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TOWARDS NUMERACY LITERACY DEVELOPMENT: A SINGLE-CASE STUDY ON THE USE OF THE LIVING BOOK HOMESCHOOLING MODEL

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ABSTRACT

Public schools are not always believed to be able to support the development of an individual's potential comprehensively. Homeschooling, an educational program where students learn from home, is currently an alternative education. This study aims to reveal why parents choose to homeschool their children and describe how a homeschooler parent as a single tutor develops her child's numeracy literacy skills in living book homeschooling. This research is a holistic single-case study with two subjects: a homeschooler (J) and his mother (UPL) as the tutor. Data were collected through in-depth interviews and document analysis of J's learning activities. Thematic analysis with Atlas.ti software was employed. Findings reveal that the parents' main reasons for homeschooling are dissatisfaction with public school instruction and flexibility to comprehensively develop homeschoolers' skills. In addition, the integration of RME (Realistic Mathematics Education) in the living book homeschooling model is a very powerful support to students' literacy numeracy development. Practically, there are three main strategies implemented; the use of real contexts and concrete teaching aids, as well as an emphasis on conceptual understanding and high-order thinking skills.

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1. INTRODUCTION

Formal schools are not always trusted to be able to comprehensively support the development of children's potential. For various reasons, many parents feel dissatisfied with the academic system in formal schools and then decide to send their children to school at home (Aram et al., 2016; Boulter, 2017; Pozas et al., 2021). Home-schooling, an educational program where children learn from home, is one of many viable alternatives for education. Although the number is still limited when compared to formal schools, homeschooling has become an alternative educational program offering various advantages.

The homeschooling program provides a wider opportunity for parents to improve the educational quality, develop their children's moral and religious values (Razi, 2016), meet the needs of children with medical problems or special needs (Jamaludin et al., 2015), and maintain childrens' mental health and keep them away from various potential negative environmental influences (Ray, 2015). In addition, the main uniqueness and strength offered by homeschooling is 'customized education', where learning design is adapted to children's potential and the surrounding environment (Purwaningsih & Fauziah, 2020). Parents have the flexibility to adopt the best teaching methods and learning activities based on their children's needs, which is why homeschooling is believed to be more capable of maximizing children's potential. Some studies even claim that children who are homeschooled have better academic performance than students who are formally schooled (Ray, 2015; Wichers, 2001). It further emphasizes that customized learning in homeschooling has great potential to support students' achievement- not only for academic aspect but also for various other life skills.

The implementation of homeschooling programs should ideally be supported by adequate resources, especially in terms of parents' readiness to optimize children's learning experiences (Pozas et al., 2021). Parents play a major role as teachers, managers, dynamists, facilitators, and motivators for homeschoolers. But in fact, not all homeschooler parents are ready to optimize their children's learning process. Several previous study results reveal not all students who attend homeschooling have good academic achievements, because not all of their parents have adequate experience and good pedagogical competence to run their role as tutors/teachers. Some homeschoolers' parents tend to apply the conventional way to teach their children at home by replicating the learning activities and classroom environment in formal schools. In other cases, many of them simply hire private tutors without considering the needs and conditions of their children.

While most homeschooler parents entrust private tutors to teach their children, Mrs. 'UPL' -a housewife- dedicates most of her time to independently create the best learning environment to facilitate her child 'J' to attend homeschooling program. The initial interview with Ms. UPL revealed that trust issue toward formal, public schools is one of the main factors to elect homeschooling program. She claimed that customized home-based learning could optimize J's learning experience based on his interests and talents. The homeschooling instruction designed by Ms. UPL focuses on literacy development, a fundamental competency that should be honed from an early age but is sometimes even neglected in the formal school. Ms. UPL employed a variety of learning methods based on various instructional theories. These innovative efforts explicitly have positive impacts, hence the literacy development-based learning applied by Ms. UPL in homeschooling class is fairly interested to investigate further.

This article specifically focuses on the development numeracy literacy undertaken by Mrs. UPL in the homeschooling program for J. This issue is important to be thoroughly explored due to the fact that numerical or mathematical literacy has become a global concern in the field of mathematics education, as it is considered an essential skill that must be acquired by every mathematics learner. Numeracy literacy emphasizes the significance of learning mathematics within a real-world context (Amaral & Hollebrands, 2017; Widjaja, 2013). Despite its importance, it is a common challenge that many mathematics learners struggle to apply mathematical concepts in their everyday lives (Benson-O'Connor et al., 2019; Bolstad, 2023; Dewantara et al., 2015; Wijaya et al., 2014). The poor performance of students in numeracy literacy has become a global issue. Therefore, any efforts or strategies aimed at enhancing students' numeracy literacy skills are worth to discuss.

