019). Learning mathematics without making sense will end up as rote learning, and in their future mathematics path, leaners may encounter difficulties in solve non-routine problems (Chin et al., 2019). Once mathematics teachers incorporate new concepts, new concepts need to be consolidated with the learners' existing understanding or experience, so that they can make sense of mathematics (Boaler, 2015). United Stated of America National Council of Teachers of Mathematics described:

> "sense making may be considered as developing understanding of a situation, context, or concept by connecting it with existing knowledge or previous experience" (NCTM, 2009, p.4).

When we investigate the sentence deeply, making sense of mathematics emphasizes two elements which are understanding the context and connect with the existing experiences. This contributes to the question of how mathematics teachers can support students with existing knowledge or previous experience to grasp and consolidate new concepts (Chin et al., 2019). Mathematics teachers need to grasp the fundamental structure of how people link these structures together so that pupils can obtain sensible mathematics (Chin et al., 2019). However, they did not mention what and how the mechanism is? This study is to propose a new mechanism framework about making sense of mathematics to fill up the research gap (see Fig 1). We propose a new mechanism framework which consists of three elements which are understanding, supportive and problematic conceptions and compression of knowledge.

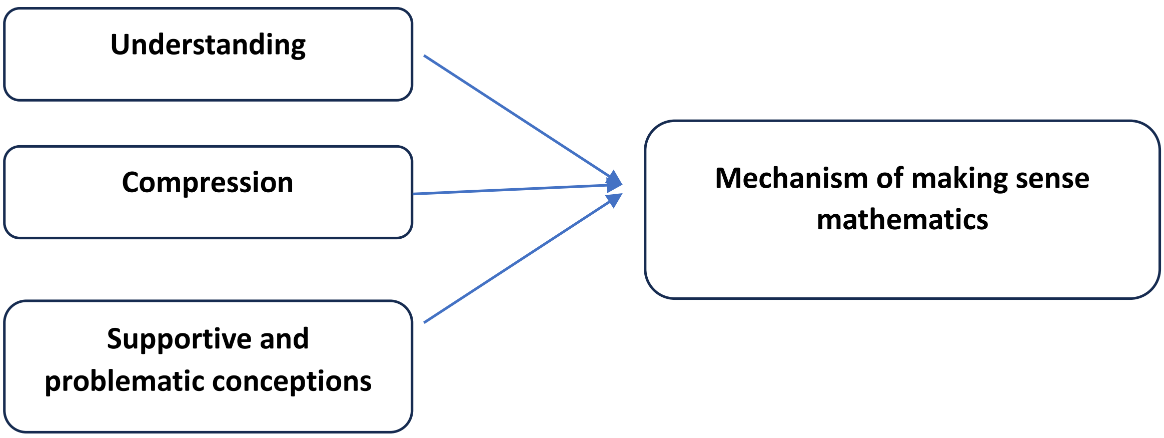

Fig 1: Mechanism of making sense mathematics framework

RELATED THEORIES

Understanding

Polya's problem-solving model indicated that the first step of solving a mathematics problem is understanding the problem (Polya,1945). It is foolish to answer a question that you do not understand. It is sad to work for an end that you do not desire (Polya,1945). Such foolish and sad things often happen, in and out of school, but the teacher should prevent them from happening in his or her class (Skemp,2002). As a result, the student should understand the problem. Somehow, as young children begin formal schooling, they feel anxiety in their mathematical ability, often because their mathematics knowledge has procedurally gone from the meaningful to the abstract too quickly (Tucker, 2010). The worksheets are infeasible for young children, and the unfamiliar formal mathematical vocabulary has no significance for young children. Encouraging children to draw connections between interactions is essential; however, worksheets do not reinforce this crucial connection-making information (Tucker, 2010).

