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Research Article

Young students' views on problem solving versus problem posing

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Abstract: For decades, problem solving has been of interest to researchers, and several studies have tried to capture the influence of students' beliefs, attitudes and emotions towards mathematics and problem solving. However, problem posing as part of problem solving has not been investigated to the same extent. This article focuses on six-year-olds' views on solving and posing problems. How do the students themselves describe their views on solving and posing problem-solving tasks, and what similarities and differences can be found? An educational design research study was conducted in three classes where the students first solved and then posed problem-solving tasks. Afterwards, the students were interviewed. In these interviews the students expressed positive views towards both solving and posing problem-solving tasks. The students expressed autonomy and challenge as positive when both solving and posing tasks. However, a posed task needed to be solved before being finished. Further, not all students considered problem posing to be a mathematical activity, and a plausible explanation for this is the students' limited experience of problem posing.

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Problem posing; Problem solving; Early childhood; Mathematics

Introduction

Today there seems to be an international consensus that problem-solving education may start at an early age (Ellerton, Singer and Cai, 2015). This is reflected in the curricula in several countries where problem solving is implemented in kindergarten and preschool (e.g. National Agency for Education, 2017; 2018; The Stationery Office, 1999, Utdanningsdirektoratet, 2013). Problem solving includes both solving and posing problem-solving tasks (Niss and Højgaard, 2019), and for students to become competent problem solvers, problem-solving education ought to include both solving and posing problem-solving tasks. However, the focus in school mathematics has traditionally been on the *solving* part of problem solving only, and research on problem *posing* is still in its early years (Cai and Hwang 2020; Cai, Hwang, Jiang and Silber, 2015; Ellerton et al., 2015). Even though research has pointed out possible applications of problem posing at elementary school level (see for example Ellerton et al., 2015, and Lowrie, 2002), the majority of the research in this field still focuses on solving problem-solving tasks (Di Martino, 2019; English, 1998; English and Sriraman, 2010). This is why we know more about students' ability to solve problem-solving tasks than their ability to pose such tasks (Cai et al., 2015).

The empirical material in this article is from an intervention investigating the potential in using problem solving as the start for the mathematics education of six-year-olds in Sweden. In Sweden, six-year-olds have not yet begun formal schooling but attend what is called preschool class. The aim of preschool class is to facilitate a smooth transition between preschool and school and to prepare students for the next step of their education. The basis for the intervention was a national inspection showing that mathematics education offered limited opportunities for students to develop their ability to solve problems (Swedish Schools Inspectorate, 2009) even though both solving and posing problem-solving tasks are emphasised in the Swedish curriculum (National Agency of Education, 2018a). Despite the focus on both solving and

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posing problem-solving tasks in the Swedish curriculum, the intervention initially focused only on solving such tasks, where problem solving was both a purpose and a strategy. The intervention has been ongoing for several years and previous reports have shown positive results regarding students' learning of mathematics (Palmér and van Bommel, 2018a, 2018b; van Bommel and Palmér, 2018) as well as their feelings towards working on problem-solving tasks (Palmér and van Bommel, 2018c). The students had previously evaluated problem solving as fun and accessible, even in cases when their initial solutions were incorrect and they have had to struggle a lot to solve a task. Thus, understanding a task from the beginning or being able to solve it quickly are not necessarily prerequisites for young students to experience enjoyment when working with problem solving (Palmér and van Bommel, 2018c).

However, as both the Swedish curriculum and research have pointed out possible applications of problem posing at the elementary school level (e.g. Ellerton et al., 2015), we found a need to expand the intervention to also include problem posing. This article will focus on the first time problem posing was included in the intervention. Thus, the students were used to problem solving but to be able to pose a problem-solving task themselves, the students had to change perspective; instead of answering questions they were required to pose questions, and instead of interpreting information they needed to provide information. In this article, we will focus on the young students' views on problem posing and compare with their views on solving problem-solving tasks. Some cognitive but mainly emotional aspects of views will be focused on. 27 six-year-olds worked on both problem solving and problem posing, hence similarities and differences in their views on these two can be investigated. The following research question is elaborated on in the article:

- What similarities and differences can be found in young students' views on solving versus posing problem-solving tasks?

This question is of interest since previous studies have shown that students' emotional experiences may influence their process of solving non-routine mathematical tasks (Di Martino, 2019; Hannula, 2016; Passolunghi, Cargnelutti and Pellizzoni, 2019), and they may also influence how students view themselves as learners of mathematics as well as of other subjects (Clements and Sarama, 2016). This study adds to the limited research on problem posing (Cai et al., 2015) by providing insight into students' views on problem posing and whether there are, from the perspective of the students, any differences between solving and posing problem-solving tasks.

Problem Solving and Problem Posing

Connection between problem solving and problem posing

Research shows that a challenging level of the mathematical content can benefit students' learning (Claessens, Engel and Curran, 2014). However, such challenges are rare as routine tasks are more often included than challenging problem-solving tasks in early childhood education programmes (Cross, Woods and Schweingruber, 2009; Perry and Dockett, 2008). A task becomes a problem-solving task when the methods for solving are not known by the student beforehand. A problem-solving task is thus challenging as the student does not know in advance how to proceed to solve it. Instead, the student has to develop new (for him or her) strategies, methods and/or models to be able to solve the task (Cai, 2010; Lesh and Zawojewski, 2007). Offering a variation of problem-solving tasks to solve, where specific aspects are varied and other aspects are kept constant, will give the students an opportunity to distinguish the particular and discover the general (Peng, Li, Nie & Li, 2017).

Brown and Walter (2004) put forward two reasons why problem posing and problem solving are connected. When solving a problem-solving task, new questions arise (e.g. *What happens if…?; What if I were to…?*), and these posed questions are a natural part of the problem-solving process. Further, in order to be able to pose problem-solving tasks, students need to shift sides and change perspective. To be able to construct a problem-solving task themselves, the students have to change perspective; instead of answering questions they are required to pose questions, and instead of interpreting information they need to provide information. The understanding of both the mathematical content and the solution per se may be deepened

by posing problem-solving tasks, as students will have to operate on and modify the mathematical content. Modifying the content can of course be done without changing to problem posing.

Some researchers are more explicit and state that problem solving and posing are not only connected but include problem posing in the notion of problem solving (Niss and Højgaard, 2019). This implies problem posing as asking students to formulate, and thus to pose problem-solving tasks. Such problem posing in mathematics can cover *reformulation*, *reconstruction* and *imitation* (Kadir, Adelina and Fatma, 2018; Stoyanova, 2005). For Stoyanova (2005), reformulation means that the elements of the initial task are restructured by using different sentences. Reconstruction would incorporate a modification of the properties of the initial task through a change of content, whereas imitation goes further and is realised by adding and expanding the purpose. Similarly, Lee, Capraro and Capraro (2018) explain reformulation as one way to pose problems, and they write that problem posing can be done in two ways: through reformulation or through the generation of tasks. In both ways, students can investigate and develop knowledge of mathematical content and ideas. Reformulation, however puts a focus on students' reflection on the existing problem-solving task (Stickles, 2011). In contrast to reformulation as described by Stoyanova (2005), Lee et al. (2018) state that reformulation can mean asking students to pose a new task where either the structure or the method for solution remains similar to that in the initial problem-solving task.

One way to work on problem posing is to ask the students to pose a new problem-solving task with a structure similar to that of an initial task (Carrillo and Cruz, 2016). Cai and Hwang (2003) classified such posed problem-solving tasks as (1) *extensive*, having the same structure as the initial task but with higher mathematical demands; (2) *not extensive*, having the same structure and level as the initial task and (3) *other,* having a structure different from that of the initial task. Earlier, Leung (1997) used a similar classification distinguishing between posed problem-solving tasks that were mathematical and those that were not. In his classification Leung also included whether it would be possible to solve the given task and whether new mathematics would be needed. However, this does not mean that the students who pose the problems have to be able to solve the problem themselves (Lowrie, 2002).

Several researchers have pointed out that problem posing enriches the learners' experience and provides teachers and researchers with insights regarding students' understanding of the content taught (e.g. Carrillo and Cruz, 2016; Watson and Mason, 2002). When students for example are asked to produce a similar task, their understanding on the initial task can be revealed, providing the teacher with information on students' learning (Carrillo and Cruz, 2016). Thus, problem-solving tasks posed by students are not to be evaluated in terms of right or wrong but instead in terms of aspects such as structure (e.g. Carrillo and Cruz, 2016), the level of the mathematical content addressed (e.g. Cai and Hwang, 2003; Carrillo and Cruz, 2016) and also in terms of the information provided in the task (e.g. Leung, 1997). When students are asked to generate a problem-solving task there is no right problem-solving task to create. As such, problem posing can counteract the common view that there is one right way in mathematics. Further, a shift from solving to posing problem-solving tasks can be seen as a shift of control from others to oneself. Thus, problem posing may also promote a sense of autonomy and independence for students (Brown and Walter, 2004).

Problem posing in the curriculum

In Sweden, as well as in several other countries, problem solving has gained ground in the curriculum, and its emphasis has changed. In the past, students were encouraged to become problem solvers only after they had acquired the necessary mathematical knowledge needed to solve the tasks, nowadays the emphasis is on becoming a problem solver and how problem solving makes possible for students to acquire new mathematical knowledge (Boesen et al., 2014; Wyndhamn, Riesbeck and Schoultz, 2000). Working with problem solving will enable students to develop important mathematical ideas and competences (Csapó and Funke, 2017; Lesh and Zawojewski, 2007; Schoenfeld, 1992), and in order for students to become competent problem solvers, problem solving ought to be integrated in early childhood education instead of added after concepts and skills have been taught (Cai, 2010).

According to the Swedish curricula, problem solving is to be part of mathematics teaching from

preschool onwards, continuing throughout all grades. When the curriculum changed in 2011, competences were introduced and problem posing became an explicit part of the curriculum: one of five competencies emphasized for elementary school mathematics is to "formulate and solve problems using mathematics and also assess selected strategies and methods" (National Agency for Education, 2017, p. 56). In preschool class the students are to be given conditions in which they can develop their abilities to experiment with and develop ideas, solve problems and put their ideas into action. Further, the students should be challenged and stimulated to use mathematical concepts and reasoning to communicate and solve problems (National Agency for Education, 2018a). Posing problem-solving tasks and solving problem-solving tasks are part of the curriculum for preschool and kindergarten as well (National Agency for Education, 2018a; 2018b).

Investigating students' views

Studies have shown that young students' achievement in science, technology, engineering, reading and mathematics is predicted by their interest in and feelings about mathematics and science (see for instance Clements and Sarama, 2016, for more details). In line with this, a special ESM issue on *Affect and mathematics in young children* was recently published in which "the importance of studying affect in young children who are in the early stages of acquiring formal mathematical skills" (Batchelor, Torbeyns and Verschaffel, 2019, p. 202) is emphasised. Leung (2013) has stated that (young) students' feelings towards problem posing are of importance for teachers to consider and several studies have tried to capture the influence of students' attitudes and emotions towards mathematics and problem solving. Some studies indicate that students' attitudes and emotions impact students' learning of mathematics (Di Martino, 2019; Giaconi, Varas, Tuohilampi and Hannula, 2016; Hannula, 2016; Mason and Johnston-Wilder, 2006; Schoenfeld, 1992) as well as students' interest in the subject (Clements and Sarama, 2016; Giaconi et al., 2016). For example, mathematics anxiety and mathematics difficulties are often connected to students' attitudes and feelings towards mathematics and problem solving (Antognazza, Di Martino, Pellandini and Sbaragli, 2015; Liljedal, 2017), indicating correlations between attitudes, emotions and performance in mathematics (Dowker, Bennett, and Smith, 2012; Giaconi et al., 2016). Feelings such as frustration, anxiety, confidence, surprise and curiosity have been shown to influence the process of solving non-routine mathematical tasks (Di Martino, 2019; Hannula, 2016; Passolunghi et al., 2019). However, there are also studies where no such correlations are found (Dowker et al., 2012; Pinxten, Marsh, De Fraine, Van Den Noortgate and Van Damme, 2013), or where correlations found might be explained through cultural differences in students' feelings towards mathematical problem solving (Dowker, Cheriton, Horton and Mark, 2019).

In studies on affect and mathematics, a wide range of constructs are used, for example beliefs, attitudes, and emotions as introduced by McLeod (1992). Of these, beliefs are seen as most cognitive and stable and least affective while emotions contrary are least cognitive, least stable and most affective (Hannula, Pantziara and Di Martino, 2018). Hannula (2011) has developed a model of affective constructs where the three dimensions of cognitive/affective/motivational, state/trait and psychological/social/embodied are combined illustrating the large variety of possible constructs in affective studies.

The intervention presented in this article takes a sociocultural perspective on mathematics teaching and learning which implies that knowing and doing mathematics is seen as a social and cultural practice (Rogoff, 2003). The learning of solving and posing problem-solving tasks is a process of increasing participation in the practice of problem solving and, through that participation, becoming knowledgeable in and about solving and posing problem-solving tasks (see also Lowrie, 2002). The students in the intervention presented here, had frequently participated in problem-solving activities. The focus of this article is on when these students are introduced to problem posing, an activity they had not participated in before. Them taking part in problem-posing activities can promote thinking and feelings in new directions and expand the students' participation in the social and cultural practice of school mathematics (e.g. Jakobsson, 2012). In line with this, the notion of *views* will be used in the study. Based on the above mentioned model of Hannula, *views* are affective (what one feels), state-type (dynamical) and developed

in social practices. An individuals' views of a situation or a topic (for example solving and posing problem-solving tasks) includes what the individual feels and the ways the individual thinks of the specific situation. Thus, views includes aspects of cognitive as well as affective elements (Debellis and Goldin, 2006; Op't Eynde, DeCorte and Verschaffel, 2001; Wedege and Skott, 2006).

Method

The empirical material in this article is from one design cycle in the longitudinal intervention conducted in line with an educational design research. The aim of the intervention is to investigate the potential in using problem solving as the start for the mathematics education with six-year-olds in Sweden. The study started in 2014 and has been ongoing, involving more than 40 Swedish preschool classes from different schools and cities in different design cycles (see for example Palmér and van Bommel, 2018a, 2018b; van Bommel and Palmér, 2018, for more details on the different design cycles and their outcome). Common in educational design research studies is the iterative design (Prediger, Gravemeijer and Confrey, 2015), with the goal to develop theories that "guide, inform, and improve both practice and research" (Anderson and Shattuck, 2012, p. 16). Each design cycle includes preparing for teaching, implementation of the teaching, and finally, retrospective analysis of the teaching and learning (Cobb and Gravemeijer, 2008).

In this article, one specific design cycle on solving and posing a task within three-dimensional geometry is focused on with emphasis on student views on problem posing by reformulation. As this was the first time the students worked on problem posing, reformulation was chosen as it made it possible to explore students' reflection on the initial problem-solving task (Stickles, 2011). Also, reformulation gives students freedom to pose a new task where either the structure or the method for solution remains similar to the initial task. The design cycle was divided into two lessons and an individual follow-up interview.

Selection of Preschool Classes

Three preschool classes were selected for this design cycle based on their teachers' interest in participating. Two of the schools are located in an urban area and one in a rural area. In accordance with the Swedish Research Council's (2017) ethical guidelines, the students' guardians were informed about the study and they approved their children's participation. Altogether, 27 students from these preschool classes got approval and thus participated in the design cycle. The four teachers (two teachers work together in one of the preschool classes, thereof four teachers and three classes) working in these three preschool classes are educated as preschool teachers which implies that they have completed a three year university course in preschool teacher education. These teachers had participated in several of the previous design cycles and hence were familiar with problem solving, educational design research, and with the aim of the study. The teachers had taught mathematics through problem solving for some semesters why they had also implemented the problem-solving task on three-dimensional geometry several times before in other preschool classes. Problem posing was however new for both the teachers and the students.

The Problem Solving and Problem Posing Lessons

The two lessons were conducted in the usual classrooms of the three preschool classes. The lessons were designed in line with the previously described research on problem solving: the mathematical ideas were to be understandable, but the students should not have previously been taught a method for solving the tasks. In the first lesson, the students were to work on solving a problem-solving task, and in the second lesson they were to work on problem posing by reformulation by posing a similar problem to be given to a friend. By doing so, our focus on problem posing is very pragmatic and will provide only one experience to examine students' views. However, in order to be able to deepen these views a narrow focus helps us as the students in the interviews will refer to the same experience of problem posing. In the first lesson the students were handed a picture of a building (Figure 1).

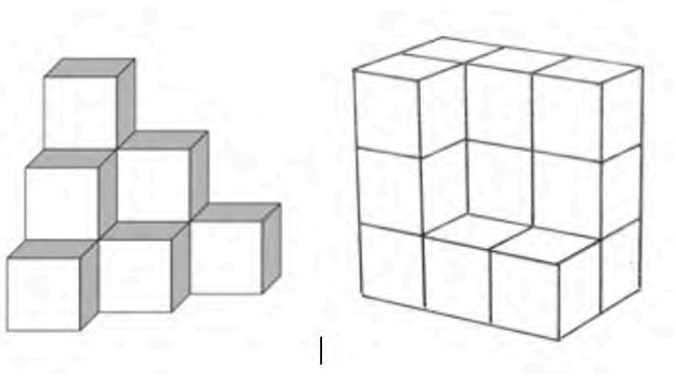

Figure 1. Pictures of the buildings used in the first lesson. (The building to the left is taken from http://ncm.gu.se/kangaru, Milou, 2008, question 9).

One of the preschool classes had previously worked with the building to the left in Figure 1, so they instead worked with the building to the right in Figure 1. The question asked was "How many blocks will you need to build the building?" The task deals with a two-dimensional representation of a three-dimensional figure. To determine how many blocks they would need to build the building, the students had to imagine it from different perspectives. At first, they were to find a solution by themselves. After working by themselves the students were put in pairs to discuss and argue for their answers. In this phase of the lesson they were provided with blocks to build with, and a digital version of the building was also provided. The digital version provided an environment in which the students could build by swiping blocks to the building area and by doing so, creating a building similar to the one on paper. Once they built the building, they could manipulate the building by turning and twisting it. Further side views of the building were visible in this application[3]. Finally, in a joint whole-class discussion, the three-dimensional aspects of the building were discussed. One student (out of the 27) initially gave a correct answer to the question "How many blocks will you need to build the building?" Some of the answers from the other students indicated that they realised that there were more blocks than the visible ones. After building with blocks, all students explored the need for more blocks than the visible ones, and hidden blocks from different perspectives were explored in a whole-class discussion. This aligned with experiences from previous design cycles using this problem-solving task. Results from around 200 preschool class students show that even though only visible blocks are considered by the students initially, a large majority of the students give answers involving reasoning on the number of hidden blocks in follow-up interviews (see Palmér and van Bommel, 2018a).

The second lesson focused on problem posing. The students were first reminded of the problem-solving task they had worked on in the previous lesson, then they were asked to pose a similar problem-solving task to a friend. In accordance with the socio-mathematical norms (Yackel and Cobb, 1996) in these preschool classes, students could choose to work alone or with one or more classmates. As six-year-olds in Sweden have just started reading and writing, the task was given orally. The students were free to use blocks if they wanted, and no specific instructions were given about how to design their posed problem-solving task. If needed, the teachers helped the students to document the tasks they posed. If the students had built a building, these were photographed. Some groups of students took these photographs themselves, in other groups the teacher took the photograph making sure it captured what the students wanted it to capture. Paper-and-pen work as well as photographs of the buildings built by the students were collected at the end of both lessons. Together the students posed 14 tasks.

Interviews

To explore the students' views on solving versus posing problem-solving tasks, an interview was conducted one or some days after the second lesson. For practical reasons, the interviews had to be conducted when the rest of the students were involved in another activity thereof a difference in time. The

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decision to conduct interviews was based on the age of the students and the fact that they, in line with the Swedish school system, had just started reading and writing. Thus, writing would not be possible for most of the students, and drawings could get away from the focus of the exercise, leaving too much room for interpretation during the analysis. In the educational design research study as a whole, the teachers have been taking an active role and similar to previous design cycles they were the ones conducting the interviews. To obtain comparability with four teachers involved, a structured interview guide was used and the teachers were instructed, in writing and verbally by one of the researchers, on how to carry out the interviews and how to take notes.

In the interview, the students were asked of their views on the two lessons. As previous presented an individuals' views includes what one feels and ways of thinking. Table 1 presents examples of how the questions in the interview were connected to these two aspects. The questions in the interview were both open questions and questions where the students were to select between several pre-formulated alternatives. First in the interview the difficulty of solving and posing, as well as feelings while working on the two different types of tasks were addressed. The students were to finish sentence, for example – I think this task was… – by selecting among four alternatives: Super easy; Easy; Hard; Super hard (In Swedish: Jättelätt; Lätt; Svår; Jättesvår). As a follow-up question they were asked the open question, What, specifically, made the task super easy/easy/hard/super hard? The students were also asked questions about preferring problem solving or problem posing and reasons for their preferences as well as questions addressing their feelings when other students were to solve "their" task. Here the students got a positive statement, for example, I am happy when a friend can solve my task. Then they were to select one of four alternatives: Yes!; A bit; Well, not that much; No; I don't know (In Swedish: Ja!; Lite grann; Nja, inte så mycket; Nej!; Vet inte). After that, questions on mathematics, problem solving and problem posing in general were asked (ways of thinking). The students were asked if they knew what mathematics and problem solving were. These questions were asked because previous studies have shown that young students may not always have a good understanding of these words even though they have experience with both mathematics and problem solving (Di Martino, 2019). If the students said they knew what mathematics and problem solving was, they were shown tasks from the two lessons and asked if the two lessons involved mathematics and/or problem-solving.

Table 1. Examples, alternatives and number of questions in each aspect of the construct of views

Aspect of views	Example of question	Alternatives	Total number of questions
What one feels	I think this task was …	Super easy; Easy; Hard; Super hard	6
	I am happy when a friend can solve my task …	A bit; Well, not that much; No; I don't know	
Ways of thinking	What, specifically, made the task … (super easy/easy/hard/super hard)	[No alternatives, open question]	9
	Do you know what mathematics is? If yes, what is it?	[No alternatives, open question]	

The interview was tested in a pilot study where the choice of words was in focus; this was to make sure that the words used were related to the experiences of students at this age. Some adjustments in the formulation of alternatives were made after this pilot study (e.g. hard instead of difficult).

The interviews, together with the students' documentation from the two lessons, were analysed by the researchers (author 1, author 2). Based on the limited number of students, the analysis is qualitative, explorative and mainly on group level. First, each question was summarised and then patterns between questions were explored. Even though some means are presented in the results, the intention is not to make any statistical analysis, as a larger sample would be needed for this.

Results

In the results we first shortly focus on the students' posed tasks in the second lesson. These solutions will serve as a background when presenting the data from the follow-up interviews as this lesson is the experience of problem posing of these students.

The Second Lesson – Students Working on Problem Posing

During the second lesson, when the students were to pose a similar task to a friend, the students had access to building blocks, paper and pens. As previously mentioned, they did not have to write their problem-solving task by themselves; instead, they could formulate it to their teacher, who wrote it down for them. All pairs/groups of students built a building with blocks, and all but one group posed a question connected to this building. The student who did not pose a problem-solving question was working by himself. He built a building with blocks but then said that it was not possible to pose a question. The other students both built a building and formulated a question, below are three examples of building built and questions posed by the students (Figure 2).

How many blocks are there in the building?

(Hur många klossar finns det i tornet?)

How deep is the hole if it has 42 blocks?

(Hur djupt är hålet om den har 42 klossar?)

How do you make them talk?

(Hur får man dom att prata?)

Figure 2. Three examples of problem-solving tasks posed by students

These tasks are examples of the three categories of tasks created by the students: (1) a task based on a building and a similar mathematical question as in the initial task; (2) a task based on a building but a different kind of mathematical question than the original task and (3) a task based on a building but with a non-mathematical question. These categories are in line with Cai and Hwang's (2003) categories: not extensive (1), extensive (2) and other (3).

The Follow-Up Interviews

First in this section students answers on questions focused on ways of thinking will be presented and after that follows students answer on questions focused on what one feels.

On the question when a posed task is finished the majority (21) of the students thought that their posed task needed to be solved before they were finished with it. Thus, from the perspective of the students, it is not enough to pose a problem-solving task; for them to feel that their work is completed someone has to solve the task.