Numeracy or mathematical literacy development have been addressed by numerous studies (Chen & Chiu, 2016; DeCoito & Richardson, 2018; Solano et al., 2018). Several

previous studies also have examined homeschooling programs which highlight the homeschooler parents' perspective. Those previous researches could generally categorized to four aspects: diversity of parental profession as main tutors in home-schooling (Purwaningsih & Fauziah, 2020), parents' perspective on homeschooling (Jolly et al., 2013; Neuman & Guterman, 2017a), the impact of homeschooling program (Letzel et al., 2020), parents' motivation for home education (Collom, 2005), as well as parents' experiences of homeschooling amid COVID-19 pandemic (Fontenelle-Tereshchuk, 2021; Parczewska, 2021; Reaburn, 2021; Thorell et al., 2022). However, there are no studies that specifically investigate how to develop numeracy literacy of a young learner in a homeschooling program. Therefore, this study aims to reveal why parents choose to homeschool their children and to examine how a homeschooler parent as a single tutor develop her child's numeracy literacy skills in the living book homeschooling model.

2. METHOD

2.1. Research Method

This is a qualitative research with holistic single-case study approach. Holistic single-case study is a type of case study approach that investigate a unit as single global phenomenon (using single unit of analysis) (DePoy & Gitlin, 2016; Yin, 2014). This study is categorized as a single case study due to it focuses on single-case which is considered unique and has special distinction compared to other similar cases.

2.2. Participants

The researcher tried to explore information about the literacy development process through the living book homeschooling program which was carried out by two subjects involved in this study: Mrs. UPL and her son J. Mrs. UPL is a 35 year old housewife domiciled in Yogyakarta, Indonesia who chose to be a tutor for her son J (7 years and 3 months) who is currently undergoing a homeschooling program.

2.3. Instruments and Procedures

This study used two instruments: interview guidelines and documents (syllabus, teaching materials and homeschooler J's portfolio documents). In-depth interviews were conducted with two research subjects using semi-structured interview technique to reveal how the homeschooling learning process was undertaken by J and to deeply analyze how the numeracy literacy development model was implemented by Mrs UPL in the homeschooling program. The interviews were conducted three times online via Zoom meeting (twice with Mrs. UPL and once with student J, accompanied by Mrs. UPL), on October 21, November 15, and November 22, 2022. The duration of each interview ranged from 50 to 70 minutes. To ensure the informants felt free and comfortable during the interview process, the researcher aimed to create a conducive atmosphere (Creswell & Poth, 2016).

To support the results of these interviews, the researcher analyzed homeschooler J's portfolio documents, particularly in the mathematics course. The portfolio documents refer to J's completed mathematics problems provided by Mrs. UPL on various topics/materials. In addition, there were several short videos that demonstrated J's problem-solving process for some mathematics questions. The selection of learning documents was purposive, aligned with the specific topic addressed in this study, namely integer operations (addition and subtraction). Data validation was carried out using the triangulation method: source and method/technique triangulation. The interview data from Mrs. UPL and J were cross-

referenced with the learning documents and videos of J's learning process to gain the credible data. The obtained data were subsequently analyzed qualitatively.

2.4. Data Analysis

Data analysis employed thematic analysis using Atlas.ti (version 22.2.5) software. Analysis is inductive, where the results of qualitative research emphasize meaning rather than generalization. Data analysis consisted of three stages: data reduction, data display, and drawing conclusion (Miles et al., 2019). The initial step of data analysis in this research involved transcribing the recorded interview and J's learning video into a written transcript, enabling easy analysis of the content. The researchers thoroughly reviewed all the transcripts multiple times. In the data reduction stage, the researchers reduced the collected information from the first stage (including interview results, learning documents, and videos) by sorting and selecting relevant and significant data, identifying themes and patterns, and excluding irrelevant data. The identified important information was then grouped into central themes. The reduced data was displayed in the form of descriptions and diagrams (see Figure 1) that illustrated the relationships between themes or categories. The core of the description entails capturing the essence of the informants' (Mrs. UPL and J) experience and examining how they deal with numeracy development in the book living homeschooling. Subsequently, interpretation was conducted on the reduced and displayed data. In the final stage, the researchers performed verification to ensure the accuracy of the analysis results, drew conclusions, developed findings, and assigned meaning based on the data analysis.

3. RESULT AND DISCUSSION

3.1. Results

3.1.1. Parents' Reason for Homeschooling

Mrs. UPL, the subject of this research, decided to homeschool her son for some reasons. Being the only parent in her village to decide to independently school her children with a homeschooling system is based on several considerations, one of which is the degradation of trust in the meaningfulness of the learning process from regular formal schools. In an interview, Mrs. UPL stated that "My husband and I are interested in homeschooling because we think that the lessons in schools are not relevant and not lasting. Even if most of us are asked what lessons we remember, we mostly forget them, even though school is for years." Furthermore, Mrs. UPL emphasized that most or almost all of the formal school programs are focused on academic development. However, in her opinion, to optimize a child's potential, it is not enough to simply develop their academic abilities, but it is also necessary to develop their talents, interests, and life skills. Therefore, according to her, homeschooling is the right choice because the academic learning sessions can be balanced with the child's other needs.

Mrs. UPL's decision to school her child through homeschooling was welcomed by her son, J. Initially, Mrs. UPL also gave J the freedom to choose whether he wanted to try formal schooling like the other children in the village, or to go to school with a homeschooling system. Without thinking too long, J chose to attend school independently at home because he is a child who likes to explore the environment. With the flexibility in time that he has when learning through homeschooling, before starting academic hours (at 09:00), he is free to play and explore the environment such as going to the fields, small rivers, gardens, and around. Such activities are certainly difficult for him to do freely when restricted to school hours if he were to attend formal school.