The central idea of making sense number patterns within 1 to 100 is helping children build their own mathematics conceptual understanding using language, concrete experiences, symbols, and pictures. The degree of a child's mathematical understanding depends on strengthening the child's connection between their mental representation with the mathematical concepts (Cotton, 2021). Also, Chinn and Ashcroft (2017) stated that mathematics educators might not need to be a degree level mathematician, but to help children to make sense of mathematics effectively at least must have a good understanding of the nature of mathematics and the content knowledge. In depth, Skemp (2002) explained understanding something means assimilating it into a suitable schema. Schemas are the building units of information in this sense. The clarification of Skemp (2002) is analogous to the conceptions of assimilation and accommodation as suggested by Piaget (1952). This means that when we said we understand something, basically, we are building schemas according to the category. Tall (2013) gave an excellent example of building schema through categorization. For example, when a young child exposes to the shapes of a circle, he or she will receive the information about this shape has no edge by recognition through visualization and physical movement (hands-on experience), form a perception about the characteristic of the circle and store in his memory as a prototype, then further categorize or differentiate other shapes with his own perception in his or her future learning.

Compression

Learners who learn mathematics will engage in a brain process called compression (Boaler, 2015). The compression process occurs since the brain is a highly complex organ with multiple things to manage and can concentrate on only a few uncompressed ideas at any given moment (Boaler,2015). When learners learn a brand-new mathematics topic, it uses a large space in the brain, as learners need to think hard about how it works and how the ideas connect to other ideas. In mathematics learning, compression is needed because it can liberate a learner's cognitive space so that the learner is not forced to concentrate on that information all the time (Chin, 2013). For instance, the learning of numbers is started from the operation of counting. Maybe the learner will count quantity using count all or count on strategy. When the learner has compressed this operation of counting into the number concept, for example, five objects were compressed into Arabic digit "5," then he can use the numbers freely for different basic operations without the need to do the counting all the time, 5 + 5 = 10.

William Thurston, an American mathematician who won the Fields Medal, describes compression like this:

> “Mathematics is amazingly compressible: you may struggle a long time, step by step, to work through some process or idea from several approaches. But once you really understand it and have the mental perspective to see it as a whole, there is often a tremendous mental compression. You can file it away, recall it quickly and completely when you need it, and use it as just one step in some other mental process. The insight that goes with this compression is one of the real joys of mathematics. (Thurston, 1990, p. 847)”

Additionally, Tall's (2013) framework of 'three worlds of mathematics' reveals three ways of compression of knowledge. Firstly, categorization is based on recognition, for example, giving a name to identify the category, such as 'dog' or 'triangle.' This is a structural abstraction of the properties of a concept, drawing them together into a single named entity. Secondly, encapsulation based on repeating actions that are symbolized and can be manipulated as mental entities, for example, compression of a process (such as addition) being compressed into a mental concept (such as sum) and the last is the definition that uses language to formulate a specific concept in a given context (Tall, 2013).

Supportive and Problematic conceptions

Significantly, human conceptions could be developed through prior learning, and they contribute to the formation of a schema (Tall, 2013). Chin's (2013) supportive and problematic conceptions framework highlighted some aspects of previous experience may continue to work and are supportive in a new context, but others may involve problematic changes of meaning. For example, numbers concepts are multifaceted. They have different meanings in different contexts. When introducing numbers as a cardinal value such as 'counting" continue to be supportive, but more subtle implicit properties, such as "Amy takes the number 3 in the queue", or "Messi's jersey is number 10" no longer hold when introducing ordinal numbers and nominal numbers.

In summary, we may conclude that mechanism of understanding is building the structure of knowledge by compression of knowledge. The compression of mathematical concepts through categorization, encapsulation, definition accommodates the supportive and problematic mathematical concepts through different situations and various contexts. Mathematics is a subject that builds on previous knowledge as it extends knowledge (Boaler, 2015; Chin, 2013). However, teaching number pattern with kindergarten children at home differs from learning from a conducive classroom setting. The kindergarten child may not be able to catch up with the learning pace at home. After discussing the mechanism of making sense of number patterns, this study explores how a parent help her child to make sense of number patterns at home.