When asked what they would choose if they had to choose between solving and posing a problem-solving task, twelve of the students preferred to solve a problem-solving task, while 15 preferred to pose a problem-solving task. Of the students who preferred solving, several motivated this by saying that it is easy to solve. Other motives for choosing solving was it is quite exciting to think and I want to do clever things that someone else decides. There were however also students who answered that It is more difficult

to make your own because then you have to do everything yourself and that this is why they preferred solving over posing. Motives for preferring to pose a problem-solving task included that it goes faster, it is much easier, you may decide completely by yourself, you can think of how to make it more difficult and you can do what you want. Thus, time is mentioned as a motive for choosing posing (goes faster to pose) while easy is mentioned as a motive for both solving and posing. For some of the students, the autonomy that goes with posing a problem-solving task seemed to be experienced as positive (you may decide completely by yourself), while autonomy for others was instead a motive for choosing to solve problem-solving tasks (It is more difficult to make your own because then you have to do everything yourself).

Seven students expressed not knowing what mathematics or problem solving was. The most common answer of the remaining 20 students to the question what mathematics is was to count. The most common answers to the question what problem solving is? were you ought to solve things that are tricky or you should solve problems. Table 2 summarises if the students considered solving a problem-solving task as well as posing a problem-solving task to be mathematics and/or problem solving.

Table 2. Students' views on solving and posing problem-solving tasks

	Solving problem-solving tasks	Posing problem-solving tasks
…is only mathematics	1	2
…is both mathematics and problem solving	16	8
…is only problem solving	3	3
…is neither one	-	5
No answer / don't know	-	2

16 of the students answered that solving a problem-solving task was both mathematics and problem solving. One student answered that solving a problem-solving task was mathematics but did not think it was problem solving, and another three students answered that solving a problem-solving task was problem solving but not mathematics. Related to posing a problem-solving task, eight of the students thought this was both mathematics and problem solving. Two students answered that posing a task was mathematics but not problem solving, and three answered that posing a task was problem solving but not mathematics. An argument for why problem posing was not problem solving was because you are the one who created the task. However, there were students who previous had explained problem solving in terms of you ought to solve things that are tricky or you should solve problems and who still considered both solving and posing problem-solving tasks to be mathematics as well as problem solving. Five students explicitly stated that posing a task was neither mathematics nor problem solving.

Thus, the students did not think about problem posing and problem solving in the same way with regard to whether the activities are mathematics or problem solving. Fewer students thought of posing a problem-solving task as mathematics and/or problem solving than solving a problem-solving task (13 and 20 respectively). Further, some students thought that posing was neither mathematics nor problem solving; although none of these (or other) students expressed this explicitly when asked about solving a problem-solving task.

Related to feelings, when the students were asked if it was fun to pose a problem-posing task to a friend to solve their answers were scattered on all response options (scale Yes! (4); A bit (3); Well, not that much (2); No (1) and I don't know (0)) but with a strong emphasis on the positive half (mean 3.58). Similarly, the students' answers to the statement I am happy when a friend can solve my task were positive (mean 3.79). The students also responded positively to the statements I am happy when a friend can solve my task (mean 3.79), Mathematics is fun (mean 3.39) and It is fun to solve problem-solving tasks (mean 3.68). Thus, the students expressed positive feelings towards both solving and posing problem-solving tasks. The students were also asked about their experienced difficulty of problem solving as well as the problem posing. The students thought that it was harder to pose a problem-solving task (mean 2.4) than to solve a

problem-solving task (mean 2.23) but the difference was negligible (scale Super easy (1), Easy (2), Hard (3) or Super hard (4)). If connecting these answers to the students' answers to what they would choose if they had to choose between solving and posing, there were no clear pattern. There were students who expressed both solving and posing as either hard or easy and then motivate their selection of solving or posing by wanting to work hard or easy. There were also students who found posing harder than solving who preferred posing, and vice versa.

Conclusion and Discussion

While previous research provides quite rich knowledge on students' ability to and views on solving problem-solving tasks, there are more unanswered questions about students' ability to and views on problem posing (Cai et al., 2015). The questions elaborated on in this article concerned young students' views on problem posing, in specific: the feelings and ways of thinking of young students when being asked to reflect upon their own experience in problem posing. Since previous studies have shown that students' attitudes and emotions may have an influence on their solving of non-routine mathematical tasks (Di Martino, 2019; Hannula, 2016; Liljedahl, 2017; Passolunghi et al., 2019), and on how they view themselves as learners of mathematics and of other subjects (Clements and Sarama, 2016), these questions are of interest.

The results indicate that posing, just like solving problem-solving tasks (see Palmér and van Bommel, 2020), can be introduced in early childhood education. Even though this was the first time that these students were introduced to problem posing, all but one student posed a question. All categories of tasks – extensive, not extensive and other (Cai and Hwang, 2003) – were posed by the students. Further, the students expressed positive feelings towards both solving and posing. Solving and posing problem-solving tasks were equally popular amongst the students in the study: some students preferred to pose problem-solving tasks (15), while others preferred to solve such tasks (12). Autonomy (previously addressed by Brown and Walter (2004)) was put forward as one reason to prefer problem posing as students experienced their freedom to be able to choose as something positive. Conversely, autonomy was by other some students stated as negative in regard to problem posing as own creation was experienced as demanding and difficult compared to solving problem solving tasks.

Carrillo and Cruz (2016) emphasise that problem posing can provide insight into students' understanding, in this case of problem solving. Therefore, it is interesting to note that the same arguments were used by the students to express their preference for either posing or solving. For example, arguments related to time were given as a motive for preferring posing but also, by others for preferring solving. Another argument for the preference for either posing or solving was related to the difficulty, both when choosing solving and posing. Yet another argument used for both alternatives was autonomy, phrased as either the possibility to choose for oneself or the burden of having to choose. These arguments provide some insights in young students' views on both problem solving and problem posing and indicate that if both solving and posing become part of early childhood mathematics education this may attract a wider range of young students.

In order to become knowledgeable in posing problem-solving tasks, students need to be involved as participants in the practice of problem posing (Lowrie, 2002) and the students in this study were not accustomed to posing tasks, only to solving them. This might have influenced the students' answers on the question of when a posed task was finished: 21 of them thought that a posed task needed to be solved before they were finished with it. Also, fewer students thought posing (13) was mathematics, problem solving or both compared to those who thought solving was (20). There were even students (5) who thought that posing problem-solving tasks was neither mathematics nor problem solving. None of the students expressed this regarding solving problem-solving tasks. Thus, from the perspective of the students, it is not enough to pose a task: for them to feel that their work is completed, someone has to solve the task. Only few students thought that problem solving could consist of merely posing a problem-solving task without somebody solving it. A plausible explanation for this is the limited experience with problem posing of these specific students, especially compared to their experience in solving problem-solving tasks. Early

childhood education provides an opportunity to enrich young students' problem solving skills via problem posing, as suggested in this article.

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Research Article

Revealing colonial power relations in early childhood policy making: An autoethnographic story on selective evidence

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Abstract: The COVID-19 pandemic exposes uncertainty, instability and glaring inequality that requires urgent global policy decisions. Historically, bureaucrats regard uncertainty as the enemy and look for tested solutions (Stevens, 2011). In contrast, Fielding & Moss (2010) acknowledge an uncertain future and encourage shifting policy making towards the search for possibilities instead of replicating singular solutions. Escobar (2020) advocates for pluriversal politics, with many possibilities created through collective decision-making by autonomous interlinked networks. In this paper, I combine autoethnography with policy analysis drawing on my own experience in South African early childhood policy making. I argue for a fresh decolonial debate about early childhood policy to replace dominant imported evidence-based narratives. I pay attention to power relations and examine, not only the content of evidence, but who has authority to speak (Mignolo, 2007). I introduce the bottom-up appreciative participatory dialogical policy making in the Gauteng Impilo project (1996 - 2000), as one attempt to resist the dominant policy trajectory. Local networks, that can inform policy making and resource allocation though conversation and action, emerged from this experience. This article invites urgent inclusive policy debate that expands choices and can produce cumulative worthwhile change and new learnings to birth a better society.

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Introduction

Global instability and uncertainty during the COVID-19 pandemic brightly illuminate inequality and ecological precarity, calling for new ways of being and action for energy, food and education sovereignty[2]. Inequality has persisted in South Africa long after the end of Apartheid. Before coming to power in 1994, the African National Congress (ANC) promised to redress the legacy of Apartheid. While much has been achieved, there have been major failures and South Africa is one of the most unequal countries in the world. Before the pandemic, nearly one-third of South Africa's children did not eat sufficient nutritious food and twenty percent of the population was food insecure[3]. The combination of poor water policy, degradation of infrastructure, and insufficient action to address climate change, has left a large portion of the population having to walk long distances and queue for limited access to water. The majority of South Africans do not have access to good quality health, education and other essential social services.

On 15 March 2020, a national state of disaster was declared in South Africa (Gazette No 43096) and from 26 March everyone was confined to their homes. The first five weeks of the South African lockdown went further than most countries, as adults and children were not permitted to leave their homes for exercise or sunlight, or even to take their dogs for a walk. However, government did not plan to simultaneously implement complementary testing, tracing and measures to mitigate the effects of the

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[2] While, I argue that COVID-19 highlights the need for dialogue, my policy analysis does not relate directly to COVID-19.

[3] More than half a million households with children aged five years or younger experienced hunger in 2017. http://www.statssa.gov.za/?p=12135

lockdown on the poor[4]. A small percentage of the population live in homes with gardens, but most live in densely populated informal settlements or inner-city high-rise buildings. Physical distancing is impossible for the majority. In some 'homes', ten or more adults and children (who might not all be blood relatives) could be living together in a single small room. While a few children travel to school in private cars, the majority walk long distances or use public transport. The most accessible form of public transport is minibus taxis. The protest by taxi owners against the government policy that taxis must reduce the number of passengers on each trip during the pandemic, led to the revised decision that they merely needed to keep one window open. Children in a few homes have devices and internet access and have been able to continue schooling and interact with friends on-line. Most children experienced precarity and uncertainty and the majority of school children were not receiving the one free meal at school per day that they rely on. The National Income Dynamic Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM)[5] survey in the second month of the lockdown found that 7% of adults and 4% of children were perpetually hungry (hunger "every day" or almost every day) and half of the respondents had run out of money to buy food that month.

Soon after the start of the lockdown President Ramaphosa confirmed that the pandemic had exacerbated inequality, that government food distribution had been unable to meet the "huge need" and he promised to "forge a new economy"…. " founded on fairness, empowerment, justice and equality"[6]. Eighteen weeks after the disaster had been declared and the level of lockdown had been lowered from level 5 to 3, the rate of infection and death had started to increase rapidly, and more than 5000 people had died. The focus on COVID-19 had compromised human immunodeficiency virus (HIV) and tuberculosis (TB) testing and treatment as well as infant immunization and ante-natal services. Debate raged about opening schools and early childhood services and several court cases were won against government, including a court order that Grade R[7] and preschool children who attend non-government institutions can return to their centres and that the Department of Basic Education (DBE) provide one nutritious meal a day to all qualifying school children whether they had returned to class or not. While insufficient, unfunded and underfunded early childhood services collapsed, the Minister of Social Development announced the planned employment of thirty-six thousand (36 000) youth as compliance monitors in Early Childhood Development (ECD) centres and partial care facilities at a cost of 1.3 billion Rands[8].

In this article, I examine ANC policy-making for young children since the first democratic election in 1994 and invite debate about how policy-making might need to change to achieve Ramaphosa's recommitment to the pre 1994 ANC goals of building a convivial society. I analyse power relations, dominant discourses and subjugated attempts to tell a different story. As COVID-19 spotlights uncertainty and glaring inequality, this autoethnographic story invites conversation about early childhood policy-making in South Africa. As an example of the primary focus of ANC early childhood policy and financing, I trace the introduction and expansion of the extension of primary school downward, through what is referred to in South Africa as Grade R. South Africa is poised to introduce Grade RR, thus adding an additional compulsory year before Grade R and entry into the formal primary school system, despite acknowledging that in the past 20 years Grade R has increased inequality rather than decreased it. I argue for urgent inclusive debate about early childhood policy.

Walking and Talking the World into Being for a Decolonial Methodology

This is not an easy story to tell. I aim firstly to deploy an approach, 'reflexivity of discomfort' (Pillow, 2003), to reveal post-Apartheid discourses and power relations that informed the initial decisions to pilot

[4] 2020 Coronavirus Rapid Mobile Survey compiled by 30 social scientists from five different universities across the country https://cramsurvey.org/reports/.

[5] 2020 Coronavirus Rapid Mobile Survey compiled by 30 social scientists from five different universities across the country https://cramsurvey.org/reports/.

[6] https://apnews.com/3982bc2db40764467e8164f03c362aa9

[7] Initially referred to as the "Reception Year', Grade R is a year-long programme for children in the year they turn 5 and just before they enter the first year of primary schooling. These Grade R classes can be in schools or in the community

[8] https://www.gov.za/speeches/minister-lindiwe-zulu-socioeconomic-interventions-mitigate-impact-coronavirus-covid-19

and then formally introduce Grade R in 2001. Secondly, I wish to stimulate debate about current early childhood policy in South Africa by "pushing the reader to analyse, question, and re-question her/his own knowledge and assumptions brought to the reading" the same way I approach writing in this article (Pillow, 2003, p. 188). In order to stimulate the debate about policy-making for young children in South Africa, I use an autoethnographic method drawing on my own experiences in policy-making in the same geography and period of the policy-making discussed in this article. I draw on my memories as data to guide my story about juggling complex relationships with a variety of different institutions and individuals with different beliefs, paradigms and priorities. I contextualize this analysis within the framework of relevant theorists, and with reference to my archive which, in addition to published literature includes a variety of original documents, such as original reports and memoranda, personal communications and journal entries. I chose autoethnography for the possibility of disrupting colonial research methods, by reclaiming the subjective voice of those in marginalised communities, with whom I engaged in participatory action research over three decades in different geographic contexts. Autoethnography has been positioned historically as disrupting Eurocentric norms of research practice and representation (Chawla & Atay, 2018). I combine autoethnography and analysis of policy and policy-making processes. Through focusing on questions about included and excluded actors, selected stories and the ends that are served by such choices (Chawla & Atay, 2018), I challenge myself, as the researcher, to pay attention to emotions and affect in all aspects of policy-making and research.

I draw on Pillow's (2003) construction of 'reflexivity of discomfort' to help me think differently and try to avoid falling into my own trap of using the same language or categories that I reject. I try to be accountable to the "struggles for self-representation and self-determinism" of the characters in my story, including myself (Pillow, 2003, p. 193). I continuously interrogate my shifting power relations and try to write the account in a way that could provide multiple possibilities. I avoid confessing personal historical failures or applauding my successes. Whether or not the reader challenges the 'truthfulness' of my (re)telling, my aim remains constant: to stimulate discussion about future policy decisions. In this methodology, ethics is not derived from official 'ethical clearance' of the research design or informed consent of participants. The methodology "resituates ethics as the responsibility of researchers and readers" (Pillow, 2003, p. 191 referring to St. Pierre). As author, I pay attention to the ethical implications of all my research decisions and invite all to theorize our own lives and examine different frames.

I construct a theoretical framework that combines Stevens' (2011) analysis of the social world of policy-making with the literature reconceptualizing early childhood education as well as decoloniality. Moss and others discuss the transformation in early childhood policy-making (Moss & Dahlberg, 2008; Fielding & Moss, 2010; Moss, 2007, 2014, 2019). They suggest that by being open to possibilities and nurturing a willingness for transformation, it is possible to move towards one of many versions that can produce cumulative worthwhile change and new learning (Fielding & Moss, 2010, p. 135). Escobar (2020) advocates for pluriversal politics, with many possibilities created through collective decision-making by autonomous interlinked networks. Stevens explains that there is very little examination of policy-making process and draws on his own observation and participation in the United Kingdom to argue that 'evidence' is used as a tool of persuasion to sell certain policy proposals that have the greatest chance of being accepted within the particular context in which they are being presented (Stevens, 2011). He argues that support for policy proposals relies on strategies such as avoiding complexity and uncertainty, as well as the 'trustworthiness' of the proponents. He describes how 'evidence' can be used to shift attention away from inequality and the challenging of "contemporary distribution of power" (Stevens, 2011, p. 18).

I acknowledge Pam Christie's argument that "the nature of government in a modern state entails engaging with particular practices and ways of thinking which themselves set limits to the changes that are conceivable and credible" (Christie, 2006, p. 374). I analyse these practices and ways of thinking in order to expose the danger of dominant policy-making practices and uncover the "disorder, confusion and chance happenings" that might have contributed to decisions that appear, in retrospect, to have been made with careful consideration in the best interests of all children (Christie, 2006, p. 375 referring to Foucault (1997)). I wish to explore the 'rationalities that normalize acts of power' (Christie, 2006; Foucault, 2000;

Green, 2012), and invite debate and discussion about other possibilities and opportunities for resistance. I hope to stimulate conversation across the country, in government, civil society, homes and other gathering places, about well-being and food, land, energy and education sovereignty.

Fragmented and Inequitable Services for Young Children in South Africa

When I entered the early childhood field during the last decade of Apartheid, the available government funded services were unevenly distributed in terms of race and place, with urban children classified as 'white' receiving most resources, and rural children classified as 'black' receiving little if anything. Responsibilities were fragmented across different government departments, including education and welfare. The segregated education system provided well-resourced pre-primary schools for children from 3 to 6 years old, mainly in urban garden suburbs, where only families classified as 'white' were permitted to live. Before 1994, the most common form of provision was community-based 'educare centres' for children between the ages of 3 to 6 years. These 'informal' services were the responsibility of the Department of Welfare, which provided a small subsidy for a small number of educare services in mostly black urban areas; the rest were privately funded. Staff had little or no training and relied on whatever minimal fees that very poor families could afford. In the 1994 Situation Analysis, Mary Newman described educare services, explaining that, "There are many places where children are crowded together, often with little or no food supplies, little adult attention and certainly no educational stimulation" (September & Mokgoro, 1993, p. 19).

Different kinds of organisations offered adult early childhood training courses. Formal institutions, such as teacher training colleges, prepared preschool teachers in the education system and a few urban-based non-governmental organisations offered short courses for 'practitioners' in 'informal' services. Between the mid-1980s and 1990s, the South African non-government ECD sector thrived and grew to about 100 training organisations (Van den Berg & Vergnani, 1986). A number of foreign donors, including foreign government agencies that refused to cooperate with South Africa's apartheid government, redirected funding to non-government early childhood initiatives. Van den Berg and Vergnani offer a comprehensive account of the early childhood sector in South Africa in the mid-80s, identifying "an endemic and chronic disease of competition and suspicion" within the field and a volatile political climate with a "tumultuous level of conflict in many parts of the country" (Van den Berg & Vergnani, 1986, p. 8-9). This continued into the mid-90s. At the same time the absence of government attention or regulation offered fertile ground for experimentation in the non-formal early childhood field. Some training organizations, that I will refer to as Resource and Training Organizations (RTOs), had started to introduce innovative family-based programs, such as home-visitors and Community-based Integrated Management of Childhood Illnesses (cIMCI). In particular, there were a small group of RTOs who were drawing on the work of Paulo Freire and the training of Anne Hope and Sally Timmel (Hope & Timmel 1984), to use a conscientizing approach to empower marginalised communities. I started a small RTO called Woz'obona in the mid-80s, acknowledging that this was political work as we were essentially organising communities around the needs of young children (Rudolph, 1993). The Woz'obona curriculum was developed with marginalised partner communities from different parts of South Africa and drew on beneficiary visions of childhood and society (Rudolph, 1993).

Getting Ready to Govern

After the ANC and other organisations were unbanned on 2 February 1990, preparing for democracy was no longer clandestine. In October 1991, the Process of Multi-Party Negotiations for the transfer of power was initiated with preparation for the All-Party Congress. From 1991, while the multi-party negotiations determined the big issues for a democratic South Africa, such as control of the security forces, the electoral process, state media and finances, the early childhood sector was also busy with its own negotiations on a much smaller scale. While the alliance represented by the ANC in the national negotiations had been galvanised through the United Democratic Movement (UDM), in the 1980s there was still fragmentation in the early childhood sector. There were several interlinked processes that

contributed to formulating the proposed policies that the ANC would take to the electorate. In terms of my story in this article, I introduce the 1992 National Education Policy Initiative (NEPI) and the ANC consultative process, including the 1992 Ready to Govern Conference.

ANC policy guidelines for a democratic South Africa were adopted at the National Ready to Govern Conference held on 31 May 1992. The ANC stressed its commitment to broad discussion and consultation, pointing out that the guideline would need to be adapted through consultation with the "broadest spectrum of South African public opinion", in order to draw on the depth and breadth of experiences (ANC, 1992a). The 1992 ANC policy aimed to reflect the values and ideals of equality, sustainability and self-determination set out in the Freedom Charter (1955) (ANC, 1992a). It also acknowledged the magnitude of problems generated by Apartheid and the transformational challenges that would require difficult choices, given the diversity of citizens and the legacy of physical separation, spiritual alienation and inequality (ANC, 1992a). The document emphasized the commitment to "equal rights, non-racialism, non-sexism, democracy and mutual respect" and "a broad, inclusive approach, free of arrogance or complexes of superiority or inferiority" (ANC, 1992a, A.1). The intention was to develop a vision of our country "not distorted by the prejudices and sectarianism that has guided viewpoints on race and gender, in the past". I was particularly encouraged by the expressed intention to "rely on the wisdom, life experiences, talents and know-how of all South Africans, women and men" in "finding solutions to the problems created by Apartheid" (ANC, 1992a, A.1). The introduction to this important initial ANC policy discussion document, as I read it, promised the beneficiaries of services (especially those most marginalized by Apartheid) the authority to speak and design the kind of policies that would best suit their diverse circumstances. I looked forward to contributing from my experience in this kind of 'bottom-up' consultative process.

Side-lining Bottom up Consultative Processes

The 1992 National Education Policy Initiative (NEPI), which analysed different policy options for an equitable education system in a democratic South Africa, constituted one important ANC-initiated policy investigation towards preparing to govern. The results of this collective work was published in a series of 12 reports, including 'Early Childhood Educare' (Taylor, 1992). As part of the NEPI investigation, Linda Biersteker brought together policy suggestions from different research initiatives and examined them in the light of the NEPI and Early Childhood Educare (ECE) Commission criteria (Biersteker, 1992). This document served as a summary of the NEPI ECE Research Group. I was a member of that group.

Biersteker isolated three main trends in terms of ECE services, taking into account the traditionally separate education and welfare policies at that time. These were "education policy re pre-primary education", "welfare policy re day care provision" and she then synthesized these two into a third position, which she referred to as "development policy re early childhood educare provision" (Biersteker, 1992, p. 2). Biersteker explains that the education sector responded to high drop-out and failure rates in the schooling system from a 'deficit' construction, proposing an additional year of provisioning within the primary school and emphasising 'school readiness' (Biersteker, 1992). Their proposal 'undervalued' the pre-primary programme for children aged three to six years, provided in the privileged education system. This position was also influenced by the one-year Bridging Period Programme that had been introduced by the Apartheid government. The welfare policy suggestions were based on full day care for children of mothers working outside the home, to be subsidized by government only for the very poor. This perspective prioritized children's care rather than educational needs.

The third 'development' position integrated education and care, within a broad context of health, education, community development and housing. It viewed the role of government policy as enabling and empowering communities to develop adequate services for their needs, in particular the holistic development of young children. This position generated more space for beneficiary agency and a wider range of possible programmes. At that time, many civic, early childhood and literacy programmes used an approach promoted in 'Training for Transformation' (Hope & Timmel, 1984). This approach, influenced

by the work of Illich (1973) and Freire (1970) acknowledged the power of dialogue to transform relationships, build community and drive social change. While Biersteker's report offered an important first step in setting out the different positions and narratives, it failed to sufficiently acknowledge and describe the innovative conscientizing programmes that were not represented in the suggestions of the more established education research institutions.

As I review Biersteker's document, what jumps out is the number of powerful education players who suggested "the downward extension of the primary school by adding a preschool year for five-year olds, either at existing primary schools or in community schools" (Donaldson, 1992; Human Sciences Research Council [HSRC], 1981; Mehl, 1991; Reilly and Hofmeyr, 1983) (referred to in Biersteker, 1992, p. 2). This proposal was based on reports written by researchers published during apartheid and who worked in institutions such as the HSRC that was established and thrived during Apartheid.

Next in my story, I point to the way that a few influential individuals were able to subjugate other proposals and elevate the proposal to extend primary school downward.