3.1.2. Development Model of Homeschooler's Numeracy Literacy

One of the main focuses of the learning applied by Mrs. UPL in homeschooling is the development of literacy and numeracy, basic skills that should be cultivated early on but are often overlooked, including in the formal learning system in schools. This article specifically examines the development model of numeracy literacy applied by Mrs. UPL in the living books homeschooling program.

Based on the results of data analysis using software Atlas.ti, the mapping of numeracy literacy development model in the living books homeschooling conducted by Mrs. UPL and J can be visualized in the following network diagram (see Figure 1).

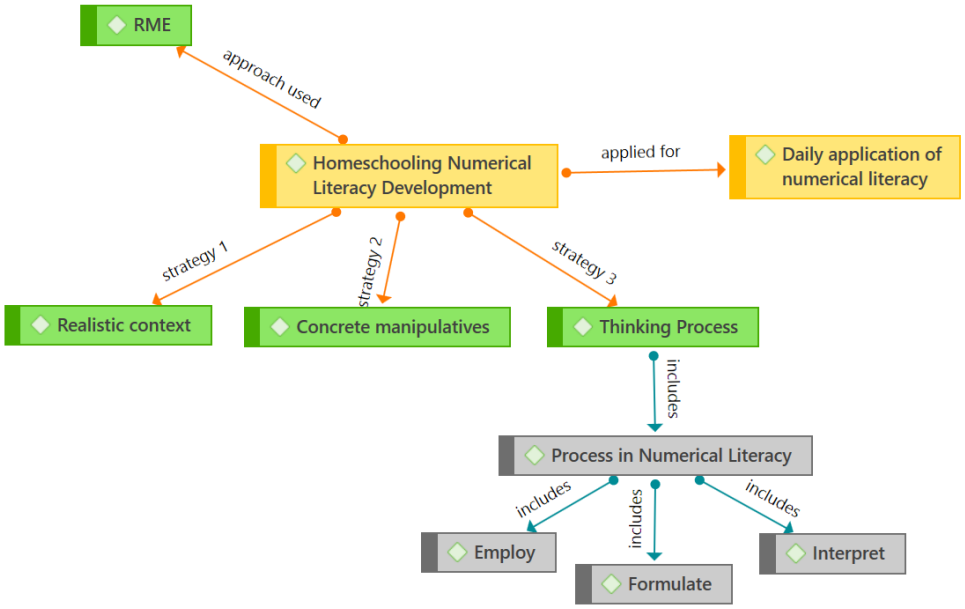


Figure 1. Development model of J's numeracy literacy in homeschooling

Based on interviews with Mrs. UPL, it was found that the process of developing numeracy literacy in the living books homeschooling program is carried out using a realistic approach, namely RME (Realistic Mathematics Education). Figure 1 also provides information that in practice, the strategies for developing numeracy literacy applied by Mrs. UPL generally consist of three things, as follows:

a. Using a real context, which is a familiar context that can be imagined by the students, or is close to the students' real experiences and consistently connects various mathematical topics with real student situations.
b. Using concrete manipulatives to bridge students' understanding of concepts from informal concrete forms to formal mathematical abstract forms.
c. Emphasizing concept understanding and high order thinking skills, not just focusing on computational or memorizing skills only.

The first strategy for developing numeracy literacy applied is the use of realistic contexts. According to Mrs. UPL, context is the starting point for introducing a material to be taught. Therefore, the selection of context must be familiar so that it is easily understandable and imaginable by J. The context selection strategy carried out by Mrs. UPL is to use contexts from things that J likes or are close to his real experiences. For example, J is a child who enjoys fishing in a pond, looking for worms in the fields, and flying kites. The

activities from these hobbies then become context ideas in the numeracy learning model designed by Mrs. UPL.

According to Mrs. UPL's admission, the context of activities such as fishing, looking for worms, and playing kites, which are used as the initial situation to introduce a mathematical concept, has proven to be effective in attracting J's attention. J was enthusiastic to ask further about the material to be learned if Mrs. UPL gave narratives or stories about things he likes at the beginning of the learning. The use of contexts that are close to the students' experiences make the students interested and motivated to learn mathematics. Students view the mathematics being learned as applied and useful for solving problems related to real world conditions and their daily experiences. Therefore, the use of the right context can motivate students to participate in mathematics learning activities. With good context, mathematics learning become more meaningful and enjoyable.

In addition to being used as a starting point for learning, realistic situations are also commonly used as the context for practice problems. Here is an example of a problem using the context of J's daily activities developed by Mrs. UPL (see Figure 2).