METHODOLOGY

This study employed a case study research design to collect the relevant qualitative data. It was carried out at one of the normal cell family in Malaysia. A two-level purposive sampling technique is chosen. Merriam and Tisdell (2016) indicated that two-level purposive sampling is typically necessary in qualitative case studies when there is a general concern, a topic, a problem that we are interested in. We find that an in-depth analysis of a specific occasion would delineate that interest. In the first level, we selected one left-handed kindergarten child, Eric (pseudonym). This is because only 10 - 12 percent of the population is left-handed (Kennison, 2018). In the second level, the parent, Elle (pseudonym), was chosen because she was Eric's mother who had an obligation to help Eric master basic numeracy skills. She works as an academic teacher, and she had 10 years of teaching experience. Elle and Eric participated in this study voluntarily. Data were collected through an in-depth interview with Elle, semi-structured observations, and document analyses of Eric's worksheet. One of this study aims to explore how does Elle help the kindergarten child, Eric to make sense of number patterns to at home. This study also explores Elle's views about the application of this mechanism at home, seeking to answer two specific research questions as follows:

1. How does Elle help the four years old kindergarten child, Eric to make sense of teach number pattern?
2. What are Elle's perceptions regarding the mechanism of making sense number patterns?
3. To what extent does Elle help Eric to make sense of the number pattern, which is being able to recognise the number pattern 1- 100?

Background of the research participants

The kindergarten child (Eric – pseudonym)

Eric was a kindergarten child, and his chronological age was four years old. He can communicate well using the Chinese language with his friends and parents, and he was a left-handed learner. Although he is left-handed, he was trained to perform writing using his right hand. Therefore, he can write in both hands. He loves to watch YouTube programs, and he can download games from the google play store on his own. Based on his past nursery assessment result, he could not perform counting well. Sometimes Eric can perform rote counting from 1 to 20 in a correct number pattern. However, he will mix up 6 and 9, and he will write the 3 in a mirror image.

The parent participant (Elle – pseudonym)

Elle is Eric's biological mother, and she works as an academic teacher in one of the national primary school in Malaysia. She obtained a master's degree major in mathematics education from one of the local universities in Malaysia. In 26 out of 31 primary six students achieved grade A in Mathematics subject during the year 2018 Malaysia primary standardized examination (UPSR) under her supervision and teaching. An overview of making sense mathematics mechanism was introduced and demonstrated explicitly to her during the 2 hours online meeting. Moreover, she is active in participating in the educational innovative competition. Elle had three mathematics lessons (30 minutes in each lesson) with her year one kindergarten child every Monday, Wednesday and Friday at night time.

Data Collection and Analysis

Data were obtained in this study through multiple sources during the month-long teaching. We reviewed Eric's worksheet, triangulate it with the lesson observations data and the 40 minutes of in-depth interview to ensure trustworthiness (O'Leary 2014). These journal reflections were the key data used in this analysis (Yin, 2018). Elle chose to compose her journal thoughts after her classes. Self-reports will provide a clearer interpretation of the participant's perspective irrespective of their external reality (Yin, 2018). The researcher implemented two lesson observations. Anecdotal notes and pictures were taken during the observations. The observations' primary aim was to explore Elle's teaching process in helping Eric learn number patterns. Rich data sources were essential to capture Elle's multifaceted interactions of convictions, feelings, and values that make up her teaching (Yin, 2018). After running through her observation findings, Elle wrote her journal thoughts. Elle was also questioned for a 40-minute duration to see her reaction to the intervention and how she feels about her teaching.

We analyzed data from journal reflections, interview transcripts, and observational data using the thematic analysis by Clarke and Braun (2013). The analysis required four separate measures. Since all the writing entries were written in the Chinese language, the first move was translating them into English. To ensure the precision of the translation, cross-checks between the research team members were conducted. Categories were developed based on metrics that arose from the journal entries and how those indicators contribute to the study. In the second step of verifying the transcription, the audio recording was transcribed. The data from Elle's reflective papers, interview transcripts, and lesson observation reports are analyzed, and additional categories of data would be generated based on the needs of the report. During the analysis process, we re-read and re-analyzed the coding principles to ensure that no new patterns have arisen in an attempt to promote the trustworthiness and rigor of the results.