Reorganising Power Lines

In the period leading up to the 1994 first democratic election, several different associations and umbrella organisations represented different groupings of early childhood training providers and practitioners. The history of separate services for different racial groups during Apartheid was reflected in national organisations. Among these, the South African Association for Early Childhood Educare (SAAECE) was the oldest and had been established by white nursery-school teachers in 1939. In the early 1980s, SAAECE began to open its membership to other population groups, but "continued to organise primarily in the urban areas and in relatively advantaged communities" (Williams & Samuels, 2001, p. 14). In 1990, the National Interim Working Committee on Educare (NIWC) emerged from a consultative conference, hosted by the National Education Co-ordinating Committee (NECC) which was operating as the ANC Education Desk, to consider a proposed University programme. The conference rejected the proposal as it did not take sufficient account of the context. At the end of the meeting, several people were nominated to take forward the process of building unity in the sector.

I was one of about ten people nominated to this national committee that decided to call itself the National Interim Working Committee on Educare (NIWC), and we started to hold regular meetings in five-star hotels, which were the only available racially integrated accommodation at the time. Despite the sector being predominantly female, all three NIWC office bearers, the National Chairperson, Organiser and Treasurer, were all men. After several meetings, a decision was made to approach the previously 'white' SAAECE to negotiate a 'settlement'. So, while the political parties negotiated the future of the country, the Educare sector held our own 'negotiations'. Williams and Samuels (2001) report that "After a gruelling process of negotiation, SAAECE and NIWC finally amalgamated in 1994 to form the Congress of Early Childhood Development (SACECD)" (Williams & Samuels, 2001, p. 10). While this might have appeared to be a democratic process, unequal power relations in the sector, including patriarchy, meant that some individuals were able to dominate. The majority of early childhood practitioners and all beneficiaries were excluded from any debate. The late Roy Padayachie[9], who also led the World Bank Research Group (Padayachie et al., 1994), had been consolidating his influence in the ANC and the early childhood sector. He had played an influential role in the early childhood policy-making processes leading up to the first democratic election and was elected as the first National Chairperson of the South African Congress of Early Childhood Development (SACECD) in 1994.

Padayachie explained, in a presentation to a 1993 ANC consultative meeting, that he saw his role as preparing the "educare constituency so that it is ready for the present challenge of building the new democratic order" (Padayachie, 1993c). However, it is evident from a range of documents in my archive that Padayachie was presenting a set of ideas to be accepted without discussion or debate (Padayachie,

[9] Roy Padayachie died of a heart attack on May 4, 2012, in Ethiopia while serving as South Africa's Minister of Public Service and Administration.

1993a, 1993b, 1993c)[10]. These ideas included a vision for policy, resource mobilization and an appropriate national organisation that "speaks with a united and powerful voice" (Padayachie, 1993c, p. 1). Only a small group of people regarded as 'experts' were involved in the consultative process. My persistent inquiries, as a member of a local ANC branch, suggest that no discussion about early childhood policy was taking place in local ANC branches. Even the records of the ANC consultation at provincial and national level show that there was no open-ended discussion of possibilities for early childhood policy (ANC, 1992a, 1992b, 1994).

A Charismatic Storyteller and an Accident: The Birth of Grade R

At the time while I was participating in those early consultations, I did not recognize Padayachie's strategy of building a single narrative as clearly as I do in retrospect. Padayachie's narrative echoed the 'education' perspective of the 1992 NEPI educare research proposals. This was also the perspective being promoted by the World Bank which commissioned a study led by Padayachie to investigate the downward extension of primary school (Padayachie et al., 1994). The power of this single story supported by the familiar Apartheid era discursive tropes, and education experts from the same era, and told by a politically savvy and influential storyteller displaced discussion about the other NEPI proposals. In particular, the proposal that emerged from the non-formal educare sector that had quietly been working in and with marginalized communities, could not mobilize the same authority. The more complex and innovative story that emerged from the bottom up, came with the uncertainty of empowering communities to design the kind of services that would support their visions of the childhoods and the society they hoped to achieve in a democratic South Africa.

The scope of this article does not allow for a detailed account of power relations and the 'accidents of history' during that period. However, to further illustrate the way that this single story emerged as the dominant narrative from the early ANC education consultation, I briefly trace some nodal moments in the 'ready to govern' consultative process. Despite the heartening ANC promise of consultation, I was perplexed to see how this recurrent single educare story, by an influential storyteller, emerged without any meaningful opportunities for debate and discussion. My analysis of archival documents, and enquiries of ANC leadership at the time, including Mary Metcalfe, head of the Education Desk, suggest that a critical historical accident might be found in a story that Metcalfe told me in 2015. The story is about an early ANC consultative meeting that took place before the 1992 Getting Ready to Govern Conference. The key controversial issue of the conference was the number of years of free and compulsory education that the ANC could afford. Financial modelling by the ANC leadership had determined that ten years would be the maximum. However, the student movement and the affiliates of the NECC[11] that had argued as part of the political struggles for free education up to end of Grade 12, expected more than ten years. It was critical that this issue be resolved to avoid taking contestation into the election. Metcalfe explained:

> At the end of the day when we were carefully managing the report back to the conference, the late Ivy Matsepe-Casaburri joined us as we were summarising and finalising the resolutions. She was a passionate supporter of educare (although not part of the educare sector) and asked why educare had not been included. We had been thinking specifically of schooling and had assumed that educare would be included more broadly outside of the school system. It was now too late to discuss this suggestion fully and she insisted that educare must be included. So, we included Grade R as the first year of 10 years of free and compulsory education. So, we now have Grade R with grades 1 to 9 as our 10 years of schooling but without the exit exam. Then this became some kind of rule (Mary Metcalfe, 2015)[12]

It seems that part of this accident of history was the complexity of 'educare', which straddled more than one ANC policy grouping in the consultative process. In addition, Padayachie had already started elevating the dominant coloniality story in senior ANC circles. Consequently, the Ready to Govern Conference Report says little specifically about educare, but commits to

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[10] Retrieved from my archive.

[11] The National Education Crisis Committee (NECC) was launched in early 1986 with the support of the United Democratic Front (UDF) and Congress of South African Trade Unions (COSATU), in the context of militant anti-apartheid student action.

[12] Personal communication in my archive.

> … the provision of a minimum of ten years of free and compulsory education, which shall include, where possible, one year of preschool education. This commitment is based on our belief that ten years of quality education is the minimum necessary to prepare individuals to participate in the economy and society (ANC, 1992a, Section K.Education, subsection 1. Provision).

This position based on colonial thinking that had emerged from the Apartheid education era was taken to the election as ANC policy and has persisted into the present.

Ironed power lines: ANC policy for young children

According to the three key documents produced by Padayachie between March and October 1993 (Padayachie, 1993a, 1993b, 1993c)[13], he emphasized the need for a movement that "speaks with a united and powerful voice". He promoted NIWC, which he chaired at the time, as the appropriate organisation to lead this process of preparation and articulating the selected education policy position (Padayachie, 1993a, p. 1). He prioritized consensus and referred to several 'discussion' documents and 'consultative meetings' that did not provide any meaningful opportunities for debate or engagement. For example, an invitation[14] to an ANC Early Childhood Educare Policy Workshop, held on 2 September 1993 in Cape Town, lists the aims as: "To discuss and make recommendations for ANC Early Childhood Educare Policy; and To establish criteria and nominate a representative to the Regional Education and Training Forum 11 and 12 September" (Padayachie, 1993b, p. 1 from archive of Linda Biersteker). A wide range of complex policy issues from guiding principles to budgets, governance to redistribution were all to be discussed, alongside the nomination of one representative to the ANC regional forum, in the four hours scheduled for the meeting (Padayachie, 1993b, p. 1-2). The style of the invitation and the unachievable agenda reflect the intention to inform and vote for given decisions, rather than consult.

The 'consultative' documents circulated by Padayachie present a deficit model of the users of services and assume that communication will be in one direction, from services to parents who need 'to learn about and respond to their children's developmental needs' (Padayachie, 1993a, p. 2). There is no reference to parents and communities knowing what is best for their children and society, nor how the proposed services would best serve their needs. The discourse frames parents as merely users of services in order "to take up work or further education' (Padayachie, 1993a, p. 2). The recommendations focus on the establishment of structures and limits local influence, rather than encouraging opportunities for listening, experimentation and meaningful participation. The emphasis is on generating awareness of the need for 'early childhood care and development', based on an assumption that there is consensus about what that means. The new umbrella organisation that Padayachie was leading is positioned as the primary credible influence.

It seems Padayachie was a great bureaucrat, and excelled in performing what Stevens (2011) refers to as "bureaucratic reason", by combining "effective persuasion" with "control of uncertainty" and his personal "career incentives" (Stevens, 2011, p. 12). Padayachie selected the proposal with least uncertainty to tell a story about a new policy area, and at the same time identified himself as the primary storyteller. I believe Padayachie was using discursive tropes, not to bring like-minded people into an advocacy coalition, but rather to show his worth in this "thought world" (Stevens, 2011, p. 13). Padayachie reinforced, rather than challenged, the "fundamental assumptions and tropes" of the preferred policy narratives of education experts of that time (Stevens, 2011, p. 14). The story Padayachie chose was from the Apartheid era and so, perhaps unwittingly, he carried colonial thinking into the new democratic policy terrain.

Creating Impilo as a Participatory Alternative

My position was different to that of Padayachie. I was inspired by the ingenuity and survival strategies of the marginalized communities in which I had lived and worked. I had started to read about integrated early childhood approaches and I was particularly inspired by the work of Marta Arango in

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[13] Retrieved from my personal archive.

[14] The document does not indicate the author, but it is most likely from Roy Padayachie.

Colombia (Arango & Nimnicht, 1987, 2004). She and her husband wrote about decolonizing education and human development strategies, and introduced me to an "integrated policy" for young children as part of the "hope for creating a new society with social and economic justice" based on what citizens desire (Arango & Nimnicht, 1987, p. 37). It was with this understanding that I continued to challenge my own colonial thinking and to listen for other stories and possibilities for social justice. In particular, I took up this challenge through Impilo, which used an experimental integrated approach in a three-year appreciative participatory action research process in 1000 community-managed sites in Gauteng.

Impilo was based on the principles stated in the 1996 Interim Policy for Early Childhood (IPECD), which was the first step that the National Department of Education (DoE), as lead department, took towards realising the ANC's promise for young children, families and communities. I was one of three ECD specialists given the task of drafting the IPECD (DoE, 1996). Our draft document emphasised an integrated approach, based on the narratives of the progressive non-formal sector, with possibilities for local communities to produce a range of stories about the kinds of services that would best enable them to support the well-being of their young children. When the policy was published, the IPECD acknowledged the importance of an integrated approach to address the "basic needs of families for shelter, water and sanitation, primary health care, nutrition, employment and adult basic education", but it only committed funding for the Reception Year[15] (DoE, 1996, p. 6). The interim policy envisioned that eventually children of Reception Year age would all be included in the school system. Consequently, it emphasized the need for this one year of provisioning to be part of an integrated system of ECD programmes that could include a variety of strategies and a wide range of services, directed at helping families and communities to meet the needs of children from birth to at least nine years old. The introductory section of the IPECD set out in detail the principles of an integrated approach and identified the paramount task as building "a just and equitable system" directed at the "integrated needs of children, women, and families" (DoE,1996, p.12). The policy specifically stated that funding for the Reception Year should not weaken funding for other kinds of services.

Despite the ANC commitment to providing opportunities for wide consultation even after it was elected to power, this did not happen except in Gauteng province. In Gauteng we used action research to engage families and communities in conversation and action to support the well-being of young children, through the Impilo Project. With the support of Education MEC, Mary Metcalfe, the Gauteng Department of Education (GDE) attempted to resist the dominant discourse and included consultation with communities in the research design of the provincial implementation of the national ECD pilot.

The scope of this article only allows for a brief overview of the Impilo Project. I took up the position in GDE as Chief Education Specialist responsible for Primary and ECD policy during the period we were drafting the IPECD. In my new position in GDE, and with the support of Mary Metcalf, we implemented the Impilo Project. I firmly believed at that time that it would be possible through action research to actively mobilize and demonstrate that there were possibilities, other than the single narrative of extending primary school downward. We had to negotiate with the National Department of Education (NDoE) to implement the national ECD pilot flexibly, as the national research design was limited to investigating the costing of one year of provision for four-year old children.

The primary assumption of Impilo was that the well-being of young children depends on the well-being of the families and communities. Little can be achieved by taking children out of their homes for a few hours without taking steps to change their socio-economic circumstances. Impilo sought to engage civil society and service providers in conversations about well-being by trying new paradigms, such as shifting from expert solutions to local solutions, and enabling dialogue, rather than merely pouring down simplistic messages for consumption by service users viewed as deficient (Shiva, 2002). Impilo included three linked action research projects for children from birth to nine years. The two additional projects were

[15] The Reception Year was later called Grade-R.

added as funds became available, but the main project was the provincial implementation of the national ECD pilot, referred to as the district pilot.

Collective Learning through Action

We contracted different consortia of RTOs, to each work in one of the new education districts in close collaboration with the newly appointed ECD district officials. The aim was to learn with community groups through supporting them to make decisions, and if necessary, we could all learn through small missteps. At the provincial level, I started to meet with my counterparts in other departments such as Health and Welfare, to understand each other's functions and find ways to collaborate. We spent a long time building a shared understanding of the definition of the new umbrella term 'ECD', as our health comrades pointed out that services and support should start from conception rather than birth. We were able to start building referral systems and help families to access available services across different departments. We also supported organizing and mobilizing to ensure everyone could access the services to which they were entitled and start advocating for additional services to fill the gaps. For example, we talked about food sovereignty and initiated community gardens, rather than merely providing information to families about how they should feed their children and offering some food to a limited number of children who could afford to attend centres. Together, we learned about the importance of building 'networks of care', known as uMusa (acts of kindness), with trusted helpers identified by the communities in which they live.

Deleting Data That Does Not Fit the Frame

The Director responsible for ECD in NDoE dismissed the idea of allowing community groups, in dialogue with training providers, to make decisions about the kinds of service they wanted and how best to spend their small stipend. She said it could not be accepted as it could lead to corruption. I find this particularly ironic in the light of the scale of corruption committed by ex-President Jacob Zuma[16]. By the time the Impilo Project featured as the lead story in the UNICEF 2000 State of the Word Report (UNICEF, 1999), it was clear that other than the experiences that participants might carry forward, our attempt to take a new narrative into early childhood policy-making had failed.

When I resigned from my position at GDE, I understood what Tsing, 2015, alludes to when she states that "a scalable research project admits only data that already fits the research frame" (Tsing, 2015, p. 38). Before the national ECD pilot started, the decision was made to scale up the one year of provision. Consequently, the national ECD pilot research was designed for scalability and could not accommodate the meaningful diversity sought through Impilo. With no open-ended research questions, the national research could not include any of the Gauteng data. The research design was too narrow to accommodate any complexity and diversity. So it counted the 1000 sites (there were less than 1000 sites in all the other 9 provinces combined), included a short description of Impilo (probably submitted by GDE), noted that Gauteng did not follow the ECD Pilot Project formula of R2 per child per day, and that was that (DoE, 2001b). I also began to realize that in the post-Apartheid national and provincial education departments, 'uncertainty' was the enemy and that power relations subjugated debate about policy options.

Despite the 1992 ANC promise of broad consultation, policy decisions for public provisioning for young children in South Africa during the first two decades of ANC rule have favoured simple solutions that prioritize discrete and fragmented interventions instead of engaging with more complex challenges. The centre-based approach, which was uncritically borrowed from affluent countries with high employment rates and strong welfare programmes, persists as the most familiar and popular kind of ECD service provision. The primary focus of government ECD provisioning since 1996 has been the introduction and gradual extension of one year of additional schooling in the year before children join the formal school system, initially referred to as the Reception Year and now as 'Grade R'. This form of provisioning that

[16] On 16 March 2018, it was confirmed by the director of public prosecutions that Zuma (who was President from 2009 to 2018) would face 18 charges of corruption, including more than 700 counts of fraud and money laundering.

reproduces inequality has persisted despite government commitment to consultation and recognition, in new policies, of the need for broader 'integrated' approaches. The next part of my story briefly traces this trajectory and argues that the government commitment to 'evidence-based planning and monitoring' has reinforced this inequitable form of ECD provisioning.

Grade R: Reproducing Inequality on Economic Lines

In 1996, the ANC government committed to ten years of free and compulsory education, starting with a Reception Year for 5-year-olds (DoE 1996). By the time the Education White Paper 5 on ECD was published in 2001, the national 3-year ECD (Reception Year) pilot had been completed. The ANC's ECD policy priority, as expressed in 2001, was the establishment of a national system of provision for children aged 5 years, with the majority of these classes located within the formal school system and a small number in community-based services (DoE, 2001a, p. 5).

Despite the National Integrated Plan (NIP) (RSA, 2005), the 2005 Children's Act (DSD, 2005) and the National Integrated Early Childhood Development Policy (NIECDP) (Republic of South Africa [RSA], 2015), for nearly 20 years the primary focus of government services for young children has remained the introduction and expansion of this single year of provisioning for children before they enter primary school. Despite the 2010 target for universal access, Grade R is not yet available to all children and those living in urban areas and those with greater financial resources are more likely to be in a Grade R class (Biersteker, 2018). There is a problem of under-aged children from more resourceful families entering Grade R classes in schools and spending more than one year in that class. These are families who realize they can get cheaper better-quality childcare by manipulating the system. Since those classes attached to schools are better funded, practitioners prefer to be employed in schools. Before the introduction of Grade R, the standard model of ECD provisioning was in community-based centres with children from 3 to 6 years. This set-up more closely aligned to traditional childcare arrangements, that nurtured peer teaching and learning, with children in the village forming friendship groups (Rudolph, 2017). The community-based system of provision has been eroded by age-segregation and flight of practitioners to better paying jobs in schools.

Drawing on recent research, Biersteker concludes that "while Grade R was established as a means of reducing inequalities, it simply extended the advantage to children in more affluent schools" (Biersteker, 2018, p. 305). After concluding that Grade R is not cost-effective in terms of learning outcomes, the 2014 evaluation report nevertheless recommends that "the Grade R programme be continued and that ways to improve its impact be explored" (van der Berg et al., 2013, p. 3). The National Department of Basic Education (DBE) agreed with the evaluators and rather than considering a different approach, it committed to improving training, increasing access to materials, developing high quality school readiness tests, and reverting to a higher percentage of community-based classes (DBE, DSD, & DoH, 2017; Samuels et al., 2015). The government cost-saving strategy to increase the percentage of community sites, after having decimated community-based services through neglect over 20 years, is particularly pernicious. None of these strategies addresses the uneven expenditure across different socio-economic groups, based on the socio-economic inequalities in the entire education system. Although universal provision of Grade R has not been achieved as planned, in 2019 an additional year referred to as grade RR will be introduced, in part to address the problem of under-age children in Grade R (Biersteker, 2018)[17]. Referring to Taylor (2014), Biersteker (2018) explains the expectation that this extra year, with stricter enforcement of age-of-entry, will ensure smooth progress from one grade to another with children of their own age (Biersteker, 2018). This is an example of what Stevens (2011) refers to as the silencing of inequality.

Outcomes-based Planning, Monitoring and Evaluation Deepens Inequality

The Grade R policy decision, initially drawn from the Apartheid era and sold by Padayachie, has been reinforced through the decision that all South African government planning, monitoring and

[17] Confirmed by the President in his 2019 State of the Nation Address (SONA).

evaluation functions be centralized in a single high-level Department of Planning, Monitoring and Evaluation (DPME) (The Presidency RSA, 2015). In the context of the 2030 Vision and ANC election manifesto, the 2010 adoption of an outcomes-based approach to public management and the 2011 National Evaluation Policy Framework (NEPF) emphasizes "increasing the utilization of evaluative evidence in planning, budgeting and management decisions" (Amisi, 2015, p. 1). Despite the laudable intention of improving value from government spending, the nature and role of monitoring and evaluation (M&E), and the way that 'evidence' is understood, will determine whose judgments are valued and what kind of change is possible. The dominant 'scientific evidence' discourses prioritize the perspectives of experts over beneficiaries (Rudolph, Millei, & Alasuutari, 2019). Communication, in the form of messages, is viewed as a strategy for enlisting civil society buy-in, rather than enabling meaningful conversation that includes all concerned about child and community wellbeing.

A series of articles[18] published in the African Journal of Education, disseminate monitoring and evaluation developments in South African policy and planning and promote 'evidence' as the key policy driver (Amisi, 2015; Davids et al., 2015; Samuels et al., 2015). Amisi argues for communication as a tool for evaluators to improve the "usability and utility of evaluation evidence" (Amisi, 2015, p. 6). This is what Stevens (2011) refers to as using 'evidence' to sell a chosen story. According to Amisi, the focus on communication among evaluators, practitioners and policymakers as users of evidence, encourages dialogue as adding "meaning to often complex and technical evaluation findings in a way that is understandable and enlightening to the target audience" (Amisi, 2015, p. 5). This confirms that, from the perspective of the Presidency, policy makers assume that avoiding complexity is necessary to sell their policies. There is no reference in any of the articles to dialogue generating new knowledge or the role of service users in the evaluation process. Service users are constructed as deficient, unable to understand or engage constructively with different ideas. Consequently, they need simple messages.

Amisi identifies two separate communication processes, between practitioners and evaluators in the evaluation process, and between government and civil society in different forums, in order to target messages distilled from findings. Amisi cautions that at a later stage when "evaluations become imprinted in the operating processes of government", there will be more scope for evaluation findings to be "communicated transparently and widely", but in the meantime proposes "communication that generates interest and appreciation of evaluations, and encourages the application of lessons learned in policy and management practices" (Amisi, 2015, p. 7). Concerns are raised in all three articles about publishing evaluation findings that could "provide an opportunity to sensationalise critical findings to show government in a bad light" (Davids et al., 2015, p. 7), especially if the DPME independently communicates "evaluation outcomes of another department's programme" (Amisi, 2015, p. 5). This statement highlights government concern for the way it is viewed, rather than the social justice outcomes of their policy choices. Consequently, the singular solution is reinforced by refusing to learn through experience and possible missteps.

A Story without Ending …

Early childhood policy-making and evaluation has used 'evidence' selectively in South Africa to avoid complexity, uncertainty, or challenge to the dominant narratives, and in so doing ensures that government decisions are viewed positively. In this way, despite the good intention of the ANC government, inequality has been silenced and even exacerbated through early childhood policy. This kind of mistrust of citizens has been carried into the coercive and heavy-handed government strategy during COVID-19. Government is not linking the disease response to local practical knowledges and culture[19]. Citizens have not been invited to collaborate in solving the huge problems facing the country. Dicta are handed down in the form of simplistic messaging, without any explanation of the thinking behind these

[18] The first two articles relate directly to ECD and the third to the overarching national monitoring and evaluation process.

[19] Important lessons learnt in the Ebola crisis in West Africa and the AIDS pandemic in South Africa. https://steps-centre.org/blog/science-uncertainty-and-the-covid-19-response/

decisions. Most school children rely on the one meal a day they receive through the School Nutrition Program. Many early childhood workers rely on the meagre fees paid to attend large ECD centres. Consequently, experts debate whether schools and early childhood services should open, rather than engaging civil society in finding creative ways to feed and take care of children in their communities.

The kind of integrated policy-making process used in Impilo, based on trusting citizens and enabling co-operation between government and civil society, could provide the kind of environment that is urgently needed, so that citizens can understand as much as possible and choose to co-operate with government. Impilo recognized the potential of a strong network of trusted helpers in every community, who know where young children are and engage with families as partners. They could surely play an important role in helping families access food and care close to their homes. As 'essential workers' with the necessary protective equipment they could link with families and find out the nature and location of urgent needs, including food, water, protection, exercise and sunlight, or anything else our government departments might not yet have identified. They could engage in dialogue to help everyone to understand the complexity of the pandemic, avoid discrimination and work together to experiment in finding the best strategies for survival and willingly implementing public health measures.

In terms of policy for young children beyond the immediate escalating crisis of the pandemic, and in light of the expressed intention of our President's messages during COVID-19 to address inequality and forge a new economy, it is time to consider other options to the single story that has dominated early childhood policy. I pose the following questions to restart conversations: Can we learn from the uncertainty of COVID-19 in ways that open up debate and encourage a more democratic deliberation? Can government acknowledge missteps and be open to proposals from service users? How can we extend the notion of evidence, and include in our conversations early childhood theorists who have long been calling for the reconceptualization of early childhood policy, such as Peter Moss who promotes hope through contestation (Moss, 2015)? Can we imagine another way of knowing, being and communicating that does not advantage the privileged few with devices, unlimited airtime and data packages? Can we rebuild livelihoods and solidarity through recognizing the agency and voice of communities? Can we all work together towards the vision of a convivial society set out in the 1955 Freedom Charter?