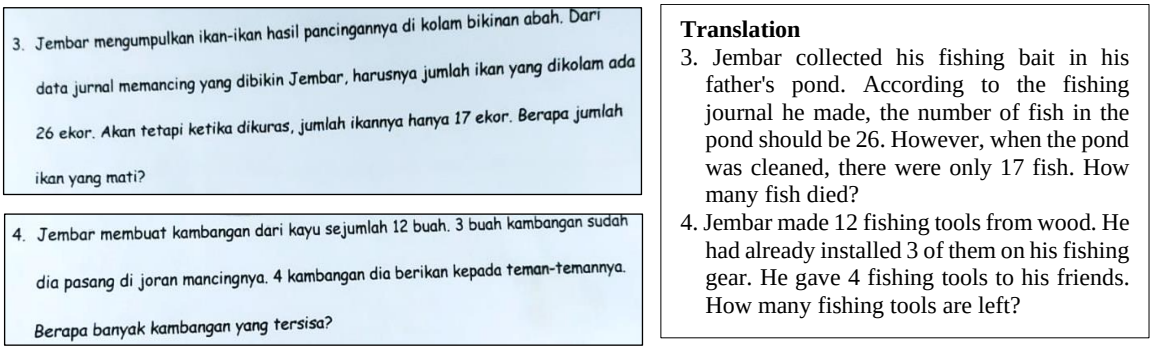


Figure 2. Context problems

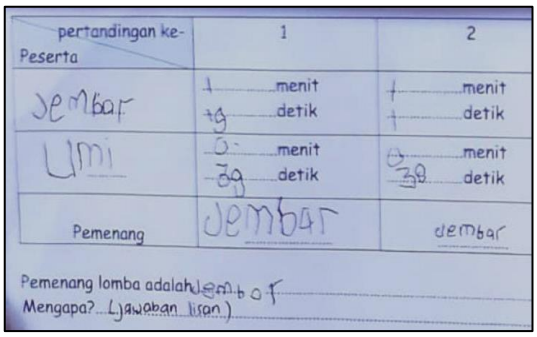
Figure 2 indicates that the realistic context is not only found as the starting point of learning designed by Ms. UPL, but it is also used as the context for assignment or task problems. The context used to construct the situation in the problem is referred to as the problem context.

The use of realistic context by Mrs. UPL is closely related to the characteristics of the living books model, the homeschooling approach being followed. The focus of this model is the involvement of students in various activities to gain real-life experiences. The concept of living books can be realized in various mathematical activities that are close to the students' everyday experiences.

Some examples of daily activities used as learning contexts by Mrs. UPL include fishing in the river, shopping at a store, playing with toy cars, making kites, and accompanying Mrs. UPL shopping at the market. Mrs. UPL uses these daily activities as realistic contexts to introduce various mathematical concepts. In some cases, these activities are also used as 'learning environments' in developing numeracy literacy. Mrs. UPL calls it 'playing while learning' and 'engaging in daily activities while learning mathematics.' In many cases, J was involved in various mathematical activities on a daily basis. For example, Mrs. UPL introduced J to currency topic. As a follow-up activity, Mrs. UPL gave J some money and asked him to go shopping at a store, recorded the purchases and told about his activities after returning from shopping. From this simple activity, many applied mathematical content could be taught to J in an enjoyable way.

Another example is the activity of playing gasing (a traditional game in Indonesia). Mrs. UPL and J competed in playing gasing and recorded the time of their play in each

session (see Figure 3). Through this activity, Mrs. UPL introduced the concept of time measurement through an enjoyable game. The context of shopping and playing gasing are just two out of many learning contexts used by Mrs. UPL to design mathematical learning in the living books homeschooling program.



Translation:

Participants	Match	
	1	2
Jembar	1 minute 19 minutes	1 minute 1 minute
Umi	0 minute 39 seconds	0 minute 38 seconds
Winner	Jembar	Jembar

The winner of the match is (Jembar)……..
Why? (oral answer)

Figure 3. Game activity (time measurement) record

The second strategy applied is the use of various concrete manipulatives as learning aids. Mrs. UPL uses manipulatives as a support to bridge J's understanding towards the formal mathematics stage. Mrs. UPL believes that abstract mathematical material will be much easier to understand with the help of manipulatives. The manipulatives used are tailored to the teaching material and easily found or made using simple materials.

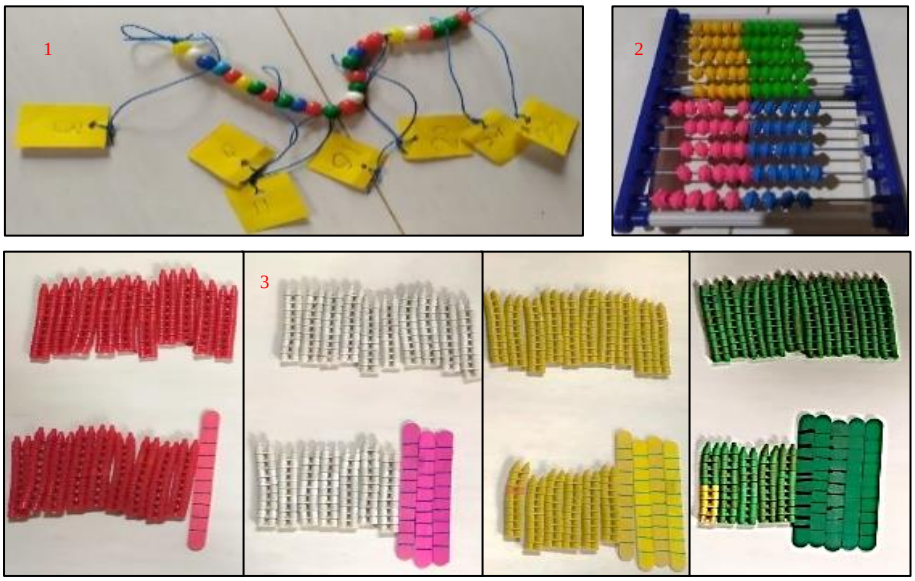


Figure 4. Manipulatives (1. beads, 2. abacus, 3. mini legos)