FINDING

Three themes emerged in this present study: (1) Structured play (2) Unlock potential (3) Play and creativity. This section provides a case profile of helping Eric to make sense of number pattern. The case description clarifies how Elle help a kindergarten child, Eric to make sense number pattern through structured play at home. The intended learning outcome for this lesson was being able to make sense and recognize number patterns 1-100.

Theme 1: Structured Play

The result presented in this section is used to answer the first research question (i.e., How does Elle help the four years old kindergarten child, Eric to make sense of teach number pattern?

Finding revealed Elle implement structured play to help Eric to make sense of number pattern 1 – 100.

Board games

Before Elle started the lessons, she prepared an Aladdin board game set and die as her teaching aids (see Fig. 2).

Fig. 2 Teaching aids: Aladdin board game and die

In the interview, Elle explained: "Firstly, I explained the game's rules and regulations to him, I demonstrated how to roll the dice and move the counter according to the dots as shown on the die, when the counter lands on the bottom of a ladder, the players may climb up to the top of the ladder and when the counter lands on the soldier, the player must go back to specific space. At the end of the game, the first player to get the space at 100 is the game-winner. He

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(i.e., Eric) was urged to touch the counters and die." She further elaborated that: "He loves to play games compared to do the mathematics worksheets, normally he initiatively asks me to join his game as well. After that, Elle told Eric about the learning outcome of the day indirectly, which was being able to recognize the number pattern 1 to 100. From the observation data, Eric was so excited to roll the die and move the counter by himself. Elle demonstrated how to subitize the number of dots on the die and move the counter in one-to-one correspondence. Eric repeated Elle's actions to speak the number words aloud and moved to the counter in correspondence then (see Fig. 3). In Elle's reflective journals, she remarked that: "Board games (Aladdin games) may train the young learner to learn subitizing when rolling the die, emphasize counting one-to-one correspondence, and teach the young learner to recognize the number pattern 1-100. The child can move the counter on the Aladdin game board. The child can deepen his concrete experience by touching the concrete materials (counters and die)."

Fig. 3 Eric demonstrated move to count strategy using his left hand

Hundred boards

After the games, Elle showed Eric the green hundred board (see Fig. 4). Elle explained: "I tried to help Eric to make connections between Aladdin games board games that we played previously, and the number pattern 1- 100 shown on the hundred board." Elle further elaborates: "I showed him count in 2, counts in 5 and counts in 10 by pointing the numbers on the hundred board, for example, 5,10,15,20…". Elle stated: "I noticed that eric needs some time to learn the number pattern of 2, 5, and 10. Err…Normally, he learns number sequence by adding one to the previous number, for… for example, 23 +1 =24, so he can get the following number: 25, 26, 27, and so on. When I teach him number pattern of 2, for example, 2, 4, 6..., the gap of each number is adding 2, he needs some time to absorb and learn the new pattern." From the observation data, Eric was engaged in the lesson, and he was motivated to speak aloud the number when he was able to recognise the number pattern within 1-100. Elle led Eric to perform skip counting and pointed to the number board's corresponding numbers concurrently. In this step, Eric can verbally count " two, four, six, eight… (counts in twos) and ten, twenty, thirty… (counts in tens) " slowly in the Chinese language. When Elle asked Eric: "Let's try to count in fives, can you? Eric looked around and paused for a while, then he started to count verbally: "five, ten, fifteen, twenty, twenty-five…" in Chinese. Eric could perform skip counting correctly, and he recognized the number pattern within 1- 100 using point to count strategy. In Elle's reflective journals, she remarked: "My teaching activity is quite smooth... Eric paid attention at all time." This shows that Eric could concentrate on his learning.