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Research Article

Preschoolers' views on integration of digital technologies

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Abstract: The aim of the present study was to explore preschool children's views on the integration of digital technologies in their school. The study included 171 Israeli children aged 3 to 6 who participated in in-depth interviews regarding their views on digital technologies in their preschool. The interviews were analyzed using content analysis. Three major views regarding digital technologies in the preschool were found: The degree to which digital technologies are necessary; the goals of the use of these technologies; the setting for using the digital technologies. Fifty percent of the children, especially the younger ones, claimed that use of these technologies is not necessary in preschool. However, most of them understood the importance of using these technologies and their contribution to many fields. In relation to the setting use, they referred to time and social aspects. The findings indicate that preschool teachers need to mediate these aspects more wisely and adapt them to the children's understanding and view toward digital technologies than actually takes place when they use them with the children.

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Introduction

Digital technologies, such as computers, tablets, smartphones, and others, have become an integral part of our lives and their influence is apparent in all life domains. Use of digital technologies has become increasingly common among children, both at home and in education settings, including schools and preschools (Holloway, Green, & Livingstone, 2013; Ng, 2016). Studies in the world indicate increasing use of these technologies, already from early childhood (Elias and Sulkin, 2017; Kabali et al., 2015; Palaiologou, 2016a). Teachers and educators have concerns regarding the use of digital technologies by young children. One of the main arguments for not enabling children's exposure to digital technologies refers to children's passivity in these situations. The idea is that lack of physical and mental activity when watching the screen may inhibit development in many fields (Ebbeck, Yim, Chan, & Goh, 2016). Concerns that increased use of screens will cause attention and focusing problems, cognitive decline and emotional and social problems were also raised (Ebbeck et al., 2016). However, these concerns have not been proven scientifically, and there is ambiguity surrounding this issue. The scientific literature is divided on this matter. On the one hand, there is evidence of a relationship (but not a proven causal relation) between extensive use of media means and attention problems, low achievements, and obesity (Brown, 2011; Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). On the other hand, there is increasing evidence that well-designed digital technologies are effective in supporting children's development. Use of digital technologies was found to contribute to improvements in children's cognitive functions, such as memory, visual thinking skills, analogical thinking, abstract thinking, logical mathematical thinking, creative thinking, metacognition, development of language and literacy and development of visuo-motor coordination (Neuman, 2018; Passig, Tzuriel, & Eshel-Kedmi,2016; Vernadakis, Avgerinos, Tsitskari, & Zachopoulou, 2005). They can help children with learning disabilities and attention deficit disorders, children with special

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needs and children from a low socioeconomic status (Felicia, Sharif, Wong, & Marriappan, 2014; Korat, Gitait, Bergman Deitcher, & Mevarech, 2017). It was also found that use of digital technologies contributes to communication with friends and promotes meaningful interactions with other children, and that adult mediation for using digital technologies improves children's discourse skills (Hsin, Li, & Chin-Chung, 2014).

Many countries encourage the use of digital technologies for preschoolers for supporting their development, and it is also recommended by the OECD (Organization for Economic Cooperation and Development) (Bakia, Murphy, Anderson, & Trinidad, 2011). In education settings, digital technologies can be integrated for example in the area, of Information and Communications Technology (ICT). Teachers can use ICT for instruction, and for administration and communication purposes, with numerous implications for classroom management, instructional practices, pedagogical approaches and time use. Competence in using ICT and digital literacy are becoming recognized as important skills that students need to acquire if they are to flourish in the digital age (OECD, 2018).

However, in spite of the contribution of digital technology use to young children, the encouragement of countries and the OECD's recommendation to use digital technologies for preschoolers, the actual situation in many countries is far from assimilating digital technologies (Preradovićet, Lešin, & Boras, 2017). In Israel, for example, where the present study was conducted, a national ICT program was begun in 2010, which continues to date, within whose framework schools receive budgets from the Ministry of Education to purchase digital technology means, infrastructures and maintenance, and for professional development in this field (Ministry of Education, 2017a). This program does not include preschools. The only national program that advances assimilation of digital technologies in the preschools is "Laptop for Every Preschool Teacher", which has been operating since 2012 and helps preschool teachers to acquire laptop computers and progress in their professional development (Ministry of Education, 2017b). In a model currently being developed by the Ministry of Education regarding the "Future Preschool" it is indicated that digital technologies should be integrated into the preschool pedagogy and that the children should develop technological skills in preschool, but this aspect in the model is not yet detailed (Ministry of Education, 2020). However, the actual situation in preschools in Israel is far from including digital technologies. The only recent research performed on this subject in Israel to date (Zilka, 2011) found that 10% of 150 preschools had a new computer that was connected to the internet, and the Ministry of Education policy was implemented in only 15% of the preschools. According to the Israeli Ministry of Education policy, the computer environment comprises part of the preschool's social-cultural environment and helps train an independent and active learner who uses digital technologies wisely for carrying out processes that support emotional, social and cognitive development (Ministry of Education, 2017a). Nonetheless, old computers were found in 70% of the tested preschools. However, the computer was not in use in 65% of these preschools, due to technical problems. Some preschools had one computer for 35 children (Zilka, 2011). This situation harms mainly those children who do not have access to a computer at home, and they also do not approach the computer often in the preschool. Such a situation comprises a risk for expanding digital gaps that lead to education gaps (Rogers, 2001). The preschool teachers reported difficulties in organizing the preschool, making time for each child or group of children, absence of a solution for technical problems and non-usability of the computer (Zilka, 2011).

Similar findings were reported in additional studies from Israel and elsewhere (Joshi, Pan, Murakami, & Naranayan, 2010; Magen-Nagar and Firstater, 2017; Manessis, 2011; Ntuli and Kyei-Blankson, 2010; Palaiologou, 2016b; Preradović et al., 2017). Magen-Nagar and Firstater (2017) tested the perceptions of preschool teachers in Israel regarding the assimilation of ICT in their classes. Their aim was to identify obstacles embedded in this assimilation. They found that although preschool teachers recognize the value of these media, they think that ICT does not play a major role in preschools, that ICT serves mainly as an instrument for collecting information and as an advanced teaching mean for visual illustration of the learning contents, and that ICT contributes mainly to the social interaction between the children, albeit not always in a positive manner, in particular among children with difficulties. Their main conclusion was that preschool teachers do not pose pedagogical goals that include ICT and do not realize its

pedagogical potential. They use it mainly for illustration, diversification, and enrichment. The investigators indicated a need to cause preschool teachers to adopt innovative pedagogies in ways that are suitable for the preschool, with emphasis on changing the traditional perceptions.

Children's Views

Investigation of children's views or perspectives is a relatively new field of research that has developed over the past two decades. This research stemmed from the understanding that it is important to hear the children's voice and perform studies together with boys and girls, and not only about boys and girls. The aspiration was to develop research methodologies within whose framework children would not only be objects of research, but rather partners in the research (Dockett and Perry, 2003; Einarsdottir, 2010). These insights were influenced by the UN Convention on the Rights of the Child, where Section 13 states that each child will have the right to freedom of expression, including freedom to search, receive and give information and ideas of any kind, regardless of borders, orally, in writing or in print, in an artistic manner or by any other mean of their choice (United Nations, 1989). The year of the publication of the Convention on the Rights of the Child comprises a landmark that symbolizes a change in perception. Children are no longer perceived as passive objects lacking opinions and outlooks, but as subjects with opinions and independent ideas, ability to describe and interpret their routine life, power and strength, and a right to be involved in decisions that will affect them (Fargas-Malet, McSherry, Larkin, & Robinson, 2010).

Researching children's perspectives is based on two theoretical approaches: the postmodern approach in education and the "sociology of childhood" approach. It is compatible with a democratic worldview that emphasizes the independence of all individuals in the society and their right to express their opinions. The postmodern approach perceives reality as being complex and as including many perspectives. According to this approach, there is no single objective reality and no absolute knowledge or universal truth. Knowledge is the result of social structuration and those who experience reality interpret it through their interactions with their community. Knowledge therefore exists in a specific and subjective context (Cannella, 2005). The "sociology of childhood" approach presents childhood as a unique and important period, and not only as a period of preparation for adult life. According to this approach, children are a social group that operates in a social-cultural space and maintains reciprocal relations with other groups in society, such as adults (Vandenhole, Desmet, Reynaert, & Lembrechts, 2015). According to this perception, children are active and skilled subjects able to present attitudes and ideas (Harcourt and Conroy, 2011), to describe and interpret their routine life, have power and strength, and construct knowledge through everyday interactions with others (Alderson, 2000; Langston, Abbot, Lewis, & Kellett, 2004).

The democratic viewpoint also comprises a point of origin for research on children's perspectives. Democracy must recognize multiple opinions and viewpoints and enable individuals to develop in different ways. In a democratic system, there is awareness of the fact that there is no one correct answer and shared meaning can be constructed through a democratic discussion. A democratic discussion is supposed to enable children to express their opinions and construct meaning for their experiences (Dahlberg, Moss, & Pence, 2007). According to this perception, preschools should comprise a space in which diverse opinions can exist and the preschool teacher, together with the children, create a meaning that enriches thinking and participate in decision-making processes in all areas of preschool life.

The research literature in the field of investigating children's perspectives refers to construction of knowledge on children's lives from the children's point of view (Christensen and James, 2000; Clark, 2017; Corsaro and Molinari, 2000).This literature presented children's perspectives in the preschool and showed that things that are important for children can be revealed and that boys and girls are able to understand and analyze experiences in a much broader manner than we sometimes think. It is therefore important to examine and discover their views in different fields of their lives, including the field of digital technology.

Our literature review yielded very few studies on young children's views and attitudes toward integration of digital technologies in the preschool. These studies tested the knowledge, understanding and

preferences of young children regarding the use of digital technologies in general (Aubrey and Dahl, 2014; Danovitch and Alzahabi, 2013; Dashti and Yateem, 2018; Eisen and Lillard, 2016, 2017; Palaiologou, 2016a). Other studies interviewed children on their attitudes and views regarding the use of digital technologies in the context of the school and the preschool. However, they referred solely to computers (McKenney and Voogt, 2010) or tablets (Dunn, Gray, Moffett, & Mitchell, 2018; Oliemat, Ihmeideh, & Alkhawaldeh, 2018). Oliemat et al. (2018) tested young children's views regarding tablets in general. They interviewed and held observations of 40 children in an educational setting, from preschool to second grade, on their use, knowledge and views in the context of tablets as well as on parents' role in supporting tablet use among children. They found that children have knowledge on tablets and their components and acquired the abilities necessary for using a tablet. However, in some cases mastery was not complete. Furthermore, children perceived tablets more as an entertainment than as a learning tool, and used them for different uses, where the most common use was playing games, followed by watching YouTube. Use of games applications and pleasure replaced traditional play activities, and the children indicated that their parents had rules regarding use of the tablet and that they need help and guidance on tablet use from their parents.

The present study explored children's views, not regarding one specific technology, but rather in general regarding digital technologies, including computers and tablets as well as smartphones, projectors, digital photography, game consoles, etc. The present study explored children's views regarding use of these technologies, but also, and especially, regarding the desired integration of these technologies in the preschool. For example, should there be such integration in the preschool, what should it include and what should be its characteristics, through in-depth interviews. Our assumption was that such research will enable better understanding of the opinions and needs of preschoolers in this context and will lead to improved and more effective integration of digital technologies in the preschool. This understanding is very important for preschool teachers in their work with children, in order to better adapt it to the needs of children in the 21st century and can contribute to optimal training of future preschool teachers in colleges of education in the context of integration of digital technologies in the preschool.

Method

Participants

The research population included 171 Israeli children, aged 3-6 (younger than 4 years: 38 [18 boys, 20 girls], 4-5 years: 77 [38 boys, 39 girls], older than 5 years: 56 [29 boys, 27 girls]), from 37 preschools. The parents of the children gave their consent for their children's participation in the research. The children were also asked for their consent and a child who did not agree to participate, did not participate. The research procedure was approved by the ethics committees of the researchers' institute and by the Israeli Ministry of Education.

The preschools are from the national education stream, located in the center of the country. They are situated in neighborhoods with different socioeconomic statuses (SES), from the low to the high status (SES level was determined according to the Israeli Municipalities' Statistical Report, Central Bureau of Statistics, 2012).

Instruments

Semi-structured in-depth interviews were held with the children. The interviewers were undergraduate students for early childhood with experience in the researched preschools as part of their degree. They were trained by the authors on how to interview the children. Each interviewing student randomly chose four children from each preschool for interviewing (with one or two students performing interviews in each preschool). The interviews were held individually, in a quiet room in the preschool, in a one-time session that lasted 15-20 minutes. The questions which the participants were asked included: "I want to ask you about digital technologies such as a computer, tablet (iPad), smartphone, digital camera, PlayStation, Xbox, and so on. Do you use them often at home? Do you like to use them? For what?", "Do you think that the preschool should also have them? That it is important that they be in the preschool?

Which of them should be in the preschool? Why?", "What should be done with them in the preschool? What would you like to do with them in the preschool?". The questions and the time of the interview were adapted to the child's age and/or understanding if necessary. All interviews were voice recorded and transcribed.

A single preliminary observation of the preschools was also made by the interviewing students in order to ascertain whether the preschool has digital technologies, such as computers, tablets, smartphones, television, projectors, digital photography and game consoles. These yielded a diverse situation. A few preschools had no digital technology (no computer and no television, in some there was no computer, but there was a television). Most preschools had only one computer, which was used mainly by the preschool teacher. Very few preschools had two computers. In some of the preschools where the children did use the computer, the computer was not connected to the internet and contained mainly games, including educational games, for example for learning arithmetic, literacy and language. In very few preschools the computer also included inquiry software. Five preschools had a projector. There were no tablets and no game consoles in any preschool and there was practically no use of digital cameras. A smartphone was used only by the preschool teacher.

Data Analysis and Processing

The interviews were analyzed by two coders (the authors), using content analysis. Content analysis enables identification of an organizing pattern that reflects the participants' view regarding the integration of digital technology in the preschool. The children's responses were coded through open processes. The responses were developed into categories and headings, with reference to the number of respondents who shared the same responses under each heading. Next, quotes were selected from the interviews and were used to support and develop the results.

Results

The aim of this study was to test how children perceive the integration of digital technologies in the preschool. We found that the children were aware of the existence of digital technologies in their environment, and when answering the question, what digital technologies should be added to the preschool, they indicated technologies such as television, computer, projector, tablet, computer games, game consoles such as PlayStation and Xbox, digital camera and mobile phone, which they apparently use mainly at home. In the first stage, we analyzed the in-depth interviews held with the children according to the questions they were asked. In the second stage, we identified three main categories that were raised from the children's answers: The degree to which digital technologies are necessary in the preschool; the goals of their use; and the framework for using digital technologies in the preschool. The main results are illustrated in Figure 1.

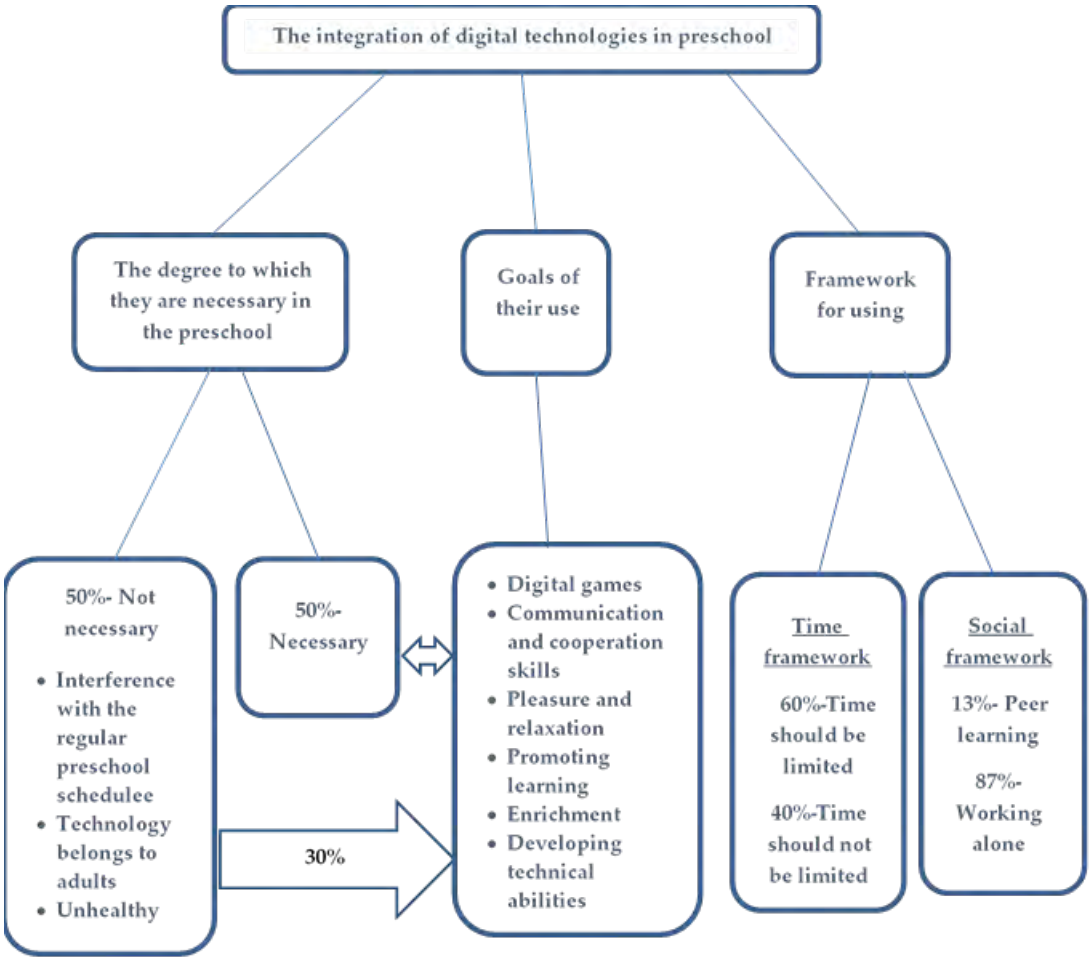

Figure 1. The participants' view regarding the integration of digital technology in the preschool

The Degree to Which Digital Technologies Are Necessary in the Preschool

Two main sub-categories arose from the children's answers regarding the degree to which digital technologies are necessary in the preschool: non-necessity of the use of digital technologies in the preschool; importance and contribution of the use of digital technologies in the preschool:

Fifty percent of the children do not perceive any need for using digital technologies in the preschool. They spoke against its integration and gave diverse reasons for this. This view is, apparently supported by examples from their life experience at home and their limited experience in preschool according to the observations which were made in their preschools. Some children perceived digital technology as a source for interferences. Some indicated that they comprise a waste of time and interference with free play, which they apparently perceive as more enjoyable or important. For example, 3.8-year-old Alma indicated that: "*This is not necessary in the preschool because there are non-digital games and that is more fun*". Other children indicated that this may cause interferences with the routine and distraction from the preschool teacher's explanations. Hodaya, 5.5 years old, said: "*It is impossible to learn with a computer, tablet and TV, we need to listen to the teacher!*". Five-year-old Ben is aware of the contribution of the other activities in the preschool: *"You cannot play on the computer all day because you are wasting your time for other things"*. Several children claimed that digital technologies are not needed for promoting learning in the preschool, and that children learn from other sources, such as adult mediation or a book. For example, 5-year-old Yuval said: *"They do not help, because learning is things that one knows from the head and from reading books, and a computer is not a real thing"*. Some children explained their opposition in that technology belongs solely to adults. Uri, 3.5 years old, expressed this: *"Only when I am big will I play on the computer. Now I am not big"*. Some are afraid

that the instrument will be ruined, will get lost, will not be charged (technical difficulty) or will electrocute. For example, 4.5-year-old Alex explained: *"I would like to put them in a drawer so that they will not break or be destroyed"*. Six-year-old Lior claimed: *"A person can become electrocuted by this and the charge can decrease"*. Hodaya, 5.5 years old, added: *"It will get lost and the children will be really sad"*. A few children perceived their technological/technical ability as limited, and therefore it is not desirable that they use digital technologies. Four-year-old Jonathan: *"This is my mom's phone. She does not allow me because I do not know"*. Several children said that the adults do not allow them to use digital technologies.

There were children who claimed that use of digital technologies may be dangerous and unhealthy. Some indicated that general harm to health is possible, others used arguments that describe possible injury to body parts that are more specific to use of digital technologies. It seems that some of the children heard these claims at preschool or at home, by the preschool teachers, parents or other relatives. Four-year-old Rotem: *"Screens are not good for the eyes, the head and the brain"*. Six-year-old Hadar and 4.6-year-old Gur: *"There are people who wear reading glasses because they are very close to the computer. This is not healthy for the eyes*". Another argument was that these technologies emit dangerous radiation and should not be in the preschool. Omri, 5.5 years old, said: *"Clearly they should not be entered into the preschool! If there will be many digital technologies, there will be more radiation, and this is harmful*". Additional items that express the non-necessity of digital technologies in the preschool explain the children's concern for unfair and unequal division of time between the children using them that may cause quarrels. Five-year-old Mor described a situation where: "*In the middle everyone will want, and they will begin to cry. This will be unpleasant and unfair*". Ariel, 4.5 years old, said: "*Because there is only one computer and one telephone, and it will not be fair and then we can fight about this*". This led to concerns about possible harm to social relations and social skills. Dor, 5.5 years old, added: "*I would not like that because the friends will not play with me or with other children and will always be with the technologies*". Ben, 5.5 years old, summarized: "*It is more important to play with your friends*".

The Goals of the Use of the Digital Technologies in the Preschool

As the interviews advanced, and reached the question: "What should be done with digital technologies in the preschool?", 30% of the children who expressed the non-necessity of the use of these technologies in the preschool added ways and goals for which they should be used in the preschool. Those children, and the other 50% of the children who thought the digital technologies are necessary in the preschool, supplied explanations on the importance and possible contribution of the use of digital technologies in the preschool. Their sayings indicate that they are well-aware of the purpose of digital technologies and understand what goals they may promote in the preschool. The children's answers present the main goal of using these technologies as games. They indicate their main occupation with digital games and their pleasure from them. Five-year-old Shai stressed the importance of introducing other digital technologies for upgrading the playing possibilities: "*It is possible to play with the mobile phone in the preschool. It has games we don't have on our preschool computer*".

Improving communication and cooperation skills: The children indicated the importance of shared play. Four-year-old Roy: "*We are always lots of children on the computer*". Some are aware of the messages transmitted by the preschool teacher and others feel the significance of shared play and express it in their own words. Four-year-old or: "*From the game we have on the computer in preschool, the teacher told us that we learn to cooperate with friends*". Very few stressed the experience of personal play. The children's views expressed the importance of the ability to communicate using the digital technologies, for example to "*send a message*", "*to share what we do in preschool with the parents*". The children indicated the importance of maintaining contact with the environment, in the close circle and in broader circles, in different contexts (with the family, friends, emergency responders). There were also children who indicated the possibility for peer learning. For example, 4.5-year-old Dan explained: "*If someone forgets then one of the friends will explain to him and will enable him to look with the other child and see how he does it*".

Twenty five percent of the children (half of those who expressed the necessity of technology) also expressed an understanding of the contribution of digital technology to promoting pleasure and relaxation. In this aspect, the children who espouse this view referred particularly to TV shows and series, YouTube

videos and digital games. They apparently believe that an activity which uses digital technologies enables increasing relaxation, attention and concentration as a basis for other activities. Five-year-old Shaked stressed: "*It is important that we play with the computer so we will calm down and only then go to the workshop*". Five-year-old Ben added: "*If there were no television there would be a mess, this way it is comfortable and quiet*".

The children also described the way in which they perceive the integration of digital technologies as a mean for promoting diverse fields of learning. One-hundred and two children (60%) mentioned the possible foci of learning. Zohar, 4.1 years old, and Gur, 4.6 years old, believe that technology can help to "*learn and to inquire*". Five-year-old Ofir reinforced this view: "*The computer can help us inquire and learn because it shows lots of things"*. It seems that the children's answers reflected their knowledge on searching for information and the possibilities they attribute to increasing scientific knowledge by means of digital technologies. It is interesting to note that some of the children perceive the digital technologies as a mean for independent search for information and inquiry. For example, 6-year-old Dan: "*If someone wants to inquire about something, then instead of the preschool teacher having to explain every second, it is possible to use the computer*". Daniel, 5.5 years old, recalled: "*The preschool teacher sometimes tells us to check things on the computer because perhaps there are answers to our questions*". The children mentioned specific fields of knowledge which may be supported by the technology, such as learning literacy and language. Four-year-old Uri described recognition of letters and regarded the computer as a basis for learning to read and write: "*I saw my name on the computer! Mother showed me how to write it*". Offir, 5.5 years old, described expansion of knowledge for learning other languages: "*You can learn, for example, English or Spanish, like I learn with the Mermaid, this is in English and Spanish and I try to understand what they are saying*". Mathematics enrichment was also indicated. Gali, 5.5 years old, mentioned: "*Sometimes you can learn numbers, arithmetic, all kinds of things like that*". These quotes illustrate the children's view regarding the ability to learn arithmetic, numbers and exercises using digital technologies.