Some examples of concrete manipulatives (see Figure 4) used by Mrs. UPL and J are:

a. Beads. This manipulative is used to recognize numbers as a sequence and as a tool to perform addition and subtraction operations 1 - 100.
b. A 10 x 10 abacus, used for counting numbers up to 100.
c. Mini Legos as a tool to learn place value and perform operations counting 20 - 1,000. The mini Legos are a simple and inexpensive modification of the relatively expensive Dienes blocks.
d. Stopwatches and and broken clocks are used to help learn about time measurement.

e. Rulers, popsicle sticks, rulers, and sewing meters are used as manipulatives to learn about length measurement.

The third strategy applied by Mrs. UPL is emphasizing understanding of concepts and high-level thinking skills such as reasoning and problem solving, not just computational skills. In order for math learning to be more meaningful, the learning goal should not just focus on memorizing formulas or proficiency in applying mathematical algorithms. Instead, students should have meaningful experiences in the learning process, one of which is discovering mathematical ideas/concepts with the help of the teacher as a facilitator. In the context of homeschooling being undertaken by J, Mrs. UPL plays an important role in facilitating and stimulating the development of independent learning so that J is expected to be able to construct his own mathematical concepts being learned. As the sole tutor of math in the living books homeschooling program, Mrs. UPL plays a central role in designing learning activities for J. Using realistic contexts and manipulatives, Mrs. UPL designs learning with activities that stimulate J to construct his cognitive ideas in understanding mathematical concepts from abstract to formal mathematics.

In an interview, Mrs. UPL explained that the activities designed for mathematics education used a Realistic Mathematics Education (RME) approach, which focused on the development of numeracy literacy. RME was chosen as the learning approach to create meaningful learning. In the RME view, mathematics is a human activity. In the RME approach, the focus of the learning activities is based on students' real-life experiences and the use of real-life situations. Therefore, the learning activities began with a realistic or real-life context, aided by manipulatives, and then developed into a model using the manipulatives, culminating in the discovery of abstract, formal mathematical concepts. This series of learning activities is known as a learning trajectory.

One example of a learning trajectory with RME approach oriented towards the development of numeracy literacy developed by Mrs. UPL is on the addition and subtraction of numbers 1-999 topic. The learning is started with various activities using realistic contexts, that is, contexts that are close to real situations or everyday experiences. For example, context situations used for the subject of addition and subtraction are various activities that J likes. For example, adding up the fish or worms caught by J, adding up the passengers in a train car, subtracting the papers used to make a kite, and so on.

Next, the counting operations are carried out using concrete manipulative materials or replicas of real objects, such as mini legos. After J is proficient in using the concrete manipulatives, the next step is to create a model/illustration of the manipulatives (a representation of legos) and provide a sign as a representation of the counting operation being carried out. A picture model of the legos he made refers to a model-of. Creating an illustration/model of manipulatives was shown by J in solving substraction problems in his learning document (see Figure 5).

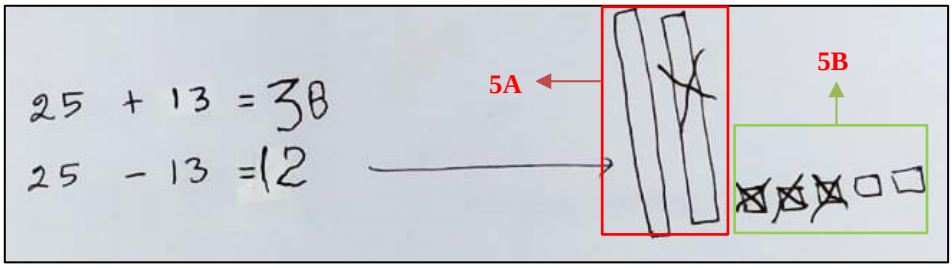


Figure 5. Creating model-of a substraction problem

The way of his thinking beyond the picture and answer J made were then confirmed through interview as follows.