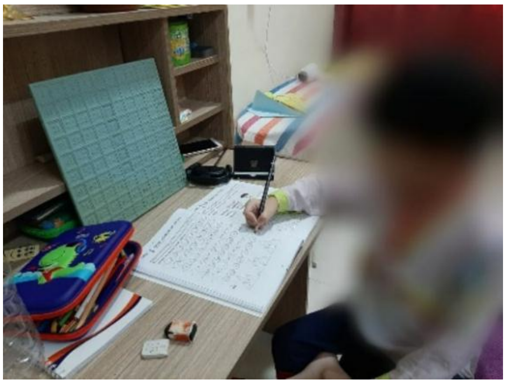

Fig. 4 Elle helps Eric to build up his connections about number concept using hundred board

Worksheet

Elle assessed Eric to recognize number patterns within 1 to 100 in the last learning step. Elle demonstrated the skip counting again and pointed to the correct number on the hundred board.

After the lessons, Elle expressed in her interview excerpt: "It was great that Eric mastered the number pattern, including number sequence 1 to 100 and counted with 2,5 and 10 within 100 after the sessions". Results show that Eric recognized the number sequence 1 to 100 by filling the missing number in the worksheet (see Fig.5). In addition to this, Eric was able to perform skip counting and fill in various number patterns in the worksheet correctly (see Fig. 6). Moreover, Eric can write the number 3 in the correct formation using his right hand.

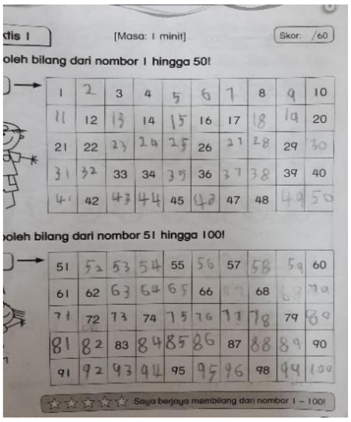

Fig. 5 Eric can fill in the missing number within 100

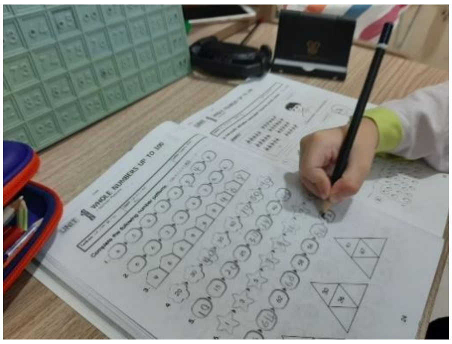

Fig. 6 Eric tries to fill in the missing number in different number patterns using his right hand

Theme 2: Play and creativity

The result presented in this subsection is used to answer the second research question (i.e., What are Elle's perceptions regarding teaching number pattern?). In the interview, Elle indicated that play is practical that could guide her teaching and scaffold child's creativity. Below is the interview excerpt:

> *"Every child loves to play…emm…Eric is motivated to roll the die on six and move the counter from space 20 to space 26. Well… he performs the skip counting by two, and count the number two, four, six verbally. He said counts by 2 is faster. It was a good sign for him to know about number patterns of 2, 5, and 10."*

She stressed that:

> *"Frankly, erm…I started my teaching strategy by playing games, then makes the connection the number pattern with the hundred board. Finally, I assessed Eric's understanding by giving him a worksheet and asked him to fill in the missing numbers on different number pattern within 1 to 100.*

She further elaborated that:

> *"When he can't remember the missing number in the sequence, I try to give him a hint, for example, do you still remember you the space that you meet the bottom of the ladder that you climb up to space 72, then he can recall the number of 51 is the bottom of the ladder."*

Observation data indicate that Reconnecting Learning is a practical intervention. Below are excerpts from her reflective journals:

"Sometimes, he is quite creative and thinks out of the box, and he will break the rules to get up the ladder. For example, space number 4 is the bottom of the ladder which connect to space number 24, and Eric rolls a number six on his die, then he counts one, two, three, four, then he moves his counter to space 24 and continue to move two steps forward to space number 26 ."