Another learning channel was identified in the children's answers, which refers to enrichment and self-instruction using digital technology. Five-year-old Itai: "*On the computer, I inquired about my father because he is a pilot and I inquired about pilots*". Five-year-old Emily indicated that she was exposed to new information using the tablet at home: "*Yes, on the tablet I learn all kinds of things. Once I didn't know that there was a state called Hawaii, and then I heard this on the tablet*".

The children indicated their technical/technological abilities that develop when using these technologies, which help their orientation with digital technologies at home, so they feel confident in using them in the preschool. The children referred to the great benefit of photographing pictures and movies, watching them and sharing with others. For example, 5.5-year-old Topaz: "*It is important that there will be such instruments in the preschool so we can see movies and can learn many things from them. This is very helpful*". Five-year-old Shai added: "*You can photograph things from the mobile phone and send them to the iPad and then more children will see the pictures. Children can photograph each other*". These answers represent the children's view that there is no limit to the knowledge they can obtain via digital technologies, via viewing pictures, listening to explanations or watching different instruction videos, which they mentioned, for example, when referring to YouTube or the teacher's computer. Other children referred to instruction that can be obtained regarding things that we can do ourselves, such as cooking, fitness or construction and creation.

The Framework for Using Digital Technologies in the Preschool

We found that the majority of the children (60%) think that the time for using digital technologies should be limited, such as 3.8-year-old Alma, who said: "*Yes, I can play on the computer just a little because it is boring*". Only 40% think that play and learning with these technologies should not be limited, such as 4-year-old Danielle: "*We need more time on the computer during free time, this is not enough*". It can be seen that the children are accustomed to having a short and limited time for using these technologies. Although time perception is not well-developed at these young ages, the children indicated recommended time periods and stressed that "*we need smaller numbers*" (a short time). The arguments of those who believe that there is no need to limit the time for using these technologies were that this is enjoyable and educational and should be done more and more. Others suggested not limiting the time so as not to harm the continuity of learning

that is possible when using digital technologies. Five-year-old Ben: "*There is no need to tell children when to stop, because maybe they are in the middle of something important, and they will be stopped in the middle and perhaps will not be able to continue to learn*".

Only a small percentage referred to the social composition, which in their opinion is ascribed to the use of digital technologies in the preschool. 13% of the children expressed a preference for learning together (in a group or with friends). For example, 4.3-year-old Anael: "*Yes, I would like, but together with someone else*". Some of the children described an existing situation. Four-year-old Roy: "*Always on the computer, we are many children*". Only six children expressed a desire to play and learn alone using the digital technologies. Some perceive a computer game as something done independently, compared to non-digital games that are a social matter. Five-year-old Shai: "*If the teacher would bring a tablet to the preschool, I would prefer to play on it alone, I would prefer to play regular games with friends – puzzles, cubes*".

In conclusion, the findings indicate that most of the children are greatly aware of the different representations of the digital technologies that exist in their close environment, apparently mostly at home but also to a certain extent in the preschool, and recognize their importance and contribution to our lives. However, 50% (mostly the younger children, up to age 4) also apparently express the messages transmitted to them by the adults in their surroundings, parents, older relatives or teachers, which reflect non-necessity and danger in the context of these technologies. The non-necessity of digital technologies in the preschool was expressed in three main fields, regardless of age: these technologies may comprise interference to the regular preschool schedule, digital technology is intended solely for adults, and possible health hazards. Fifty percent of the children expressed the need to use digital technologies in the preschool and with the 30% of the children who expressed the non-necessity of the use of technologies in the preschool, indicated the goal of using these technologies and their contribution to different aspects of their lives in general, and in the preschool in particular, such as promotion of pleasure and relaxation, establishment of learning processes and enrichment in diverse learning fields.

In their answers, they also referred to the different timeframes of the activity and the social composition, which are ascribed to using digital technologies in the preschool. As to the children's view that pertains to the timeframe of using digital technologies in the preschool, it is mainly the younger children (up to age 4) who think that the time should be limited, while the older ones believe that the time for playing and learning with these technologies should not be limited. Regarding the social composition during activity with the digital technologies, the children who supported working in a group (13%), expressed a preference for playing and learning together. Only a minority (4%) expressed a desire to play and learn alone using these technologies. Among some of the latter, playing on the computer is perceived as something done independently, whereas non-digital games are a social matter.

Conclusion and Discussion

Three main views were raised in the present study regarding the integration of digital technologies in the preschool: the extent to which digital technologies are needed, the goals of the use of digital technologies in preschool; the setting for using digital technologies in the preschool. Fifty percent of the children, especially the younger ones, claimed that use of digital technologies is not necessary in the preschool. Their explanations referred to interference with the regular preschool schedule, the view that technology is intended for grown-ups and possible health hazards from this use. The lack of digital technologies in the preschools which these children attend, or the scarce, ineffective or unwise use of these technologies that does not arouse curiosity, may have led them to these conclusions. This importance was also indicated by the view raised in the present study, which refers to the goals of using digital technologies in the preschool. Most of the children indicated mainly or only play and pleasure. This view was also raised in their description of the use of digital technology at home. This finding is compatible with the few studies that interviewed children on their attitudes and views regarding use of digital technologies in the context of the preschool and the school (Dunn et al., 2018; McKenney and Voogt, 2010; Oliemat et al., 2018). In these studies, it was found that the children perceived these technologies as entertainment and play instruments, more than as learning tools, and that their most common activity with them was play, followed by watching

movies, mainly on YouTube. Young children's main uses of digital technologies in the home context is also for play and pleasure. A longitudinal study conducted in the United States among 350 families found that parents gave mobile phones to their children when they had to perform house chores or to calm the children, and that most children used these technologies for pleasure and watching movies alone (Kabali et al., 2015).

The current study shows that some of the children emphasized the social aspects of digital technologies in the context of play. They expressed an understanding or desire that play with the digital technologies will be social (in a group or with friends), apparently as opposed to the individual digital games at home. The third view that was raised, that refers to the setting for using digital technologies in the preschool, indicates that several children who considered to the social aspects of digital technologies expressed a preference to play and learn together, and several children expressed a desire to play and learn alone on these technologies. Some perceive playing on the computer as something that is done independently, whereas non-digital technology games are a social matter. The preschool teacher's mediation in the context of digital technologies is therefore important in the context of shared work and social-group interactions among children, as well as with reference to the fact that young children have fewer opportunities for such contexts in the home setting. It was indeed found that use of digital technologies contributes to communication with friends and supports meaningful interactions with other children (Flewitt, Messer, & Kucirkova, 2015; Hsin et al., 2014).

It seems that most of the children who participated in the current study understand the importance of using the digital technologies and their contribution to different aspects of their lives in general and in the preschool in particular. They indicated different aspects, such as promoting pleasure and relaxation and enrichment in different learning aspects. It seems that the children have a view of different levels of learning sources or mediation in learning, and while digital technologies are a source of learning and research in different fields, in their opinion they are not as good a source for learning and mediation as a preschool teacher or printed books. These findings emphasize the great importance and need for mediation of the preschool teacher for wise use of digital technologies in the preschool, and regarding the advantages and contribution of using these technologies for topics learned in the preschool.

These findings illustrate the importance of additional, deeper, and wiser uses of digital technologies in the preschool. The children in the present study indicated a broad range of inquiry and learning possibilities with the digital technologies in the fields of language, mathematics, scientific inquiry that includes independent inquiry ability, enrichment and instruction, making contacts with different agents, photography, watching and relaxing. Other studies also presented many and diverse examples for deep and wise uses and inquiry and learning possibilities that include digital technologies among young children (Flewitt et al., 2015; Friedman, 2018; Keren and Fridin, 2014).

Concomitantly to the above-indicated modes of mediation, it is recommended that preschool teachers explain use of these technologies to the children in an age-adapted manner. This should be accompanied by setting clear rules on wise use of these technologies and the dangers that sometimes accompany their use (for example, health hazards which the children in the present study indicated). They should also teach the children about forbidden contents and interactions with strangers (which the children in the present study did not mention), which are also very important for safe use of digital technologies. Preventing the use of digital technologies and/or frightening children regarding their use will probably not help them make wise use of these technologies. Rather, real, meaningful, relevant and greater use of these technologies by the children that will be accompanied by effective mediation of the preschool teacher is necessary. Such mediation will not only contribute to safe use of these technologies, but will also improve and increase children's understanding and learning from these technologies and will even help set the desired time setting of using the digital technologies in the preschool, which is an additional component to which the children referred in their third view. Some children think that the time for using the technologies should be limited. Others believe that the time for play and learning with these technologies should not be delineated. The preschool teacher should take the age of the children into account when determining the time of the activity with the digital technologies and his/her mediation during these activities to adapt a

suitable time for each child with these technologies.

The present study indicates the importance of listening to children's voices on integration of digital technologies in the preschool and their perspectives and needs in this field, since they are partners to the everyday activities in the preschool. From the current study, it is possible that the children's views about digital technologies were more influenced by their home environment and less by the preschool environment, perhaps because of the limited digital technology environment which was observed in the preschools. They may also have been influenced by what they were told and or heard by adults (their parents and teachers). The children's points of view may also reflect the society and the cultural practices in Israel regarding the use of digital technologies. There is very limited literature on these aspects among parents to young children (Elias and Sulkin, 2017, 2019; Lev and Elias, 2020) and preschool teachers (Magen-Nagar and Firstater, 2017; Zilka, 2011) in Israel. Magen-Nagar and Firstater (2017) for example, found that preschool teachers do indeed recognize the value of the digital technologies. However, in their opinion such technologies do not play a major role in preschools and are mainly used as instruments for collecting information and as a teaching mean for visual illustration of the learning contents. These means contribute mainly to the social interaction between the children, albeit not always in a positive manner especially among children with difficulties. Their main conclusion was that preschool teachers generally do not formulate pedagogical goals that include digital technologies and thus do not realize their pedagogical potential. The teachers use digital technologies mostly for illustration, diversification and enrichment. Elias and Sulkin (2017, 2019) and Lev and Elias (2020) who investigated the use of digital technologies at home among toddlers until age 3 revealed that using digital technologies has become normative behavior among toddlers. This emphasizes how deeply use of digital technologies is integrated into the basic daily routine of parents to very young children who use digital technologies platforms to fulfill a wide range of their childrearing needs. Their use of digital technologies is mainly instrumental, as a babysitter, for schedule regulation, family time and before bedtime and not for children's enrichment. In addition, the children were exposed to contents not intended for them and experienced limited interaction with their parents during this activity.

It is therefore recommended that future research investigate the perspectives of preschoolers in this context at greater depth in an attempt to understand the sources for the children's views and their influences. This may be achieved by using additional means beyond personal depth interviews, such as group discussions on this issue, asking the children to draw or photograph the things that are important to them in this field and talking with them about it, videotaping children during interactions that include digital technologies in individual and group settings and with the preschool teacher's mediation, and afterwards watching them together and interviewing the children in order to understand their interpretation of the videotaped interactions. After collecting these data, the preschool teachers can integrate and mediate digital technologies more intelligently, in a way that is adapted to the children's understanding and view of these technologies. The children in the current study referred to the integration of the digital technologies, to the promotion of pleasure and relaxation, establishment of learning processes and enrichment in diverse learning field, as well as to time frames of activities with these technologies and their social composition.

To complete the overall picture, it is also advisable to examine the perspectives of preschoolers in this context in greater depth and using quantitative research methods, with reference to the children's SES. It is recommended to examine the views of preschool teachers and parents on the integration of digital technologies in preschool. İt is further recommended to compare these issues to countries and cultures other than Israel.

According to the limited digital technology environment in the preschools which was observed and raised from the children's descriptions in the current study, as well as from the very few studies which were performed in Israel (Magen-Nagar and Firstater, 2017; Zilka, 2011), it is possible that the preschool teachers in Israel may be encouraged to increase their integration and mediation of digital technologies and to do so in a more developmentally appropriate practice. The Ministry of Education is currently developing a model of the "Future Preschool", where it stresses the need to integrate digital technologies into preschool

pedagogy. The model claims that children should be supported in the development of technological skills in preschool. However, this part of the model has not been completed, and has not been formulated in detail as yet (Ministry of Education, 2020). There might be a stronger and clearer Ministry of Education policy in this field, as recommended by the global policy (see, for example, the recommendations of the OECD and the National Association for the Education of Young Children (NAEYC) as presented in Bakia et al., 2011 and Radich, 2013). This situation may have a greater influence on preschoolers' views about optimal integration of digital technologies in the preschool in general, and on more positive views in this aspect, especially among the younger preschoolers as emerged from the present study. Preschool teachers might integrate and mediate digital technologies more wisely, and in a manner adapted to the children's understanding and view toward these technologies. Such integration will enable 21st century preschoolers to better adapt their needs and the needs of society in the present and in the future and prevent a risk for expanding digital gaps that lead to education gaps.

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Research Article

Children's problem solving skills: Does Drama Based Storytelling Method work?

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Abstract: This research aims to investigate the effect of Problem Solving Training provided through the Drama Based Storytelling Method on the problem solving skills of five-year-old children. Within the context of quantitative methodology, pretest-posttest control group quasi-experimental design was employed in the study. Forty children, 20 in the experimental and 20 in the control group, were included in the research. In addition to the National Education Preschool Education Program, children in the experimental group were given problem solving training with Drama Based Storytelling Method one hour 2 days a week for 7 weeks. Children in the control group were not included in this education, but continued their daily education programs within the scope of Ministry of Education Preschool Education Program. The problem solving skills of the children participating in the research were measured using the Scale of Problem Solving Skills. The test was administered to children before and after the intervention period. In addition, it was read ministered to the experimental group 2 weeks later. Results suggest that the problem-solving education provided with the Drama Based Storytelling Method, which is implemented in combination with the National Preschool Education Program, has contributed positively to the problem-solving skills of five-year-old children.

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Introduction

Described as the golden age of childhood, preschool is a period when various skills are acquired and develop. Basic problem solving skills, one of the most distinctive features of this period once the foundations of development have been laid, can be developed with the experiences gained and the programs implemented. Educational opportunities and activities offered to help build problem solving skills enable children to recognize problems, produce possible solutions to the problems they encounter, and as a result, enable them to establish a cause-effect relationship between events.

Definitions vary on the problem solving skill and Heppner's (1987) definition differs from other definitions in certain aspects in studies dealing with this issue. According to Heppner, problem solving has the same meaning as the concept of dealing with problems. Personal problem-solving skill is defined as directing cognitive and emotional processes to a target in order to make behavioral reactions with the aim of adapting to internal or external demands in real life. Based on this, it should be ensured that the teacher and the student use problem solving skills in order to develop all the features of the mind in the education process, students should be given problems appropriate to their level taken from life and then they should be asked to produce alternative solutions and to review possible results. If the educational environment is organized based on this philosophical idea, students will grow up to be individuals that have problem-solving skills (Çavuş, 2004).

With social problem-solving skills, children learn to be in good relationships with their friends and to be responsible for their behaviors by developing the skills necessary to communicate effectively with

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their environment. In addition, thanks to this skill, children are able to understand their own emotions and the emotions of others and look at events from the perspective of others (Bingham, 1998; Shure, 2001). Especially children with attention deficit and hyperactivity disorder, who act impulsively and tend to be aggressive, are likely to experience social problem solving difficulties. This type of children behave aggressively, lacking an empathic perspective and acting without thinking about the non-aggressive solution. It is stated that children with problem-solving skills play more constructive games, are liked more by their peers, and exhibit more cooperative behaviors at home and at school (Webster-Stratton, 2012).

Children mature and develop greatly in social problem solving during their school years. Around the age of seven, children tend to display prosocial behaviors, such as relying on friendly persuasion and compromise, rather than on antisocial behaviors like tugging, hitting, or insisting that the other child conforms to them, thinking about alternatives when their first strategy doesn't work, and resolving conflicts without adult intervention. However, children aged five cannot think that problem-solving behaviors will affect the future of their relationships. This is also related to their cognitive maturity (Mayeux & Cillessen, 2003; Yeates, Schultz, & Selman, 1991).

Problem solving is a very important skill for individuals to cope with life's problems and adapt to life. As the individual ages, the conditions and environmental factors change over time and the problems they encounter become more complex. For this reason, individuals should gain problem solving skills in early childhood because if they cannot manage the problems and find solutions as they get older, they lose their self-confidence and are more likely to lead an unhappy life. A society of such individuals is in danger and can fall apart. Only people with the necessary problem-solving skills can lead the society to a better future. Thus, considering that problem solving skill not only affects the individual's own abilities but also the society in which s/he lives, the necessary importance should be given to solving social problems. One of the questions that arise here is whether problem solving is an innate skill, or whether it is gained later by various methods. However, Kneeland (2001) has stated that in fact there are not many people with sufficient training to master this skill.

Intervening children with poor social problem-solving skills supports development in various ways. Effective social problem solving allows children to successfully cope with stressful life situations, as well as the development of peer relationships. In addition, it reduces the risk of adjustment difficulties in disadvantaged children from families with low socioeconomic status (Goodman, Gravitt, & Kaslow, 1995). Readily accessible in the literature, intervention programs that support social problem-solving in children have made positive contributions to children's development (Bash & Camp, 1985; Battistich, Schaps & Wilson, 2004; Beelmann, Pfingste, & Lösel, 1994; Brown, Odom, & McConnell, 2008; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Goldstein & Pentz, 1984; Schneider, 1992; Shure, 2001; Webster-Stratton, 2012; Weissberg, Kumpfer, & Seligman, 2003).

The most effective and correct use of mental processes can only be achieved with a qualified education program. Various methods and techniques are included by enriching the contents of the educational programs in order for children to find alternative solutions to their problems (Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017). When these methods and techniques are applied at certain time intervals, they contribute to the skill acquisition of children. These include social problem solving education with direct teaching approach, social problem solving education based on cognitive process approach, collaborative learning method, peer-mediated teaching method, modeling and video modeling method, role playing technique, coaching, homework and drama method (Gardner, Cartledge, Seidl, Woolsey, & Schley, 2001; Webster-Stratton, 2012; Webster-Stratton & Reid, 2004;). The Drama Based Storytelling Method, which is used as an intervention method in the research, includes most of these methods with its eclectic perspective.

Especially in recent years, stories and drama have attracted great attention among the methods used in the development of problem solving skills. The origin of the word "story" comes from the word "mesel" in Arabic, and the history of its literal usage today is quite recent. Instead of this term, which has a history of 130 years, words that have their own meaning such as parable, epic and story were previously used.

The "mesel" form of the word, which will turn into a "story" over time, began to appear from the beginning of the 19th century, thus, a new meaning is loaded in addition to its old meaning of "mesel" (Sakaoğlu, 2016). "Story" in the dictionary of Turkish Language Association is defined as "the literary genre, which is generally created by the folk, based on imagination, living in an oral tradition, mostly describing the extraordinary events experienced by humans, animals and beings such as witches, gnomes, giants and fairies (Ministry of National Education [MoNE], 2013). The Boratav defines story as a short narrative spoken in prose, independent of religiosity and magic, beliefs and customs, completely imaginary, unrelated to reality and without any pretense to make anyone believe what it tells. According to him, the main feature that distinguishes the story from the legend and the epic, no matter what kind of story it is, is that it is a type of narration that gives the impression of the creation of dreams (Boratav, 2019).

Stories and fairy tales foster children's imagination and act as a bridge between the fantasy world and the real world. From stories, children notice the acceptable and unacceptable behaviors of the society they live in, and learn how to adapt them to their own life when they encounter problems arising from these behaviors especially in the preschool period. Children also learn how to produce solutions in these negative situations since the events and characters encountered are advisory. We can say that stories that contain all these features have many advantages such as increasing vocabulary knowledge, developing attention and problem solving skills, and establishing cause - effect relationships. Today, based on these advantages, stories provide creation of awareness by combining their strengths with effective methods that can improve children's skills.

Drama, one of the most effective methods used to create awareness, has been included in educational activities for many years (Bolton, 2007; Webster, 2010). Drama, with its inclusion in education, beginning in England and America in the 20th century, is currently either used as a teaching method to teach certain subjects in schools of many educational levels or included in the programs as a stand-alone course (Powell, 2020; Sağlam, 1997). Adıgüzel (2013) and Szecsi (2008) defines drama as: "Activities with actions inside that include internal and external movements in which one or more people interact with each other, the nature or other objects and their life situations to a large extent.". Preschool drama is an activity that aims to help the childlearn by doing and experiencing and supports all developmental areas.It has predetermined goals, is based on expressing events with verbal or non-verbal communication methods, and includes animations (Ministry of National Education [MoNE], 2013).

Practicing by giving the child an active role around a certain story ensures more effective learning in the educational drama, which is seen to be a valuable learning tool as one type of drama. Therefore, stories can be considered among the techniques that are frequently used in the drama method. According to Önder (2016), role-playing, the most basic technique of educational drama, has a quality that runs mental processes by putting oneself in another's place in her mind. The child can evaluate himself in different situations by acting different roles in role playing. Thus, role-playing contributes to the child on development of self-perception, language development, knowledge of rules and empathy positively. In Preschool Education Program prepared by the MoNE (2013), it is emphasized how important it is to carry out drama activities and include dramatic play centers in classrooms while planning daily activities. Since drama practices are used in preschool education plans for educational purposes, children can recognize their own identity and body by the help of drama, maintain harmonious relationships with the people living around and the group they work in, produce new ideas and find different solutions to problems. Also in the drama, attention should be paid to the acquisition rather than the artistic dimension in role-plays. Creative thinking skills develop and permanent learning occurs when questions like who, what, why, when, how, and where are prioritized in drama activitiesand the activities are prepared within this framework (Erdoğan, 2019; Ritter & Mostert, 2017).

In ancient times, people used to tell stories to convey their experiences to other people and to spread the beliefs of society.Accordingly, it can be said that the origins of storytelling date back to very old times. In every culture and society, storytellers take different names such as shaman, meddah, kıssahan, şehnamehan, mukallid, dengbej, minstrel, bard epic, story mother, story ancestor, nakkal, seanachaithe, rakugo, echo master and so on (Berlin, 2001; Topçam, 2019). The storyteller conveys events in words and

images, often by improvising and embellishing. The training of the storyteller has been carried out in a master-apprentice relationship until this time, and the apprentice, growing up with a narrator, is encouraged by the master and passes the stories to other generations when the time comes. Nowadays storytelling education is carried out in the form of in-service training courses or short and long term workshops. We can show Argın Kubin, Şeyda Çevik and Aslı Hazar as examples to those who have recently adopted storytellingas a profession. At the Seiba International Storytelling Center founded by the storytellers Nazlı Çevik Azazi, Ayşe Senem Donatan and Şeyda Çevik who developed themselves in this field, professional storytellers are trained. Also "Basic Level Storytelling Trainer Training Course" was given for the first time in 2019 as an in-service training by the Ministry of National Education General Directorate of Teacher Training and Development with a goal to teach various methods and techniques related to storytelling to teachers in various branches who want to improve themselves in this field (MoNE, 2019).

In this sense, the main goal of this research is to find out whether the problem solving training providedthrough Drama Based Storytelling Method (DBSM) affects five-year-old children's problem solving skills. Accordingly, the following hypotheses will be tested:

1. Does the problem solving training provided through Drama Based Storytelling Method affect the problem solving skills of the five-year-old children?
2. Is the problem solving training provided through Drama Based Storytelling Method more effective in improving the problem solving skills of five-year-old children than the pre-school education program currently implemented?
3. Is the effect of problem solving training provided through Drama Based Storytelling Method permanent?
4. Does preschool education program that is currently implemented affect the problem solving skills of five-year-old children?

Method

Research Design

With an aim to examine the effect of problem solving training provided through DBSM, this study was done using quasi-experimental design, one of the quantitative research methods. In the quasi-experimental design, when the experimental and control groups are formed, forming groups from test subjects with similar characteristics rather than randomly chosen ones distinguishes this model from the true experimental design (Fraenkel & Wallen, 2006; Stuart & Rubin, 2007). In the research, pretest - posttest control group experimental design was used. The Scale of Problem Solving Skills (SPSS) was administered to both the experimental group and the control group just before and soon after the intervention program. A follow-up test was given to the experimental group two weeks after the post-test in order to determine the follow-up effect of the program. Personal Information Form was filled in for both groups after the study group was divided into experimental and control groups. Afterwards, the SPSS pre-test was administered individually to 40 children from experimental and control groups. MoNE Preschool Education Program was applied to control group. In addition to the MoNE Preschool Education Program, problem solving training provided through Drama Based Storytelling Method was given to the experimental group one hour two days a week for seven weeks. In the problem solving training provided through Drama Based Storytelling Method, 14 stories were told twice per week for seven weeks and the drama of these stories were acted out. The SPSS post-test was administered to experimental and control groups following the problem solving training. A follow-up test was administered to the experimental group 2 weeks following the SPSS post-test.