Transcript 1

[1] R : *Why did you use picture/ illustration to solve 25-13=12 problem?*
[2] J : *Because I did not use legos anymore.*
[3] R : *Ok, Could you explain what picture is this?*
(pointing illustrations 5A and 5B).
[4] J : *Lego. The bigger one (pointing illustration 5A) is lego "tens", the big lego.*
The smaller picture (pointing illustration 5B) is lego 'ones', the small lego.
[5] R : *Then, how to solve the problem using these pictures?*
[6] J : *Mmm…The problem is 25. I drew 2 big legos and 5 small legos.*
Then minus 13. Mmm..that was 1 lego and 3 small legos.
[7] R : *What did you do with 13?*
[8] J : *We crossed it out. 1 big lego and 3 small legos.*
[9] R : *If it is a substraction, do we need to cross it out?*
[10] J : *Yes, it is, Mrs.*
[11] R : *Then, how to get the final answer?*
[12] J : *See how many are left, which are not crossed out. 1 big lego, 2 small legos.*
[13] R : *So, what is the answer?*
[14] J : *12. 1 big lego is 10, 2 small legos are 2.*

In the next step, J is assisted by Mrs. UPL in creating a model that is directed towards finding solutions to add or subtract. In the final step, J works with procedures and mathematical symbols as a form of formal abstract mathematics. At this formal level, J is able to write mathematical sentences for addition or subtraction operations, such as 25+13=38 and 25-13=12. The learning trajectory can be depicted in the form of an iceberg in the following Figure 6.

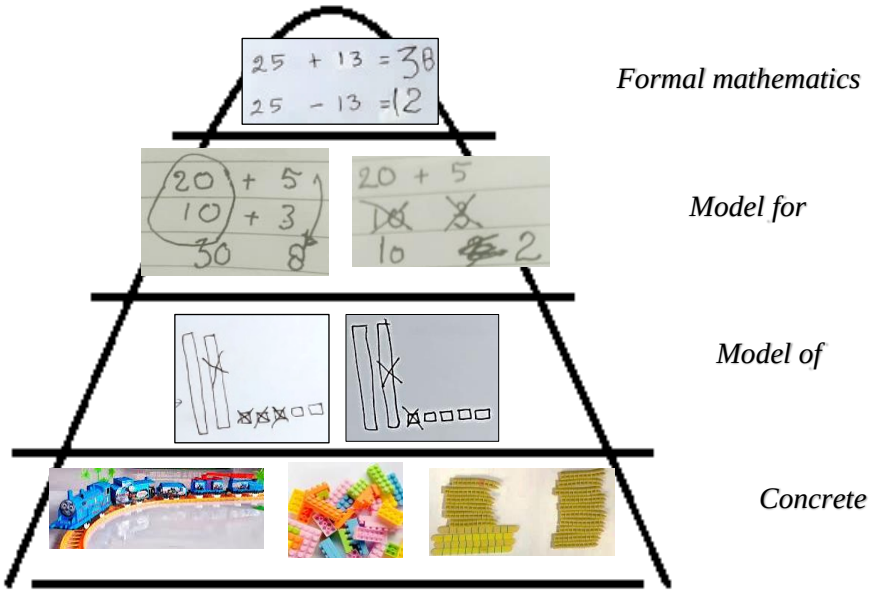


Figure 6. Iceberg of learning trajectory (counting 1-999)

3.2. Discussion

3.2.1. Parents' Reason for Homeschooling

The decision of parents to school their children with a homeschooling system is motivated by many factors. Mrs. UPL, the subject of this research, is also such a case. One of primary reasons is the willingness to optimize her son's potential, not only for academic aspect but also talent, interest, and life soft-skills such as problem solving, creativity, self-regulated, independent, and so forth. Homeschooling then is considered as the most fit program to develop all those potential in a flexible way.

This reason is in line with the results of previous studies that lack of trust in formal schools is one of the major reasons that parents decide to school their children with a homeschooling system (Nuhla et al., 2020). In addition, the trend of homeschooling has become popular because it is considered able to support a child's competence and potential more optimally. The flexibility in time and material makes homeschoolers have more opportunities to explore and develop their potential based on their unique learning style, talent, and interests. Homeschooling is considered able to develop a child's cognitive, affective, and psychomotor domain aspects in a balanced way, so homeschooling education provides a real experience that is beneficial for a child's life skills.

The homeschooling education system can be categorized from structured homeschooling (like school at home) to unstructured homeschooling (unschooling) (Neuman & Guterman, 2017b). In practice, the approaches used are varied. Mrs. UPL applies a homeschooling system called the living books model. This model developed by Charlotte Mason focuses on the use of real experiences. The approach used is teaching good habits, basic skills (reading, writing, math), and activities to gain real experiences such as going for a walk in a park, visiting a museum, shopping at a market, and so on (Muhtadi, 2012; Na'imah, 2019).

3.2.2. Development Model of Homeschooler's Numeracy Literacy

One of strategies to develop numeracy skill is through home numeracy activities. This strategy is suitable to apply in homeschooling program. The finding of this study reveals that Mrs. UPL tried to develop J's numeracy skill through home numeracy activity with three main strategies: 1) Using a real context which is familiar and can be imagined by the students, 2) Using concrete manipulatives to bridge students' understanding of concepts from informal concrete forms to formal mathematical abstract forms, and 3) Emphasizing the problem solving and other high order thinking skills such as reasoning, critical thinking, and creativity.

The first strategy is the use of realistic contexts. Context is the starting point for introducing a material to be taught, so that is why the context should be interesting, contextual, and easily understandable by the student. The proper selection of context is the main thing to consider in mathematics learning. Cheng (2013) proposed that real-life context problems refer to problems embedded in real life situations that have no ready-made algorithm.