"It was funny that he can think so creative and think out of the box to achieve the target (get up the ladder). Another example, Eric's counter on the space of number 6, and he rolls his die on his turn, and he gets a two, he moves his counter backward to climb up the ladder."

"Of course, Elle did emphasize the rules of the games that the counter only can move forward and cannot reverse."

Theme 3: Unlock potential

The result presented in this subsection is used to answer the third research question (i.e., To what extent does the parent achieve the intended learning outcome, which is being able to recognise the number pattern 1- 100?). Elle expressed that she tried to help Eric unlock his learning potential by exposing more mathematical skills and knowledge.

In the interview, Elle illustrated:

> *"Some of the important numeracy skills such as subitizing and number pattern within 1- 100 is not in the Malaysia standard kindergarten curriculum (KSPK). I try to lead Eric to unlock his potential and see how far he can go. Of course, I won't teach him difficult topics like fractions at this moment.*

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She continued:

> *"Based on my 10 years teaching experiences, my point is…every pupil has his own potential and own way to learn mathematics. Emm… I know about the learning milestones according to the chronological ages…emm…however… do not judge students' learning ability and their level of knowledge absorption."*

The document excerpt clearly showed that Eric was able to complete various number patterns in the worksheet, although this worksheet originated from the primary one mathematics workbook (see Fig.6).

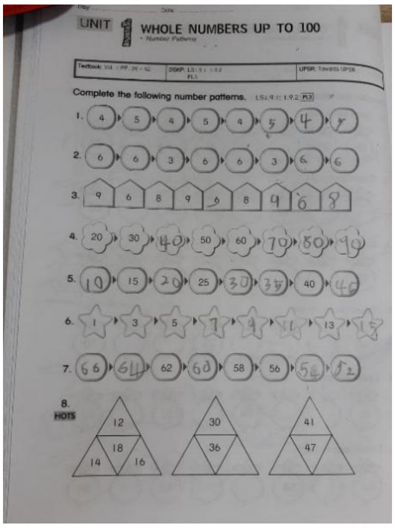

Fig. 6 Eric completed various number pattern on the worksheet

DISCUSSION AND CONCLUSION

This study provides a significant window into how a parent help her kindergarten child to make sense of the number pattern at home during conditional movement control order and the effect of teaching and learning.

Elle embodied the mechanism framework in helping Eric to make sense of number pattern by implementing structured play in three steps. As parallel to Cotton (2021), the central idea of making sense number patterns is to build their own mathematics conceptual understanding using language and concrete experiences. She began with the playing board game and provided Eric with the first input regarding subitizing and one-to-one correspondence counting (perceptual understanding) using the die and Aladdin board game. She tried to trigger Eric's first learning pathway with the game. Eric recognised the whole process of subitizing the die, counting one-to-one corresponding and number patterns in the first step. Here, Elle helped Eric to understand the game's rules and regulations. It is important to understand the problem as it is the first step of solving a mathematics problem (Polya,1945). The interview data stated: "Firstly, I explained the game's rules and regulations to him (i.e., Eric), I demonstrated how to roll the dice and move the counter according to the dots as shown on the die". Then in the second step, Elle also solved the problem of building child's mathematics knowledge has procedurally gone from the meaningful to the abstract too quickly (Tucker, 2010). Elle helped

Eric to build up his number concepts and number patterns. The interview data stated that: "I tried to help Eric to make connections between Aladdin games board games that we played previously, and the number pattern 1- 100 shown on the hundred board." and "I showed him count on 2, counts on 5 and counts by 10 by pointing the numbers on the hundred board, for example, 5,10,15,20…". In the last step, Eric was able to recognize the number sequence 1 to 100, performed skip counting, and filled in various number patterns in the worksheet correctly. Elle helped Eric to make sense of the number pattern by drawing the connections between the board games and hundred board. Then, Elle made the worksheets feasible by reinforcing this crucial connection-making information.