Research Group

Before starting the research, the proposal of the research was examined in terms of ethics at the Board of Directors of the Social Sciences Institute of Selcuk University and it was accepted on 18.04.2019. During

this period, families of children who would continue the intervention program were interviewed and consent forms with wet signature were filled in. The study group consisted of five-year-old children who received pre-school education in a nursery class affiliated to a primary school in the central district of Selcuklu, Konya, in the fall semester of the 2018-2019 academic year. Multi-stage sampling was used when forming the sample. The multi-stage sampling method is defined as the sampling method in which the sampling process is completed in two or more stages (Büyüköztürk, 2013; Sedgwick, 2015). In the first stage, a nursery class affiliated to a primary school located in the central district of Selcuklu in Konya was selected by using the cluster sampling method, in which sample selection is made on a group basis. In the second stage, children were assigned to experimental and control groups based on their pre-test scores, considering their gender and age by using purposeful sampling. The researchers held a face-to-face meeting with the families of the children participating in the research group and made a commitment regarding ethical rules in this meeting. In this meeting, an agreement to participate in the research was signed with the parents of the experimental and control groups' children. A total of 40 children, 20 in the experimental group and 20 in the control group, were included in the study. All the participants had one-year preschool education at the time.

The gender distribution of the children for both experimental and control groups was as follows: 12 (60%) girls and 8 (40%) boys for the experimental group, 11 (55%) girls and 9 (45%) boys for the control group. Considering the distribution of paternal educational background of the children in the experimental group, 5 (25%) are university graduates, 8 (40%) are high school graduates, 5 (25%) are secondary school and 2 (10%) are primary school graduates. As with the distribution of paternal educational background of the children in the control group, 6 (30%) are university graduates, 7 (35%) are high school graduates, 6 (30%) are secondary school, and 1 (5%) is primary school graduate. Overall, fathers in both groups showed varied educational backgrounds with 11 (27.5%) university graduates, 15 (37.5%) high school graduates, 11 (27.5) secondary school graduates and 3 (7.5%) primary school graduates. Regarding the maternal educational backgrounds of the children in the experimental and control groups, 5 (25%) are university graduates, 6 (30%) are high school graduates, 7 (35%) are secondary school, and 2 (10%) are primary school graduates. Considering the maternal educational background of the children in the control group, 4 (20%) are university graduates, 6 (30%) are high school graduates, 8 (40%) are secondary school, and 2 (10%) are primary school graduates. Overall, mothers also had varied educational background with 9 (22.5%) university graduates, 12 (30%) high school graduates, 15 (37.5) secondary school graduates, and 4 (10%) primary school graduates. In order to test whether the pre-test mean scores of the children in the experimental and control groups showed similarity, the pre-intervention mean scores of both groups were analyzed using the Mann Whitney U test.

Table 1. Mann Whitney U Test results related to pre-test scores of the experimental and control group

Group	n	Mean Rank	Sum of Ranks	$\bar{x}$	sd	U	p
Experimental	20	22.78	455.50	27.65	3.74	154.500	.215
Control	20	18.22	364.50	26.30	4.06		

According to Table 1, no statistically significant difference was found between the SPSS pre-test scores of the children in the experimental and control groups (U=154.500, p>0.05). These values analyzed considering mean rank and sum of ranks indicated that pre-test scores of the experimental group children and the control group children were alike at baseline.

The Drama Based Storytelling Method

First of all, an extensive literature review was undertaken in Turkey (domestic) and abroad while the Drama Based Story-Telling Method was developed. The literature review indicated that various methods and techniques are used by enriching the contents of school programs in order to find alternative solutions to their problems in educational environments where children socialize. These methods and techniques contribute to the skill acquisition in children when applied at certain times. Especially in recent

years, stories or fairy stories and drama have drawn attention among the methods used in developing problem solving skills. Based on this, 14 stories were written and drama plans were prepared for the animation of the stories by the researchers in accordance with the 18 problem situations in the SPSS. Stories were finalized following their analysis by a storyteller and a drama instructor made drama plans. The researchers informed the children in the pre-test process that they would do activities together. After pre-test data was collected, problem-solving training was provided to the experimental group with the Drama Based Story-Telling Method, which was scheduled to be delivered in one-hour sessions two days a week for 7 weeks. 20 and 40 minutes were allocated for storytelling and drama respectively. Firstly, the stories were told by the researcher, and then the characters and their roles in the stories were acted out by the children. After the drama, feedback was provided along with the evaluations. One of the researchers, who applied the program, participated in the storytelling and drama training certificate programs.

This method is implemented in two stages:

Stage 1: The story is told following the preparation of the physical conditions and materials by the teacher or researcher.

• First of all, an atmosphere is prepared in accordance with the storytelling method that can attract the interest and attention of children. During the storytelling, materials to be used with the story are included; these materials can be story carpet, candle, puppets suitable for characters, musical instruments, rhythm sticks, mirrors and so on.

• Before starting the story, children are informed about the rhythm and repetitions used in the story. For example when the narrator says “trik” while opening the closed doors in the story, he asks children to say “trak” (Dede, 2017).

• Before the story, an imaginary cream is used to prepare the child’s body for the story. The child’s body, when applied this imaginary cream called invisibility cream, calms down and blood circulation slows down. Cream, being invisible, acts as a shield for the child to feel safe and to protect himself from all kinds of evils in adventures with story heroes.

• Before the story, a song or a nursery rhyme is sung to attract the attention of the children. Children focus on getting into the story and giving their full attention to the story along with the song or nursery rhyme. For example, “I peeled an orange, put it on my bedside, I made up a story, let the story hour begin. Tick, ticking, tick, ticking, let the story hour begin".

• A candle, lantern or oil lamp is used according to the preference of the narrator at the beginning and end of the story hour. These materials can be used when telling a story in this age group, as it shows the child the beginning and the end of the story concretely. For example, the child perceives that the time has started with the candle lit when the story begins, and when it is put out, he understands that the story ends.

• The narrator should adjust his tone of voice, gestures and mimics in accordance with the story by integrating with the story during the storytelling. The narrator may use a set of story phrases to attract the attention of the audience at the beginning, in the middle and at the end of the story. These include, for example, "Once upon a time", "Once there was”, “Along time ago”, "So, that is how the story ends", or "They lived happily ever after”.

• The narrator actively engage children in the stories so that the ending of the story can be more effective and vivid in the children’s minds. While the storyteller says "At that time, three apples fell from the sky; one for the children listening to the story, one for the storyteller who tells the story, and one for the heroes of the story", he may ask the children to hold and bite the apple by throwing the first imaginary apple. He can grab and bite the second apple himself and he may ask the children to grab the third apple and throw it to the heroes of the story. Thus, children will probably feel more joyful at the end of the story.

• After telling the story, the narrator asks questions so that the children can recognize the problematic behavior and asks them to tell events from their own lives. Then, preparations are made for

the drama of the story.

Stage 2: Drama is created following the preparation of the physical conditions and materials by the teacher or researcher.

• The teacher is both the storyteller and the leader of the drama in the Drama Based Storytelling Method. The teacher guides the children to act out the story in accordance with the stages of the drama after the storytelling. Before the drama begins, costumes or masks that go with the characters, the story and the physical conditions suitable for the story can be created.

• In Drama Based Story Telling Method, the drama begins within the framework of drama plans in a way to be suitable for five-year-olds, and is prepared within the scope of the acquisition and indicators. The applied drama plans are prepared in a flexible way that may change depending on the attention span of the children and the conditions of the atmosphere.

• The first phase of the drama is warm-up. The warm-up is a phase in which the rules are determined by the leader and the rules are more distinct than those in other phases. The body goes into action heavily and the senses are used simultaneously. It is essential to create a group dynamic such as gaining confidence and adapting. At this stage, children's games or some invented games are used effectively. For example; finding one's partner, who has the hat, changing location by saying a name, who is missing, mirror and image are just a few of them. In addition, music and rhythm practices make it more fun by making it easier to warm up.

• The second phase of the drama is impersonation. This is the stage in which impersonations are made in certain stages within the framework of a subject or theme, determined in line with the goals the leader wants to achieve. While applying the Drama Based Story Telling Method, the stories written by the storyteller are animated at this stage. In this stage of the drama, improvisation and techniques of role playing are generally used more often. In accordance with the characters of the story, the roles are assigned starting first with the children who are eager or more enthusiastic to participate. The teacher, who takes on the leader role in the drama, just guides during the impersonation. He does not interfere with the children. Within the framework of the general plot in the stories, the children act out the story by emphasizing problem behaviors with sentences they use as improvisation at that moment.

• At the end of the impersonation phase, children find themselves in the relaxation stage, the third stage of the drama. Exercises for relaxation can be done physically, mentally and spiritually. At this stage, children relax their bodies, their minds and spiritually themselves through activities such as melting the snowman, pretending, lying on the floor and making some movements with instructions and music.

• The evaluation phase comes after the relaxation activity. In the evaluation phase, children sit on the floor by forming a semicircle under the leadership of the teacher. In the Drama Based Story Telling Method, discussions are held about how problem behaviors in the stories are reflected, how it feels to have a difficulty and what is felt while enacting these behaviors and how to find solutions to these problem behaviors. In addition, questions about warm-up and relaxation exercises are also asked.

Data Collection Instruments

"Personal Information Form" and "The Scale of Problem Solving Skills (SPSS)" developed by Oğuz and Köksal Akyol (2015) were used as data collection instruments in the research.

The Scale of Problem-Solving Skills (SPSS): The Scale of Problem Solving Skills (SPSS) is an instrument that aims to determine the problem-solving skills levels of children attending kindergarten classes. The SPSS includes eighteen problem situations and eighteen drawings relevant to these problem situations. The SPSS is rated on a five-point Likert-type scale. In the scale, points between "0-4" are taken for the solution produced for each problem situation. Pointing system in the scale works as follow: "0" point for no suggestion, "1" point for one suggestion, "2" points for two suggestions, "3" points for three suggestions and "4" points for more than three suggestions. In order for the child to get points from the solutions he produces regarding the problem situation, each solution must be different from other solutions

suggested. In practice, the child can repeat a solution he gives. Repeated solutions are not rated. The score to be obtained from the SPSS ranges between 0-72. Higher points in the SPSS represent better problem solving skills. In other words, the increase in the SPSS points of children shows that the child's problem solving skills have improved. In the SPSS, a child can get fifty points by responding to many problem situations. However, another child can get fifty points and produce a lot more alternative solutions, by responding to fewer questions. The important thing in the SPSS is that the child can produce more alternative solutions and the questions are only a tool. It does not matter which questions the child answers; the goal is the number of answers.

The validity of the scale was tested by means of the content-validity index and exploratory factor analysis. The reliability of the scale was tested through Cronbach's alpha internal consistency coefficient and test-retest reliability coefficient. The indexes were analyzed for two aspects: The appropriateness of the items and the appropriateness of the drawings. Finally, the content-validity indexes for the two aspects were 0.99 and 0.96 respectively. The exploratory factor analysis concluded that the SPSS had one-factor structure, which accounted for 30.68% of the total variance. Cronbach's Alpha Internal Consistency Coefficient was α=.86. The Correlation Coefficient was .60, which was significant and moderate. The mean scores in the first and second administrations of the SPSS did not differ significantly. The validity and reliability analyses demonstrated that the SPSS is an appropriate instrument for children aged 60 to 72 months (Oğuz & Köksal Akyol, 2015). The test was administered by the researcher. Each test took approximately 15 minutes to complete.

Analysis of the Data

In the research, the data obtained from the data collection instruments were analyzed using the Mann Whitney - U Test and Wilcoxon Signed Ranks Test. IBM SPSS 22.0 data analysis package program for social sciences was used for the data analysis. The reason for the use of nonparametric tests in the study is due to the fact that the data do not show normal distribution after normality test (Shapiro-Wilk Test, $p<.05$). Mann Whitney - U test was used to test whether the scores obtained from two unrelated groups differ significantly from each other and Wilcoxon signed ranks test was used to test the significance level of the difference between the scores of the associated measure set. Cohen's *d* was calculated for the effect size between the means of problem solving skills scores. Cohen's *d* is simply a measure used to determine the distance between two means. Regardless of its sign, Cohen's *d* value is interpreted as small (.2), medium (.5) and large (.8) (Cohen, 1977, 1992).

Results

This research was undertaken to test whether the problem-solving training given through Drama-Based Storytelling Method, the independent variable of the research, has an effect on the problem-solving skills of five-year-old children and in this part of the research, findings related to the sub-questions are presented.

Findings Related to the SPSS Pre-Test and Post-Test Scores of the Experimental Group

The difference between the SPSS pre-test and post-test scores of the experimental group children was analyzed with the Wilcoxon Signed Ranks Test and findings of the comparison were presented in Table 2.

Table 2. Wilcoxon Signed Ranks Test results and Cohen's d value related to the pre-test and post-test scores of the experimental group

Group	n	Mean Rank	Sum of Ranks	z	p	*d*
Negative Rank	0	.00	.00	-3.923*	.000**	.70
Positive Rank	20	10.50	210.00			
Equal	0					

*Based on negative ranks **p<.001

As seen in Table 2, a statistically significant difference exists between the SPSS pre-test and post-test

scores of the experimental group children (z=3.923, p<0.001). Considering the mean rank and sum of ranks, it can be said that the Drama Based Storytelling Method has an important effect on the development of the experimental group children's problem solving skills. In the analysis regarding the problem solving skills scores of the experimental group children, Cohen's *d* value calculated for the group shows that the effect size is medium and explains 70% of the variability in the pretest and posttest scores.

Findings Related to the Difference between the SPSS Post-Test Scores of the Experimental and Control Group

The difference between the SPSS post-test scores of the children in the experimental and control groups was tested with the Mann Whitney U test and the findings of the comparison were presented in Table 3.

Table 3. Mann Whitney U Test results and Cohen's d value related to the post-test scores of the experimental and control group

Group	n	Mean Rank	Sum of Ranks	$\bar{x}$	Sd	U	p	*d*
Experimental	20	29.00	580.00	43.80	9.13	30.000	.000*	.70
Control	20	12.00	240.00	29.85	3.58			

*p<.001

In Table 3, a statistically significant difference is seen between the experimental and control group children's post-test scores on the SPSS (U=30.000, p<0.001). Considering mean rank and sum of ranks, it was observed that the SPSS post-test mean score of the experimental group children receiving preschool education with Drama-Based Storytelling Method was higher than the SPSS post-test mean score of control group children who received the MoNE Preschool Education Program. In the analysis of the problem solving skills of children in the experimental and control groups, the Cohen's *d* value calculated for the group shows that the effect size is medium, and being in different groups explains 70% of the variability in posttest scores.

Findings Related the SPSS Follow-Up Test Scores of Experimental Group

The difference between the SPSS post-test and follow up test scores of the experimental group children was tested with the Wilcoxon Signed Ranks Test and the findings of the comparison were presented in Table 4.

Table 4. Wilcoxon Signed Ranks Test results for the SPSS post-test and follow up test scores of experimental group

Group	N	Mean Rank	Sum of Ranks	z	p
Negative Rank	7	5.71	40.00	-1.293*	.196
Positive Rank	3	5.00	15.00		
Equal	4				

* Based on positive ranks

As seen in Table 4, there is no statistically significant difference between the SPSS posttest and follow-up test scores of the experimental group children (z=1.293, p>0.05). Considering the mean rank and sum of ranks, it is seen that there is no relation in the experimental group children in terms of post-test and follow up test scores. These results of the follow-up test shows that children in the experimental program maintained their skill development.

Findings Related to the SPSS Pre-Test and Post-Test Scores of the Control Group

The difference between the SPSS pre-test and post-test scores of the control group children was analyzed with the Wilcoxon Signed Ranks Test and the findings for comparison were presented in Table 5.

Table 5. Wilcoxon Signed Ranks Test results and Cohen's d value related to the SPSS pre-test and post-test scores of the control group

Group	N	Mean Rank	Sum of Ranks	z	p	*d*
Negative Rank	1	9.50	9.50	-3.583*	.000**	.42
Positive Rank	19	10.55	200.50			
Equal	0					

* Based on negative ranks ** p <.001

The data in Table 5 shows that there is a statistically significant difference between the SPSS pre-test and post-test mean scores of the control group children (z = 3.583, p <0.001). Considering the mean rank and sum of ranks, it can be said that MoNE Pre-school Education Program currently implemented has an important effect on the development of problem solving skills of control group children. In the analysis regarding the problem solving skills scores of the control group children, Cohen's *d* value calculated for the group shows that the effect size is medium and explains 42% of the variability in the pretest and posttest scores.

Conclusion and Discussion

General results obtained based on research findings are presented in this section. It is the aim of this research to examine the effect of problem solving training provided through Drama Based Storytelling Method on the problem solving skills of five-year-old children. A total of 40 children, 20 in the experimental group and 20 in the control group, were included in the research. The research adopted pre-test-posttest control group design. The follow up test was administered to the experimental group 2 weeks after the post tests and the permanence of the intervention was evaluated.

According to this research,

1. The problem solving training provided through Drama Based Storytelling Method affects the problem solving skills of five-year-old children.
2. The problem-solving training provided through Drama Based Storytelling Method is more effective than the MoNE preschool education program in improving the problem solving skills of five-year-old children.
3. The effect of problem solving training provided through Drama Based Storytelling Method is permanent.
4. MoNE Preschool Education Program affects the problem solving skills of five-year-old children.

In conclusion, the results of the research showed that problem solving training provided through Drama Based Storytelling Method implemented together with MoNE Preschool Education Program makes a positive contribution to the problem solving skills of five-year-old children and it is more effective than the MoNE Preschool Education Program. In addition, both the experimental group and the control group children's SPSS post-test scores are higher than their pre-test scores. This means there is an increase in the scores of both experimental and control group children. This is an indication that the MoNE Preschool Education Program makes positive contributions to the problem solving skills of five-year-old children. Graves, Frabutt, & Vigliano (2007) found in their research that interpersonal problem-solving education given through drama and role-playing method increased the communication and social problem solving skills of primary and secondary school students. Drama and role playing have been used extensively in the drama-based storytelling method. The child can use all kinds of elements of communication in drama processes. Communication and sharing with individuals is the basis of drama. With this feature, drama requires using communication elements. Every stage of drama is based on verbal and non-verbal communication. In addition, drama allows the individual to realize and express his / her own thoughts, emotions and body in a free environment without worrying about being judged. These features of drama may have contributed to the development of communication skills of children participating in the intervention program and thus their interpersonal problem solving skills because the basis of interpersonal

problem solving is to use the right communication methods (D'Zurilla, Nezu & Maydeu-Olivares, 2004). Drama allows them to live by bringing the problems, situations and events in the social environment to the agenda of a certain group. The animation stage of the drama is based on the principle of using improvisation and role playing techniques, and the participants animate a topic individually, as a duo or as a group. The topics of drama usually include a problem, a conflict and tension. Animating different social problems, situations and events with drama method enables individuals to better understand the society and the relations in the society. This interaction allows individuals to examine appropriate and alternative solutions to social problems, to enact and to experience their results. Creative drama process helps individuals gain experience in solving problems (Önder, 2016). This feature of drama may have increased children's problem solving skills. Research has shown that sociodramatic play in early childhood classrooms increases opportunities for peer interaction and collaboration fosters healthy social and emotional development as children use drama to solve problems, deal with conflict, conquer fears, adopt new perspectives, regulate emotions, and practice self-regulation skills. Story dramas allow children to represent their ideas, feelings, and conflict resolution theories, as well as relate to other children's stories. These are many of the important skills needed to form a community (Curenton, 2006; Paley, 1990).

According to Webster-Stratton and Reid (2004), there are three different approaches to teaching children social problem solving skills. These are parent training, teacher training and child training which includes direct practices with children. Of these, child training is the most common approach and this can be achieved by means of preschool education programs. Today, there are many different types of preschool education programs. All known early childhood education programs intend to support all developmental areas of children. It is therefore one of the main goals of these programs to make children individuals who can solve their problems independently by supporting them in all developmental areas. Meta-analysis studies looking into the effectiveness of different training models designed to support children's problem solving skills indicate that these programs have created a significant impact on individuals. However, it is argued that combined programs or those implemented in an eclectic way have produced more effective outcomes compared to single programs (Anlıak & Dinçer, 2005). It is underlined in the literature that children participating in various programs in early childhood make good progress in their problem solving skills (Hutchings et al., 2011; Webster-Stratton, Reid & Hammond, 2001). In this research, eclectic way (drama and storytelling) is considered a factor that increased the effectiveness of the program. Apart from that, the rituals of the storytelling method may have motivated the experimental group children.

Another factor thought to affect the research result is the use of drama method. The use of drama method for activities aimed at improving problem-solving skills enables the use of the problem solving steps by the experimental group children in different situations and influences the development of problem-solving skills. It is therefore suggested to provide the opportunity of using the problem-solving steps by organizing activities where problems encountered frequently in daily life are considered and also to support more active participation of the children in the problems that require solving social problems. However, role playing and improvisation are the basis of the techniques we use in drama education. In the stages of problem solving skill development, role playing and improvisation techniques in drama cover cognitive emotion and behaviors. We think that creating problems that include decision making and problem solving and animating them with improvisation and role-playing method contributes positively to children's problem-solving skills.

The advantages of Drama Based Storytelling Method in educational programs as prepared for children include promoting creative thinking, developing critical thinking, enhancing listening skills, improving the recognition of others and empathetic skills, developing collaboration with the group and respect for peers and supporting positive perspective towards oneself. Thus, problem solving skills of children are also supported (Köksal Akyol, 2018). In addition, children understand themselves, their friends, families and many aspects of the real life by creating, developing and reflecting in the drama and storytelling setting. Upon review of various social events, they start thinking about how people live and act under different conditions. They may bring forward different views and analyze personal views

towards others. This will pave the way for children to dissent, discussion and solution (Fulford, Hutchings, Ross, & Schmitz, 2001).

When the results of similar research on problem solving training provided through Drama Based Storytelling Method are examined, similar results have been obtained, supporting the findings of our research. Kayılı and Arı (2016) state that the presence of dramatic activities, puppets and stories that support conceptual development when used in social skills training programs are effective in the improvement of children's problem-solving skills. Başdaş (2017) examined the effect of the drama-based digital storytelling program on some social skills of 6-year-old children. A total of 48 children, 24 in the experimental and 24 in the control group, did warm-up exercises for the first two weeks and they were administered drama-based storytelling program three hours a week for the following 8 weeks. As a result of the research, a significant difference was observed in favor of the experimental group in sub-dimensions such as controlling anger behavior, adapting to changes, listening, creating goals and completing given tasks. Pekdoğan (2016) included 60 children (30 in experimental group, 30 in control group) in his research to examine the effect of the Story-Based Social Skills Education Program on the improvement of social skills of 5-6 year-old preschool children. Story-Based Social Skills Training Program was provided to the children in the experimental group twice a week for 5 weeks. The results showed that there was a significant difference in the social skill scores between the experimental and the control group and the effect of the training program continued. Alemdar Coşkun (2016) included 66 children in her research in order to examine the effect of the Problem Solving Training Program on problem solving skills and interpersonal problem solving skills of kindergartners. During the research process, the Problem Solving Education Program prepared by the researcher was applied to 22 children in the experimental group 3 days a week for 8 weeks. It was found that the post-test scores were higher than the pre-test scores of the children in the experimental group in sub-dimensions such as realizing the problem, defining the problem, asking questions, guessing the reason, deciding the adequacy of the information for the solution, defining the elements of the problem, using objects in a different way, predicting the outcome of some actions, finding the most appropriate solution and choosing the most unusual solution among many possible solutions. Besides, skills like understanding and defining a problem, collecting necessary information to solve the problem, determining the solution to the problem, choosing the most appropriate solution for the problem, applying the solution determined for the problem, solving and evaluating the problem and interpersonal problem-solving skills can also be improved with educational programs that support children's problem-solving skills.