The context selection strategy implemented by Mrs. UPL using realistic situations or everyday problems, hobbies, or real experiences of her child J is in accordance with the theory of previous experts. Mrs. UPL's strategy of using realistic context aligns with the characteristics of Realistic Mathematics Education which uses the real world as a source or starting point for the development of mathematical concepts (van den Heuvel-Panhuizen & Drijvers, 2014). The use of context is one of the five characteristics (tenets) of RME. The context used in RME is real life situations or phenomena that children are familiar with.

In RME, real context is used as a starting point to construct students' mathematical concepts and ideas. It has been confirmed by Trung et al. (2019) that teachers need to use context or create context that can help students construct their mathematical knowledge. However, in RME it is necessary not only to motivate students with everyday life contexts, but also to associate with experimentally real contexts and use them as the starting point for progressive mathematization (Gravemeijer, 2001). A good context serves as a bridge for students to be involved in mathematical activities. As previous research has shown, the use of real-life context such as congklak traditional game (Dewantara & Mahmud, 2020), traditional market (Wibawa et al., 2022), origami activity (Afriansyah & Arwadi, 2021), Baratayudha war stories, and Uno Stacko game (Risdiyanti & Prahmana, 2020) has been proven to help students better understand mathematical concepts through a learning trajectory that stimulates students to construct mathematical ideas from the abstract to the formal stage. In conclusion, the use of appropriate context plays a crucial role in constructing mathematical knowledge.

The appropriate use of context can support the construction of ideas, knowledge, and understanding of the material being studied by students. Students will easily be involved in learning activities when the material they are studying is related to their daily experiences. Laurens et al. (2017) claimed that the ease of learning can be experienced if learning content and context are related to students' daily activities. As a starting point for learning, Mamolo (2018) also proposed that the use of realistic contexts would help students to get involved in meaningful mathematical activities, including exploring, modeling, visualizing data, abstracting, and concluding.

In addition, the realistic context is not only found as the starting point of learning. Ms. UPL also utilized the context for tasks. The context used to construct the situation in the problem is referred to as the problem context. The problem context is problem in which its situation is real to the student (Gravemeijer & Doorman, 1999). In the RME approach, contextual problems are mathematical problems presented in real-life situations that children are familiar with. These problems can be a word problem, a game, a drawing, a newspaper clipping, a graph, or a combination of such elements (Yilmaz, 2020). However, the term 'real' does not have to be literally interpreted as a situation that has actually been experienced by students. The context refers to a problem situation or event in the task, which often comes from real life or might be from imaginary situations (e.g., fairy tales) (van den Heuvel-Panhuizen, 2020; Vos, 2020). To sum up, a realistic context is a conceivable or familiar situation which might be from students' real experiences or simply an imaginary situation.

The contexts of the tasks should refer to situations that the students can imagine and that are truly meaningful to them. The context used in the questions or problems posed to the students is supposed to be locally based. The students' culture and their practices, which are closer to them, support the development of a more meaningful learning situation for the students (Bonotto, 2010). Contextual problem solving is known to have a positive influence on students' ability to understand mathematics. Contexts of tasks that are close to students' daily life situations motivate them and lead them to engage in solving the tasks (da Ponte & Brocardo, 2020). In addition, context plays a crucial role in leading students to engage in the mathematical world. The use of realistic context can increase the meaningfulness of mathematical tasks. Contexts drawn from a wide spectrum of areas in real life reflect that mathematics can be applied and used anywhere in society. Vos (2020) proposed that the task context can also demonstrate the use of mathematics in students' future lives outside of school. As a result, students will feel that what they are learning can be useful for solving problems around them. For example, when J learns about money and its operations, he feels that his mother will trust him with a certain amount of money and he can go shopping on his own at a store to buy his favorite snacks.

The use of realistic context is closely related to the characteristics of the living books model. This model focus on the involvement of students in various activities to gain real-life experiences. This finding shows that Mrs. UPL stimulates homeschooler J to view mathematics as a social activity. Mathematics is not just about memorizing formulas or performing calculations algorithms without meaning, but learning mathematics should be seen as an activity that requires interaction and communication in the context of various real-life activities. It then implies that in choosing tasks, students' experiences and reference frameworks have to be carefully considered and taken into account to ensure that these situations indeed make sense to them and have the potential to engage them in a purposeful mathematical activity (Ainley et al., 2006). Thus, the use of appropriate context can motivate students, spark students' de interest in learning mathematics, connect students in constructing mathematical ideas, and develope a more meaningful learning situation for the students.

The second strategy is the use of various concrete manipulatives. The use of various manipulatives such as mino legos, abacus, and beads are able to foster the student's interest to learn. Besides, the use of manipulatives also support to bridge homeschooler J's understanding towards the formal mathematics stage. The finding also reveals that homeschooler J are more easyly understand the abstract mathematical material with the help of manipulatives. Jones and Tiller (2017) claimed that students understand mathematics better when they can see and touch it, not just memorize formulas. Mathematics essentially contains abstract concepts. Manipulatives can support building such abstract concepts from concrete activities (Simon, 2022).