Elle felt that every child loves to play. She highlighted that play could motivate children to learn initiatively and build their creativity in learning. From the document analysis data, Eric's counter on the space of number 6, and he rolls his die on his turn, and he gets a two, he moves his counter backward in order to climb up the ladder. Although Eric broke the game rules, he was able to think moving backward by two steps, six minus two equals to four, and he moved two steps backward from space number 6 to number 4 and climb up the ladder. In this case, Eric has compressed his knowledge by counting backward. Tall (2013) stated that the operation of counting is one example of the compression. Elle also pointed out that teachers can impart the mathematical concept through play to the child. She gave a significant example by playing board games with Eric, made the connection between the Aladdin board game with the hundred board to build Eric's mathematical concepts, and assess Eric's understanding using a worksheet.

Elle indicated that a child's learning potential is not fixed. During the lessons, Eric could answer Elle's questions, and he was able to perform the skip counting verbally. Eric demonstrated that he knew number patterns by adding on different numbers. At last, Eric completed the number pattern correctly in his mathematics worksheet. Eric can write the number 3 in the correct formation using his right hand. The results showed that structured play is a potentially practical teaching strategy that could help the kindergarten child to learn number patterns at home. In detail, structured play can help the kindergarten child to unlock his learning potential and develop his early mathematical skills.

When we discuss the mechanism making sense mathematics framework, it consists of three main elements: understanding, compression, and supportive and problematic conceptions. In this case, Eric had the previous knowledge of rote counting from 1 to 20. Elle tried to expand Eric's mathematical skill by exploring number sequence 1 to 100 and different number patterns within 1 to 100, for example, count in 2, count in 5, and count in 10, which is not included in the national kindergarten mathematics syllabus using structured play. Elle introduced the board game to Eric, asking Eric to roll and subitize the dots of the dice and then move his counters. In this action, basically, Eric already fulfilled two elements of the mechanism of making sense of mathematics. The number is one example of compression (Tall, 2013) when Eric can subitize the die, which means he was able to compress the dots' numerical magnitude to number. Secondly, he moved his counter in a correct correspondence also means that he understands the game rule and he was able to perform rational counting as Skemp (2002) explained understanding something means assimilating it into a suitable schema. When Elle expanded the number pattern 1 to 100 to Eric, he still can consolidate the new knowledge with his previous knowledge (number pattern 1 to 20). However, Eric encountered problematic conceptions when Elle introduced him to number pattern count in 2, count in 5, and count in 10, and he needed more time (i.e., slowly, paused for a while) to comprehend the number pattern in new situations. From the interview data, Eric can verbally count " two, four, six, eight… (counts in twos) and ten, twenty, thirty… (counts in tens) " slowly in the Chinese language. When Elle asked Eric: “Let’s try to count in fives, can you? Eric looked around and paused for a while, then he started to count verbally: “five, ten, fifteen, twenty, twenty-five…” in Chinese. At the end of the lessons, Eric was able to recognize the number sequence 1 to 100 and completed various number patterns in the worksheet correctly. This indicates that the mechanism of making sense of mathematics was able to be embodied in Elle’s structured play to develop number pattern for the kindergarten child at home. This mechanism may help to unlock an individual's potential and with suitable mathematics teaching strategies.

The study clearly has limitations. Even considering the limitations in terms of the sample size and the study's relatively narrow focus, some implications are evident. First, the mechanism helped Elle teach number pattern to the kindergarten child, Eric. Second, this single case study shows that the mechanism is practical in helping the parent participant achieve the intended learning outcome through her own teaching strategies. Third, this study shows that the kindergarten child could recognise number patterns after the teacher participant implemented structured play. Further research should be undertaken with a larger sample size and a broader content focus to investigate this mechanism's effectiveness in teaching mathematics to all levels of children.

This study's main contribution was introducing a potentially practical mechanism to help kindergarten children learn and make sense of number patterns. This mechanism is practical and can potentially tackle the core problem of the left-handed kindergarten child. The parent participant has demonstrated how she implemented this mechanism in her lessons, and the proposed learning outcome was achieved.

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