Recommendations

The effect of the drama-based storytelling method on problem solving skills can be examined in new studies with larger sample groups and more children. This can be considered a limitation of the current research. The results obtained in our research have revealed the short-term effects of the training program. More studies therefore can be conducted to explore the long-term effects of the training program. The purpose of this research was to improve the problem solving skills of five-year-old children by developing the Drama Based Storytelling Method and providing problem solving training. Different skill areas can be supported by providing training for these skill areas using the same method in future research. This research was conducted with children of 5 years age group. The follow-up effect of the Drama Based Storytelling Method can be tested in younger or older age groups in different research studies. In our study, an education program was prepared in a way that the method of storytelling and drama support each other. A training program can be prepared by combining the storytelling method with different methods in future research. The effect of the storytelling method on the MoNE Preschool Education Program was analyzed. A research study can also be undertaken to compare storytelling method with different methods in future studies.

In the preschool period, drama practices are applied within the framework of certain rules and stages and they are included in the national preschool education program. Based on this, stories can be told according to certain rules within the framework of the concept of "Storytelling" in the national preschool

education program and some stages which teachers can apply collaboratively can be included. In-service training related to "Storytelling" can be popularized by the Ministry of National Education. "Storytelling" classes can be added to educational programs in order for pre-service teachers to improve themselves or workshops can be created in undergraduate programs of universities. These trainings can be provided for students by establishing "Storytelling Workshops" in educational institutions.

Declarations

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Research Article

Enhancing the quality of teacher-child interactions in Singapore pre-school classrooms

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Abstract: This exploratory study was aimed primarily at developing baseline data on the quality of teacher-child interactions in Singapore pre-school classrooms. Data were collected through observations of teacher-child interactions in 80 pre-schools, using the Classroom Assessment Scoring System (CLASS) in the three key domains which are 1) Emotional Support, 2) Classroom Organisation, and 3) Instructional Support (Pianta, La Paro, & Hamre, 2008). It was found that the overall quality of teacher-child interactions in the Singapore pre-school classrooms was low to moderate, with Instruction Support being the lowest. This finding is similar to that found in studies conducted in many other countries including China and the U.S. (Slot, 2017). Possible reasons and explanations will be presented, and suggestions to improve or enhance the quality of teacher-child interactions will be proposed. This study has implications on pre-school teacher education and professional development as well as government policies and regulations for the Singapore pre-school sector.

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Introduction

As young children in Singapore are spending a large part of their time in pre-schools, it has become increasingly important to determine the nature and quality of their experiences in pre-schools (childcare centres or kindergartens). While there is no universally accepted definition of quality in pre-school education, there are structural and process indicators that are important components of quality programmes which result in positive child outcomes (Organisation for Economic Co-operation and Development [OECD], 2018; Thomason & LaParo, 2009).

Structural indicators include programmes and features of the classroom such as class size, teacher-child ratios, and teacher qualifications, training and experience (OECD, 2018; Ramey & Ramey, 2004). These structural variables are the measurable components of quality and most often found in the licensing requirements set by the authorities to ensure that pre-schools provide the minimum quality of services (Karuppiah, 2015; OECD, 2018). Process indicators, on the other hand, include dynamic aspects of the classroom such as planning of learning activities, teacher-parent relationships and teacher-child interactions (OECD, 2018; Ramey & Ramey, 2004). While these process variables are not regulated by licensing requirements, they determine the quality of children's experiences within the pre-school environment (Karuppiah, 2015; OECD, 2018).

Researchers have identified teacher-child interactions as a key process indicator which contributes to the quality of children's learning experiences (Bertram et al., 2016; Mashburn et al., 2008). Broadly defined, teacher-child interactions are the exchanges that take place between the child and the teacher on both a formal (instructional) and informal (social) basis (Hamre et al., 2012). The quality of teacher-child interactions are dependent on the professionalism of the teachers and the wisdom of their practice and are also influenced by the teachers' background, beliefs and values (Berthelsen, Brownlee, & Karuppiah, 2011).

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In particular, responsive, sensitive, stimulating teacher-child interactions are reliably linked to the level of teacher education and specialized professional development training of teachers (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; OECD, 2018).

However, research indicates that teachers with higher qualifications together with specific training in early childhood education are most likely to provide high quality early childhood programmes (Berthelsen et al., 2011; Karuppiah, 2015). There seems to be greater interactions between teachers and children, and the children show greater social, cognitive and language abilities (Burchinal et al., 2002; Fukkink, Helmerhorst, Deynoot Schaub, & Sluiter, 2019). Additionally, these teachers were found to be more positive and less punitive, employing a less authoritarian style of interactions with the children (Fukkink et al., 2019).

Professional development and coaching are also found to have a positive impact on teachers' interactions with children. However, it was found that the design, duration, delivery and focus of training is important to ensure the effectiveness of professional development for teachers (Pianta et al., 2014). Additionally, it was also found that for the professional development to be effective, it must provide opportunities for sustained training experiences and self-reflection (Schachter, Gerde, & Hatton-Bowers, 2019; Zan & Donegan-Ritter, 2014). Creating a positive organisational climate and setting up professional learning communities have also been found to improve teachers' self-image and well-being as well as teacher-child interactions in the pre-school classrooms (OECD, 2018).

Research also suggests that child factors (e.g., characteristics, temperament, self-regulation, attention & socio-emotional skills) and home factors (e.g., maternal education, socio-economic status & stress) also affect children's learning because they influence children's engagement in activities and facilitate (or disrupt) classroom processes (Ladd, Birch, & Buhs, 1999; Pianta & Stuhlman, 2004). Although there is no definitive answer regarding the ideal teacher-child ratio, teachers in classrooms with smaller class size and lower teacher-to-child ratios tend to be more sensitive and responsive to the children than teachers who had more children in their care (Hoang, Holopainen, & Siekkinen, 2018; National Institute of Child Health and Human Development, Early Child Care Research Network [NICHD ECCRN], 2004; OECD, 2018).

Since the pre-schools in Singapore are regulated by the licensing requirements stipulated by the Early Childhood Development Agency (ECDA, 2020), it is somewhat fair to conclude that all or most pre-schools do meet at least the minimum requirements for the structural indicators (Karuppiah, 2015; Tan, 2017). Although there are many structural and process indicators which affect children's outcomes, this study focuses specifically, on teacher-child interactions. Since teacher-child interaction is identified as a key process indicator which contributes to the quality of children's learning experiences, the key research question for this study is, 'What is the quality of teacher-child interactions in Singapore pre-school classrooms'?

Methodology

The Singapore Kindergarten Impact Project (SKIP) was the first five-year longitudinal study aimed at tracking children from Kindergarten 1 (K1) to Kindergarten 2 (K2) and then, to Primary One (P1) in Singapore. This exploratory study which was part of SKIP, was aimed primarily at developing baseline data on teacher-child interactions in K (K1 & K2) classrooms in Singapore.

Participants

The sample consisted of approximately 120 teachers and 1530 K children in 80 pre-schools located across Singapore. These pre-schools which belonged to three categories of providers (government, government-funded & private kindergartens or childcare centres), were recruited using a stratified sampling technique. Hence, these pre-schools (mostly kindergartens with 3- or 4- hour programmes) provided a wide variability in terms of their social and economic status (SES), and racial and cultural backgrounds (Chinese, Malays, Indians & Others).

Prior to the study, approval for ethics clearance was sought from the Nanyang Technological

University Internal Review Board (NTU IRB). Once approval was obtained, teachers and children (through their parents) were invited to participate in the study through formal information and consent letters. Written consent was obtained from the teachers and parents of the children who were willing to participate in the study. Child assent forms were also completed by the children to confirm their willingness to participate in the study. The teachers, parents and children were briefed on the purpose of the study, data collection procedures and confidentiality of their responses. They were also informed that participation was voluntary, and that they could withdraw participation at any point of the study.

Data Collection

Instrument

The Classroom Assessment Scoring System (CLASS), which is an internationally recognised instrument (OECD, 2018), was used to measure the quality of teacher-child interactions in the Singapore pre-school classrooms. CLASS was developed by Pianta and his colleagues (2008) at the Curry School of Education in Virginia, United States of America.

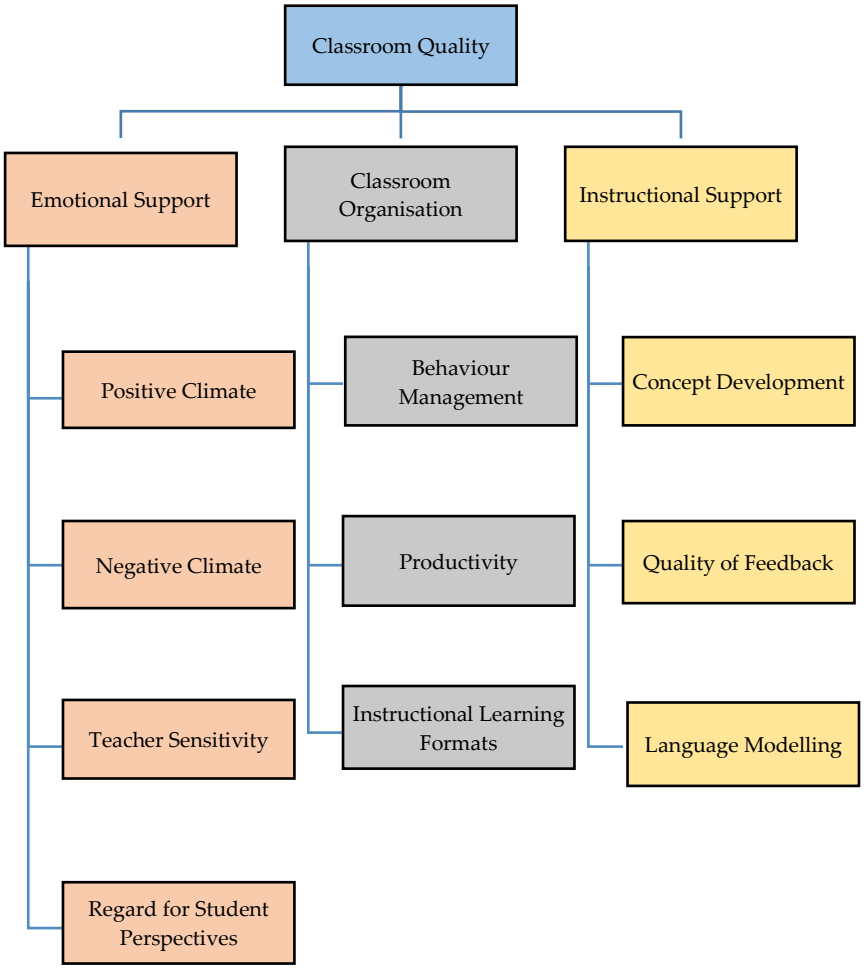

Figure 1. Domains & Dimensions in CLASS (Pianta et al., 2008)

As depicted in Figure 1, there are ten dimensions in CLASS which are Positive Climate, Negative Climate, Teacher Sensitivity, Regard for Student Perspectives, Behaviour Management, Productivity, Instructional Learning Formats, Concept Development, Quality of Feedback and Language Modelling (Pianta et al., 2008). Each of these dimensions is described in Table 1.

Table 1. Observable dimensions in CLASS (Pianta et al., 2008)

Domain	Dimension	Description
Emotional Support	Positive Climate	This is the degree to which the classroom reflects 1) enthusiasm and enjoyment children display during learning activities, 2) respect displayed during interactions between the teacher and children, and among children, and 3) positive affect and positive communication.
	Negative Climate	This is the degree to which the classroom has 1) a negative emotional and social tone, and 2) negative affect such as anger, harshness, punitive control, sarcasm and severe negativity such as bullying or physical punishment.
	Teacher Sensitivity	This is the extent to which the teacher 1) provides comfort, reassurance and encouragement, 2) is aware of children's needs for support, 3) provides individualized support, 4) is responsive to children's emotions, 5) addresses problems in a timely manner, and 6) creates a classroom in which children are comfortable seeking out the teacher and volunteering responses.
	Regard for Student Perspectives	This is the extent to which the teacher 1) provides classroom activities which are rigidly structured or regimented, 2) shows flexibility with respect to children's ideas, 3) follows children's leads, supports autonomy and leadership, and 3) maintains a balance of teacher talk and child talk in the classroom.
Classroom Organisation	Behaviour Management	This involves the teacher's ability to 1) use effective methods to prevent and redirect children's misbehaviours, 2) provide clear behaviour expectations, 3) monitor the classrooms and children's behaviour, and 4) redirect children's behaviour effectively.
	Productivity	This involves the teacher's ability to 1) manage instructional time and routines so that children learn and make progress, 2) provide activities in a way so that children are not waiting or wandering, 3) have routines that the children understand and can follow in the classroom, 4) have brief transitions that may incorporate learning opportunities, and 5) have materials ready for activities to minimize waiting time.
	Instructional Learning Formats	This involves the teacher's ability to use 1) available activities, method of presentation, groupings, and range of materials to maximize children's engagement and exploration in learning, 2) questions to engage children and 3) activities to expand children's learning.
Instructional Support	Concept Development	This involves the teacher's ability to employ strategies to promote children's higher order thinking skills (e.g., open ended questions, brainstorming, prediction & integration of information) instead of focusing on rote & fact-based learning.
	Quality of Feedback	This involves the teacher's ability to provide children with 1) quality verbal evaluation about their work, and 2) comments, ideas and feedback with information to support their understanding of the process of learning instead of just the correctness of the end product.
	Language Modelling	This involves the teacher's ability to use quality language-stimulation and language-facilitation techniques during individual, small-group, and large-group interactions with children (e.g., self & parallel talk, open-ended questions, repetition, expansion/extension & use of advanced language).

Procedure

In this study, a team of two researchers trained in CLASS visited the participating pre-schools to observe and video-record the teacher-child interactions in the K classrooms. Each classroom was observed and video-recorded for 3 to 4 hours (depending on the duration of their program). As the purpose of the study was to capture instances of teacher-child interactions on a typical day in the participating pre-school, the teachers were not given any instructions or directions regarding the content or pedagogy for the activities to be observed and video-recorded. Although the Nurturing Early Learners (NEL) Framework (Ministry of Education [MOE], 2012) was launched by the Ministry of Education in 2013, it is a recommended and not a mandatory guideline to be used by pre-schools to design and develop their curriculum (Tan, 2017). Hence, the curriculum (including the content & pedagogy for the activities) could vary among the pre-schools.

Data Analysis

A qualitative approach was adopted for the study in order to obtain rich and insightful data (Bogdan & Biklen, 2003; Cohen, Manion & Morrison, 2011; Creswell, 2008). A team of two researchers trained in CLASS organised, observed and rated the video-recorded classroom observations of the pre-school classroom.

Table 2. CLASS Scoring for Quality Interactions (Pianta et al., 2008)

Score	Range	Indication of Quality Interactions
1, 2	Low	few
3, 4, 5	Mid	some
6, 7	High	many

Each of the video-recorded classroom observations was organised and divided into four to six rounds of 20-minute video segments, depicting the teacher in different classroom activities (e.g., mealtime, large group activity, small group activity, free play, etc.). Each video segment was then followed by a ten-minute scoring session. During the scoring session, each dimension was rated from 1 to 7. As summarised in Table 2, a score of 1 or 2 indicates that the classroom is in the low range when there were few or no indicators of quality teacher-child interactions; 3, 4, or 5 indicates that the classroom is in the moderate range when there were some indicators of quality teacher-interactions; and 6 or 7 indicates that the classroom is in the high range when there were many indicators of quality teacher-child interactions. An average score across the four to six segments was then calculated for each of the ten dimensions. This average score obtained for each of the ten dimensions was then analysed by making reference to the literature.

Results

The results from the study will be presented according to the three domains which are Emotional Support, Classroom Organisation and Instructional Support. Figure 2 provides a summary of the results which is, most pre-schools scored in the moderate range (3 to 5) for Emotional Support and Classroom Organisation, but in the low range (1 to 2) for Instructional Support.

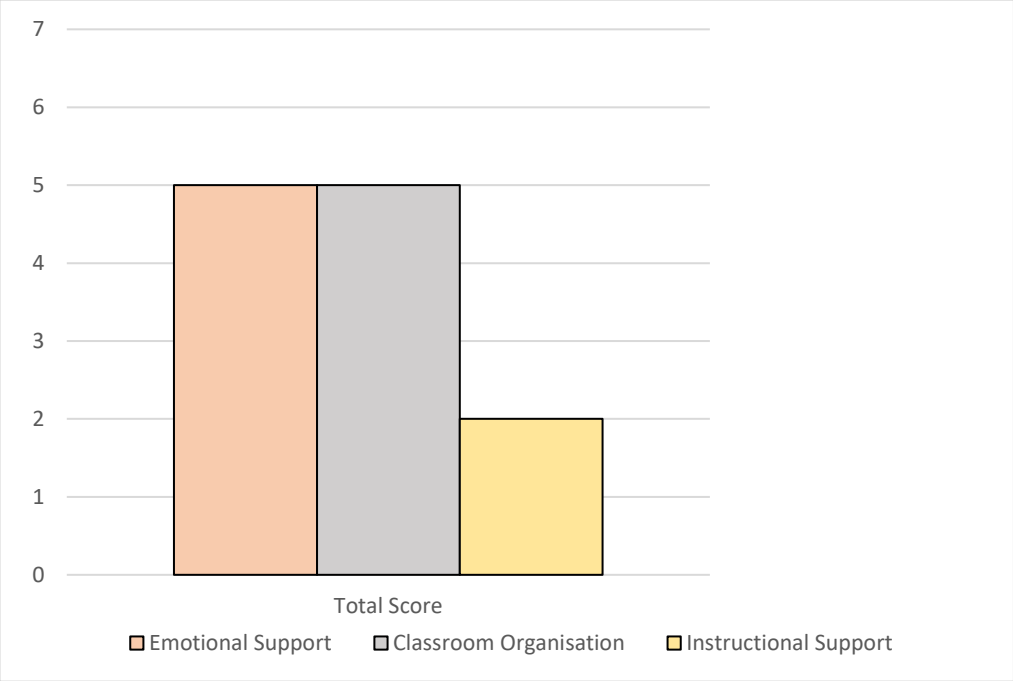

Figure 2. Quality of teacher-child interactions in Singapore pre-schools

Emotional Support

As a whole, most pre-schools scored in the moderate range (3 to 5) for this domain as they displayed some indicators of quality teacher-child interactions. As indicated in Table 1, Emotional Support comprises the following dimensions which are Positive Climate, Negative Climate, Teacher Sensitivity and Regard for Student Perspectives. Of the four dimensions that contribute towards Emotional Support, scores for Teacher Sensitivity and Regard for Student Perspectives were in the lowest range (Table 3).

Table 3. CLASS Scoring for Emotional Support

Dimension	Range	Indication of Quality Interactions
Positive Climate	moderate	some
Negative Climate	moderate	some
Teacher Sensitivity	low	few
Regard for Student Perspectives	low	few

As explained in Table 1 above, Teacher Sensitivity involves the extent to which the teacher 1) provides comfort, reassurance and encouragement, 2) is aware of children's needs for support, 3) provides individualized support, 4) is responsive to children's emotions, 5) addresses problems in a timely manner, and 6) creates a classroom in which children are comfortable seeking out the teacher and volunteering responses.

The low range scores for Teacher Sensitivity indicated that few or no indicators of this dimension were observed in the pre-school classrooms (Table 3). Teachers were seldom aware of students in need of extra support, assistance or attention. The teachers were responsive to children on a few occasions but most of the time, they were more dismissive or unresponsive; and they responded to the interests, needs and abilities of a few children but not the others. The teachers were also seldom effective in addressing children's problems and concerns; and children rarely sought support from, shared ideas with, or responded to questions from the teachers.

As explained in Table 1, Regard for Student Perspectives involves the extent to which the teacher 1) provides classroom activities which are rigidly structured or regimented, 2) shows flexibility with respect to children's ideas, 3) follows children's leads, supports autonomy and leadership, and 3) maintains a balance of teacher talk and child talk in the classroom.

The low range scores for Regard for Student Perspectives indicated that few or no indicators of this dimension were observed in the pre-school classrooms (Table 3). Teachers rarely followed the children's lead, and were controlling most of the time. They seldom provided support for children's autonomy and leadership, and opportunities for child-talk and expression. On most occasions, there was teacher-talk, and teachers seemed to be somewhat controlling of children's movement and placement during the activities.

Classroom Organisation

As a whole, most pre-schools scored in the moderate range (3 to 5) for this domain as they displayed some indicators of quality teacher-child interactions. As indicated in Table 1, Classroom Organisation comprises the following dimensions which are Behaviour Management, Productivity, and Instructional Learning Formats. Of the three dimensions that contributed towards Classroom Organisation, scores for Instructional Learning Formats were in the lowest range (Table 4).

Table 4. CLASS Scoring for Classroom Organisation

Dimension	Range	Indication of Quality Interactions
Behaviour Management	moderate	some
Productivity	moderate	some
Instructional Learning Formats	low	few

As explained in Table 1, Instructional Learning Formats involves the teacher's ability to use 1) available activities, method of presentation, groupings, and range of materials to maximize children's engagement and exploration in learning, 2) questions to engage children and 3) activities to expand children's learning.

The low range scores for the Instructional Learning Formats indicated that few or no indicators of this dimension were observed in the pre-school classrooms (Table 4). Teachers merely provided activities

for the children, and rarely facilitated activities to encourage their engagement and involvement. Teachers were inconsistent in their use of a variety of modalities and materials to gain children's attention and participation during activities. Hence, children did not seem to be engaged, interested or involved in the activities most of the time.

Instructional Support

As a whole, most pre-schools scored in the low range (1 to 2) for this domain as they displayed very few or no indicators of quality teacher-child interactions. As indicated in Table 1, Instructional Support comprises the following dimensions which are Concept Development, Quality of Feedback, and Language Modelling. Unlike Emotional Support and Classroom Organisation, the score for the three dimensions that contributed to Instructional Support were all in the low range (Table 5).

Table 5. CLASS Scoring for Instructional Support (Pianta et al., 2008)

Dimension	Range	Indication of Quality Interactions
Concept Development	low	few
Quality of Feedback	low	few
Language Modelling	low	few

As explained in Table 1, Concept Development involves the teacher's ability to employ strategies to promote children's higher-order thinking skills (e.g., open-ended questions, brainstorming, prediction & integration of information) instead of focusing on rote & fact-based learning.

Low scores for Concept Development indicated that very few or no indicators of this dimension were observed in the pre-school classrooms (Table 5). Teachers rarely used discussions and activities to encourage analysis and reasoning, or provided opportunities for children to be creative and/or generate their own ideas and products. On most occasions, concepts and activities were presented independent of one another, and children were not asked to apply their previous learning. Teachers also seldom related concepts to the children's actual lives.

As explained in Table 1, Quality of Feedback involves the teacher's ability to provide children with 1) quality verbal evaluation about their work, and 2) comments, ideas and feedback with information to support their understanding of the process of learning instead of just the correctness of the end product.

The low scores for Quality of Feedback indicated that very few or no indicators of this dimension were observed in the pre-school classrooms (Table 5). Teachers seldom supported children's learning, dismissed their responses or actions as incorrect, and ignored their problems in understanding. On most occasions, teachers gave only cursory feedback to children, and rarely queried, probed or prompted them to explain their thinking or actions. Teachers also rarely provided additional information to expand on the children's understanding or actions, or offered encouragement of children's efforts that increased their involvement and persistence.

As explained in Table 1, Language Modelling involves the teacher's ability to use quality language-stimulation and language-facilitation techniques during individual, small-group, and large-group interactions with children (e.g., self & parallel talk, open-ended questions, repetition, expansion/extension & use of advanced language).

The low scores for Language Modelling indicated that very few or no indicators of this dimension were observed in the pre-school classrooms (Table 5). The majority of teacher's questions were closed-ended, and the teachers seldom repeated or extended the children's responses. Teachers rarely mapped their own actions and the children's actions through language and description, and they did not use advanced language with children. This is also very much linked to the limited presence or absence of meaningful conversations in the classroom.

Discussion and Conclusion

The results for the three domains (Emotional Support, Classroom Organisation & Instructional Support) will be consolidated and discussed. Possible reasons and explanations will be provided as well as suggestions to improve or enhance the quality of teacher-child interactions in Singapore pre-schools will be proposed by making reference to the literature.

As a whole, most pre-schools scored in the moderate range (3 to 5) for the domains on Emotional Support and Class Organisation as only some indicators of quality teacher-child interactions were displayed during the classroom observations. There are possible reasons for this result. Firstly, the class size was large and the teacher-to-child ratio was rather high. There could be a maximum of 20 children in the K1 classroom and 25 children in the K2 classroom, and there was usually one teacher and sometimes, one assistant teacher who usually taught the mother tongue language. Secondly, teachers needed to complete a tight and sometimes, inflexible schedule of activities within the 3- or 4- hour kindergarten programme. This left the teacher with very little time to pay attention and respond to each and every child during the tight programme in the classroom. Activities were usually very much teacher-directed and as a result, there was very little child-talk or conversations as well as facilitation, support or scaffoldin for individual children's learning.