In addition, by using various shaped and colored objects as manipulatives, learning becomes more enjoyable and able to increase J's learning activity, such as observing, manipulating form or demonstrating a mathematical concept. In other words, manipulatives are used as a mathematics exploration medium for children. Larbi and Mavis (2016) asserted that the use of manipulatives can enhance learning by providing opportunities for students to explore and actively engage in observation and discovery.

The role of manipulatives is so essential that almost every topic/mathematics material studied by J is used manipulatives as a learning aid. Mrs. UPL employs manipulatives to engage homeschooler J in hands-on learning of mathematics. It is confirmed by Jones and Tiller (2017) that the use of manipulatives is able to foster learners' interest and encourage active engagement in lesson. This finding indicates that the use of concrete manipulatives has a significant contribution in making learning more effective. Students are more easily able to understand abstract mathematical concepts because manipulatives help bridge the students' thinking construct from concrete to abstract models. Based on the findings of the researcher's interview with J (refer to Transcript 1), it is noticeable that lego acts as a cognitive bridge, facilitating the transition from abstract to formal concepts. Initially, J employed manipulative lego objects, offering a concrete representation. As J progressed, a shift occurred towards a semi-concrete approach, utilizing lego illustration/model as visual aids. With the assistance of lego and its illustration, J was able to effectively convey comprehension of the subtraction concept, symbolically represented through the act of 'crossing out' subtracted numbers. In addition, the use of manipulatives can help attract students' attention and increase their motivation to learn, increase their activity and involvement in learning by providing opportunities for exploration, holding, manipulating. Engage students not only physically but also emotionally.

The third strategy is emphasizing understanding of concepts and high-level thinking skills such as reasoning and problem solving, not just computational skills. In this strategy, Mrs. UPL use RME approach to develop the homeschooler J's numeracy skill. Numerical literacy, as called as mathematical literacy, relates to an individual's ability to formulate, employ, interpret (and evaluate) mathematics in a variety of real-world situations (OECD,

2019). Formulate relates to what extent individual is able to recognize and determine opportunities to use mathematics in problem situations and then make structured mathematical model to formulate the contextualized problem. Employ indicates how well students solve a mathematics problem by computing, manipulating, and applying the concepts and facts. Interpreting refers to how evaluate mathematical solutions or conclusions and reflect them whether reasonable and/or useful in the context of the real-world problem (OECD, 2018).

Doing home activity numeracy using RME approach can directly facilitate the development of students' mathematical literacy, which essentially means being able to know, understand, and use basic mathematical concepts in daily life. The characteristics of PMRI applied by Mrs. UPL in developing literacy are through the use of realistic contexts that are close to students' real lives. The strategy used by Mrs. UPL is to always connect the use of mathematical material in a personal, social, occupational, or scientific context that is appropriate for J's cognitive development. For example, Mrs. UPL uses context problems to stimulate J's numeracy literacy after learning about addition and subtraction. Mrs. UPL will introduce how addition and subtraction are used in real life, such as counting the toys they own, counting the fish in the aquarium, counting the number of books they have, and so on.

In addition, mathematical literacy can also be developed in the form of intertwinning, one of the characteristics of PMRI (Gravemeijer & van Eerde, 2009; Sembiring et al., 2008). Mrs. UPL trains J to be able to connect the mathematical ideas/concepts they are learning with other ideas/concepts, connecting or integrating a mathematical topic with a topic, material, or even other fields. For example, when J plays a game about addition and subtraction using number cards, Mrs. UPL deliberately creates cards with various shapes with the aim of introducing simple geometric shapes. Another example is when J is learning about currency and how to apply it through shopping at the store, Mrs. UPL connects it with simple financial literacy concepts. In this way, J will realize the wide use of mathematics in real life. Using RME approach, Mrs. UPL could designing attractive learning trajectories to create meaningful mathematics lesson. When RME approach is integrated with living book model homeschooling, it is very powerful to support students' numeracy literacy development. A wide opportunity given to homeschooler doing home numeracy activity.

One major challenge in implementing homeschooling programs is the lack of professional and pedagogical competency of parents as tutors (Basham et al., 2020; Pozas et al., 2021). A common issue is that parents are unable to effectively fulfill their role as teachers and facilitators of learning (Basham et al., 2020). However, this issue was not experienced by Mrs. UPL. As both a parent and the sole tutor for mathematics education, she was able to demonstrate her role as a planner of learning activities, facilitator, and teacher for homeschooler J.

4. CONCLUSION

The findings of this study reveal that the parents' main reason for homeschooling are a dissatisfaction with public school instruction model and flexibility to provide a better personalized learning program to develop the homeschooler's cognitive, affective, and psychomotor domain aspects in a balanced way. This study result also confirm that the implementation of living books homeschooling and RME approaches strongly supports the successful development of numeracy literacy in homeschooling education. Practically, there are three main strategies for developing numeracy literacy employed by the homeschooler in this study: use of context real and concrete teaching aids, as well as an emphasis on conceptual understanding, reasoning, and problem solving. The learning trajectory with the RME approach is clearly able to support homeschooler J to construct his own ideas from the

concrete situational stage to the abstract stage of formal mathematics. The integration of RME approach and living book model homeschooling is very powerful to support students' literacy numeracy development.

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