However, teachers could provide more positive support if they were skilful in breaking up the large group into smaller groups, and conducting free play and guided activities simultaneously in the various learning centres in the classroom (Ng & Bull, 2018). This requires the teachers to possess the necessary knowledge, skills and experience to organise and manage a large class size. Hence, teacher-training institutes could take this into consideration in their teacher education, professional development and coaching programmes (Karuppiah, 2015; Ng & Bull, 2018; Pianta, et al., 2014; Schachter et al., 2019; Zan & Donegan-Ritter, 2014).

There could also be other reasons such as child factors (e.g., characteristics, temperament, self-regulation, attention & socio-emotional skills) (Ladd et al., 1999; Pianta & Stuhlman, 2004). For example, some children could require more attention, and the teacher had to spend more time with these children. This could potentially pose a challenge to maintaining quality teacher-child interactions, if the class size was large and the teacher-to-child ratio was high in that classroom (Hoang et al., 2018; NICHD ECCRN, 2004; OECD, 2018). Hence, in view of these challenging conditions, the government could review the class size and teacher-to-child ratio in the pre-schools.

Given the current shortage of good teachers (due to challenges in attracting & retaining them) in the Singapore pre-school sector, this may not be a feasible option. Hence, reviewing the curriculum in the pre-school to free up time for quality teacher-child interactions in the pre-school classroom could be another option (Bautisa, Ng, Munez, & Bull, 2016; OECD, 2018; Tan, 2017). However, parents in Singapore are particular about their children maximising their learning time especially, in the academic areas (literacy & numeracy) while they are in the pre-school (Bach & Christensen, 2017; Lim-Ratnam, 2013). Hence, besides governmental support, parental support and education would also be required for this option to work.

As a whole, most pre-schools scored in the low range (1 to 2) for the domain on Instructional Support as only a few indicators of quality teacher-child interactions were displayed during the classroom observations. Interestingly, the low score for this domain is consistent with findings from other countries including China and the U.S. (Slot, 2017). There could be possible reasons for this result which are also similar to the ones provided previously on Emotional Support and Classroom Organisation. These reasons make it challenging for teachers to provide quality instructional support for children in the pre-school classroom. Again, besides reviewing teacher education and professional development programmes (Karuppiah, 2015; Ng & Bull, 2018; Pianta et al., 2014; Schachter et al., 2019; Zan & Donegan-Ritter, 2014), the class size, teacher-to-child ratios and curriculum in the pre-school could also be reviewed (Hoang et al., 2018; NICHD ECCRN, 2004; OECD, 2018; Tan, 2017;).

Additionally, it is also important to consider the design, delivery and focus of training carefully

(Pianta et al., 2014) as well as provide opportunities for self-reflection (Schachter et al., 2019) and sustained training experiences (Zan & Donegan-Ritter, 2014) in order to ensure the effectiveness of professional development for teachers. Since the score was lowest for this domain, it may also be important to consider providing coaching and useful resources (e.g., local videos of good practices) to help teachers understand, appreciate and acquire the necessary skills to promote quality instructional support in the pre-school classrooms (Langeloo, Mascareno, Deunk, Klitzing, & Strijbos, 2019; Schachter et al., 2019; Zan & Donegan-Ritter, 2014). Other factors such as higher salaries, a positive organisational climate and professional learning communities have also been found to improve teachers' self-image and well-being as well as teachers' motivation and teacher-child interactions in the pre-school classrooms (OECD, 2018).

In summary, it appears that the quality of interactions was generally moderate for Emotional Support and Classroom Organisation but somewhat low for Instructional Support. Hence, the overall quality of teacher-child interactions in Singapore pre-schools could be described to be in the low to moderate range. Possible reasons and explanations were presented, and suggestions to improve or enhance the quality of teacher-child interactions were proposed. These suggestions include reviewing teacher education, professional development and coaching programmes, developing local video resources, setting up professional learning communities, reviewing government policies and regulations, and improving teachers' self-image, well-being and working conditions in the pre-schools.

Limitations

Although this exploratory study was a good start and would make a contribution to the pre-school sector in Singapore, there are some key limitations which are as follows. The sample comprised mainly kindergartens. Childcare centres which have a longer programme could potentially provide more time for the teachers to provide quality interactions with the children. However, this depends on the class size and teacher-to-child ratio as well as whether the teachers possess the necessary knowledge, skills and experience to support quality teacher-child interactions in the classroom.

There could be researcher-bias in the analysis and interpretation of the data. However, all measures have been taken to ensure that researcher-bias was kept to a minimum by maintaining interrater reliability, and constantly referring to the literature and purpose of the study.

Implications and Future Research

The information gathered from the study could contribute to the database on research in the care and education of young children in Singapore. It could also be used to inform various stakeholders in the pre-school sector, on the importance of teacher-child interactions. Teachers and leaders could engage in critical self- evaluation and reflection to enhance/improve their classroom pedagogies and practices. A new study comprising both kindergartens and childcare centres could also be carried out to ascertain if the duration of the pre-school programme would make a significant difference in the quality of teacher-child interactions in the classroom.

Findings from this study could also contribute to the growing research on teacher education and professional development for pre- and in- service teachers in Singapore. More local resources (such as exemplary classroom videos of good practice) could also be developed to support teacher education and professional development programmes for teachers (Hamre et al., 2012; Langeloo et al., 2019; Schachter et al., 2019).

While teacher-training institutes could consider reviewing their pre-school teacher-education and professional development programmes, the government could consider reviewing their policies, regulations and the working conditions in the pre-sector. More research could also be done in identifying what teachers think are the factors which affect their interactions with children; and how they can improve the quality of interactions with children in the classroom. Such valuable information from the teachers themselves could be used to inform policy, teacher education and professional development in very meaningful ways.

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Review Article

A posthuman perspective on early literacy: A literature review

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Abstract: Drawing on research about young children's literacy development, this review article discusses a recent paradigmatic turn for understanding the child and childhood from human-centerism to posthumanism. Building on the new materialist tradition (e.g., Barad, 2007) and the assemblage theory of Deleuze and Guattari (1987, 1997), the posthuman lens enables researchers and educators to see children as parts of entangled networks of relationships who continuously intra-act with their peers, teachers, materials, and the other nonhuman entities and activities produced constantly by the child-material entanglements. As such, the posthumanist perspective expands the current research on early literacy by offering new possibilities for re-conceptualizing the child, the materials or resources for early literacy, and the meaning of childhood and children's play. These new ways of seeing the child, the materials, and childhood have also generated new pedagogical practices that are material-oriented, intra-active, and flexible. The review concludes by providing directions for conducting research from a posthuman perspective in the field of early literacy education.

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Introduction

Over the past few decades, there have been continuing inter-disciplinary shifts and reconceptualizations regarding how researchers and educators approach early literacy and language learning. One recent advancement examines the multimodal nature of early literacy development, seeing early literacy practices as involving multiple symbolic systems in real-world contexts (e.g., Jewitt, 2011; Kress, 1997, 2011). While early language is viewed as playing a fundamental role in young children's meaning-making, multiple modes of children's representations and the myriad materials within the different sociocultural contexts also impact their early meaning-making (e.g., Dobinson & Dunworth, 2019; Hill, 2020; Narey, 2017). Children's multimodal interactions with differential materials (such as making pillows as cars or playing with the cardboard box as a pirate ship) are seen as "communications" through which children strategically choose and use actions, materials, and artifacts for a communicative purpose (Kress, 1997, p. 9).

The multimodal perspective expands the common assumptions that emphasize the nature of early literacy practices as human endeavours and lies on what children do "with each other" and "to materials" to learn to communicate (Kuby & Crawford, 2018, p. 21), whereas the posthuman perspective moves beyond the multimodal perspective and prioritizes children's ways of doing/knowing/being literacies and their unexpected and emergent literacy practices with materials and other nonhuman entities (e.g., Hackett & Rautio, 2019; Hackett & Somerville, 2017; Kuby, Spector, & Thiel, 2019). Researchers, therefore, note that this posthuman lens foregrounds the agency of nonhumans (e.g., materials, animals, and contexts) and humans (children) in co-constructing meanings; they also believe that the lens enables them to theorize and

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examine materials as active agents in producing discourses and realities, further disturbing the human-nonhuman or natural-cultural boundaries.

From human-centered research to posthumanism, the paradigm shift enables productive potentials for researchers and educators to rethink and reinterpret early literacy as emergent, entangled, and embodied (e.g., Enriquez, 2016; Leander & Boldt, 2013). It adds to what counts as literacy by focusing more on the process of making meaning than just meaning. The current article reviews this emerging trend of studies targeting early literacy development from this posthuman lens. This review was guided by the following questions:

1. How do researchers employ posthuman theories to frame their exploration of young children's early literacy development?
2. What are the new understandings of early literacy provided by the posthuman perspective, and what are the pedagogical implications?
3. What are the implications for future research and practice?

Through responding to the three guiding questions, this review aims to uncover alternative interpretations of early literacy, the child, and the childhood from the posthuman lens in different contexts. It also seeks to provide a snapshot of how posthumanist theories influence early literacy educators in fostering early literacy development in their classrooms and beyond. Further, this review will also shed light on the gaps in the conventional literature on early literacy research that can be better addressed through a posthuman lens.

Posthumanism in early literacy: An overview of key concepts and approaches

While there is a variety of scholarship to interpret posthumanism, two main approaches have been taken in the field of early education: agential realism in the *new materialist tradition* (e.g., Barad, 2007; Coole & Frost, 2010) and the assemblage theory of Deleuze and Guattari (1987, 1997).

New materialism asserts that all human and nonhuman entities in the world are matters and that knowledge and phenomenon emerge from the continuous and various encounters among living and nonliving entities (e.g., Barad, 2007; Bogost, 2012; Braidotti, 2013; Žižek, 2014). Sanzo (2018) validates that new materialism has been coined as early as the 1990s as "a theoretical turn away from the persistent dualism in modern and humanist traditions whose influences are present in much of cultural theory" (n. p.). One key approach within new materialism was taken up in early literacy research was Barad's (2007) *agential realism*. Building on the "quantum ontology" that emphasizes connectivity and relationality of different entities in the world, the concept of agential realism further sees the world as comprised of phenomena or objects that are products of "the ontological inseparability/entanglement of intra-acting agencies" (p. 139). In a phenomenon, actants including human and nonhuman objects do not pre-exist but come into being through their entanglements with material beings in the more-than-human world, namely, *intra-actions,* that change "possibilities for worldly reconfiguring" (Barad, 2012, interviewed by Dolphijn & van der Tuin, p. 55). To Barad, *agency* is "no longer aligned with human intentionality or subjectivity" (p. 177) through which human do things "to make changes in the world" (Thiel, Kuby, & Spector, 2019, p. 19) but "a matter of intra-acting" or "an enactment" (p. 178) that generates practices of mattering or meaning making from intra-actions of humans, nonhumans, and the more-than-human world in the material-discursive conditions.

In early literacy, agential realism offers a paradigmatic shift from the humanist assumption of the relationship between active minds and passive objects to the active agential roles of both children and materials playing together in the dynamic becoming of knowledge and relationships. The shift of ontological focus motivates the scholarship to ask how languages and literacies come to be and to re-read children's literacy events posthumanly by 'trying to do justice to the materials" (Jokinen & Murris, 2020, p. 49) that children work with during the becoming of literacies and considering the power of things enacted in the interactions between materialized children bodies and materials.

Another theoretical take-up in early education from a posthuman perspective is the re-reading of the *assemblage* theory proposed by Deleuze and Guattari in their book, *A Thousand Plataeus* (1987). Assemblage theory explores the way heterogeneous elements or assemblage components in material systems select, compose, and self-organize to articulate meaning. Building on Deleuze and Guattari, Bennett (2010) re-reads the concept of "assemblage" as the "ad hoc groupings of diverse elements" (pp. 23-24) in a phenomenon in which "no one materiality or type of material has sufficient competence to determine consistently the trajectory or impact of the group" (p. 21). Bennett argues that the lively kind of agency of nonhuman objects, namely, "*thing power*", manifests through the forming processes of the human-nonhuman assemblages.

Moreover, another take-up of the assemblage theory in early literacy research is the interpretation of affects and components within and among other bodies in order to better understand the child from a posthuman perspective. In this regard, scholars align and re-conceptualize from a posthuman perspective several terms suggested by Deleuze and Guattari, including *affect* (1987) and *desire* (1997), in order to seek new insights on young children's literacy development. A Deleuzoguattarian explanation of *affect* is non-conscious, instinctive bodily experiences (1987). In a posthuman reading, affect serves as a means to understand the "non-cognitive, non-volitional expressions of life, including feelings, animation, tactility, and habituation" (Roelvink & Zolkos, 2015, p. 1). The affective approach thus scaffolds early literacy researchers to explore the complex interrelations of children's bodies, thing powers, contextual-situated emotions, and material-discursive practices in a specific time and space.

One frequently explored affective dimension is children's desires. Deleuze (1997) conceives the human body as one assemblage of machines (or heterogeneous elements) that produce *desires*. Based on this conception of the body as a desiring-machine, in children's play with objects (desiring with objects), the objects children interact with also offer desire; therefore, the body and the objects emerge something co-constructive in producing the affect of desiring. Inspired by this notion of desire, researchers such as Kuby and Rucker (2015) put forward the concept of *literacy desiring,* calling for studies of early literacy to focus on the present process of "the intra-actions of people-with-materials, -movements, and -surprises" when children engage in the process of making meaning and creating (p. 315). Therefore, literacy desiring encourages researchers to focus on affective dimensions and becoming embodied during literacy creations but not necessarily a future end product (Kuby & Rucker, 2015; Leader & Boldt, 2013).

In sum, scholars have drawn on different posthuman approaches to engage in early literacy research from a human-decentered standpoint. All these scholars embrace the vitality of materials and matters and zoom in on the intra-actions or in-the-moment transactions of both children and the materialistic world as they entangle and interact with each other.

Research on Early Literacy from a Posthuman Perspective

The literature search on major databases such as ERIC and Education Source using engines "early literacy", "post-humanism", "new materialism", "early education" generated a large number of results. After reviewing the major entires, a total of twenty journal articles and two books that closely examined early literacy education (2-10-year-old) from a posthumanism perspective were included in this review. Each selected article was further coded by topic/ontological foci and theoretical frames (which are shown in the tables listed below). After this round of coding, three overlapping strands of scholarship generated, namely, the reconceptualization of the child, the attention to the materials in childhood, and the reinterpretation of processes of early literacy development.

First, a group of studies (e.g., Jokinen & Murris, 2020; MacRae, Hackett, Holmes, & Jones, 2018; Murris, 2016;) focused on re-conceptualizing what accounts for the "child" within the changed adult-child/human-nonhuman boundaries from a posthuman viewpoint (see Table 1). New materialism disturbs boundaries not only between humans and nonhumans but also between adults and children. The changing boundaries evoke the scholars to reposition the child in relationships existing in the broader world, calling for a reconceptualization of the child as the embodiment of flexibility that transforms through its in-the-

moment becomings with the nonhuman objects and the world and creating new possibilities for research and pedagogies of early literacy.

Table 1. Studies within the strands of reconceptualizing the child

Study	Topics	Age of the child participant(s)	Locale for collecting the data	The relevant posthuman approach
Murris, 2016	The posthuman child and picturebooks	6 years old, 8 years old	Home context, South Africa	agential realism, rhizome, affect
Jokinen & Murris, 2020	The posthuman child and vocabulary learning	7-8 years old	A literacy classroom, Finnish	agential realism
MacRea et al., 2018	The posthuman child and children's becomings with materials in the museum	2 years old	Manchester City Art Gallery, England	the child as "iii" (Murris, 2016)
Thiel, 2015	How the posthuman child and things collaboratively co-constructed meanings	5 years old, 6 years old, and 8 years old	A community center, the U.S.	thing power, assemblage, affect

The second strand of research (see Table 2) concentrates on the materials for young children's literacy development, or particularly the agential role of other-than-human entities in the embodiment of both representational literacies, such as discourses, texts, and artifacts, and non-representational practices, such as movements, sensations, and emotions (e.g., Lenz Taguchi, 2013; Thiel et al., 2019).

Table 2. Studies within the strands of the agency of materials

	Study	Topics	Age of the child participant(s)	Locale for collecting the data	The relevant posthuman approach
Represnetational resources	**Lenz Taguchi, 2010**	Non-digital resources	2-3 years old	A preschool, Sweden	agential realism, intra-action
	Schulte, 2019a	Non-digital resources	preschoolers	The playground of a preschool, Sweden	agential realism
	Schulte, 2019b	Non-digital resources	4 years old	A university-affiliated preschool classroom, the U.S.	agential realism
	Bendiksen, Østern, & Belliveau, 2019	Non-digital resources	3-5 years old	A kindergarten setting, Norway	agential realism
	Crescenzi, Jewitt, & Price, 2014	Digital resources, Touch (non-representational practices)	1.5-3 years old	A nursery school, London, England	intra-action
	You, 2019	Picture book	Children at the early age	N/A	agential realism
	Murris, 2016	Picture book	6 years old, 8 years old	Home context, South Africa	agential realism, rhizome, affect
Non-representational resources	**Hackett & Somerville, 2017**	Movement and sound	2 years old; 6 and 7 years old	A museum in England; the backyard, the nearby river, and places in-between, Australia	posthuman theories of both Barad and Deleuze
	Harwood & Collier, 2017	Movement	Preschoolers	A forest school, Canada	assemblage, agency, intra-activity
	Wargo, 2017	Sound and writing	First graders	A primary school classroom, the U.S.	intra-activity

In contrast to the attention to the materialistic entities, studies in the third strands pay attention to re-reading the nature of childhood and children's play through the posthuman lens (see Table 3). In particular, researchers in this vein look into literacies and practices generated from the human-nonhuman intra-actions and entanglements during children's play (e.g., Hackett & Somerville, 2017; Leander & Boldt, 2013; Procter & Hackett, 2017; Wohlwend, Peppler, Keune, & Thompson, 2017).

Table 3. Studies within the strands of reconfiguring childhood and children's play

Study	Topics	Age of the child participant(s)	Locale for collecting the data	The relevant posthuman approach
Hackett & Rautio, 2019	Children's play, movements, multimodal meaning-making	Kindergarteners, around 2 years old	A kindergarten, Finland; A daycare center, England	phenomenon, agency, intra-action, assemblage
Leander & Boldt, 2013	Children's play, movements, Reading and writing	10 years old	Home contexts, the U.S.	rhizome, assemblage
Wohlwend et al., 2017	Children's play, makerspace, and multimodal meaning-making	3-5 years old	Three early childhood classrooms, the U.S.	agential realism
Procter & Hackett, 2017	Children's play, emotions, fear	2 years old	A museum, England	affect, agency
Kuby & Rucker, 2015	Children's play, literacy desiring, and writing	Second graders	A writer's studio in a second-grade classroom, the U.S.	intra-activity
Wargo, 2018	Children's play, digital devices, sound, and writing	Early elementary age children	A 6-week intensive writing camp, the U.S.	intra-action/intra-activity

In the following sections, we detail the three strands of research followed by discussing the implications provided by these papers for future pedagogies and research.

Rethinking the Child and In-the-moment Becoming

Broadly speaking, studies on early literacy has experienced three main shifts in researching the child and childhood, namely, from the psychological territory to the sociological and then the philosophical domains, although the psychology of childhood continuously and paramountly impacts on policies, pedagogies, and practices of early childhood education (e.g., File, Basler Wisneski, & Mueller, 2012; Murris, 2016). From the psychological perspective, scholars contributed to the early childhood education domain with numerous developmental-oriented theories, including paramount ones such as Piaget's theory of cognitive and Gesell's concept of maturation. Aligning with Piaget's learning theories and developmental trajectories, the child is seen as cognitive (or "i" [Murris, 2016]) and on a linear intellectual growth from an infantile, sensorimotor, and concrete stage towards an adult, operative, and natural-universal intelligence (e.g., Anderson & Harrison, 2010; Burman, 2016; Jenks, 2005) where the world can be conceptually abstracted by and separate from children's mind. As a result, pedagogies and practices regarding early literacy keep pace with the children's developmental rule that they acquire literacy linearly "from the simple to the complex, from the particular to the general, from the concrete to the abstract, and from the empirical to the rational" (Egan & Ling, 2002, p. 94).

Another perspective on researching the child and the childhood is socio-constructivist view that aims to understand how the child gains knowledge through and with the sociocultural milieu. The socio-constructivism into early childhood education questions the universal, ought-to-be, and linear stories described by using developmentalism, as well as the hegemonic position of developmental psychology in constructing policies and curriculum for the young. Socio-constructivist researchers employ alternative lens such as feminist, poststructuralist, postcolonial, and postmodernist theories to explore the roles of political, social, and cultural powers playing in children's learning and life. Several seminal works in the socio-constructivist vein regards childhood as an invention of culture and society (Aries, 1962), or as a social construction (Alanen, 1988), as well as seeing the child as "social agent" (Cregan & Cuthbert, 2014, p. 12), or "ii" (Murris, 2016), which is "discursively produced through a process of social and cultural signification" (MacRae et al., 2018, p. 506), thereby disturbing the cognitive position of the child as an "object of cognitive science" (Murris, 2016, p. 84).

While the socio-constructivism expands the concept of the child, it does not address the shifting boundaries between humans and nonhumans and between adults and children. These gaps in our understandings invoke more philosophical discussions of what counts as literacy, the child, and childhood,

mostly from the posthuman lens. Researchers in the posthuman view question the aforementioned two constructions of the child as "a pre-determined map" (Olsson, 2009, p. 13) and childhood as an absence of adulthood, indicating that the child "perpetually becoming and not being defined once and for all" (p. 14). By reconfiguring the nature of the child with posthuman theories, researchers articulate the child's body as an unbounded organism that exists in a human-nonhuman entangled network of the world rather than representations contained in the linguistic- and humanist-oriented discourse nor production from a prescriptive, normative developmental process. So, for example, Murris's (2016) groundbreaking work detailed the posthuman construction of the child—the child as "iii", or the posthuman child. The posthuman child, as Murris elucidated, pays more attention to the not-yet-known beginnings that are "taken up and materialized in intra-action with other human animals and nonhuman others" (Murris, 2016, p. 102). A new materialist lens foregrounds the materiality of children's bodies in their entanglements with objects and the more-than-human world. It shifts the focuses from "what the child is" to "who, when, and where the child is with". In this vein, the child is seen as a "unique and singular being with fluid boundaries comes into the world" (p. 102). Thus, this notion of the posthuman child invites researchers and educators to take up their investigations and interpretations about children's learning and development from a new lens.

MacRae and her colleagues (2018) detailed how these different conceptions of the child can lead to a different understanding of the child by reinterpreting data with the "iii" perspective on a two-year-old girl's encounters with space and objects (e.g., sponge) in a museum gallery. From a cognitive viewpoint, the girl's mental concepts were developing, and her learning moved from concrete to abstract as she manipulated the objects as instruments to develop her conceptual and logical knowledge. Secondly, the socio-constructivist lens led researchers to interpret the sponge that Matilda's play with as a cultural signifier, which afforded potentials for the planned learning (i.e., naming the sponge by using language) conducted between Matilda and the accompanying adults. Through the posthuman lens, the authors shifted their attention to the agentic role of the "still" sponge and other objects in the museum in interactions and entanglements with Matilda and space, noting that the sponges "emanated desire, driving Matilda to reach for them, and stoke them across her cheek" (p. 508). Matilda's seemingly repetitive movements were viewed as qualitatively-different thinking and becomings that occur in the dynamic flow of movements, or simply, "improvisational threads of variability" (Manning, 2016, p. 2).

Thus, the materialist approach altered the researcher's understanding of the child to reconsider children's being/knowing/doing literacies by highlighting the dynamic and ongoing becoming of humans, nonhumans, and the more-than-human world. For instance, Thiel's (2015) explored how the posthuman child and things collaboratively co-constructed meanings by examining three children (5, 6, and 8 years old) from low socioeconomic families of the southeastern US and their encounter with a box of fabric remnants in their playroom. From a new materialist lens, the fabrics served as actants that propelled children's work, including designing/imagining, manipulating tools, and crafting pieces for fantasy characters (e.g., warriors) in their superhero stories. Thus, both children and the things were transformed in the intra-actions among them.

From a posthuman lens, the child's body is part of the materiality. Jokinen and Murris (2020) illustrated this point in their posthuman interpretation of 7-8-year-old immigrant children's hands with/in visual images of body-part vocabulary in a second language lesson in a Finnish elementary classroom. With the posthuman lens, the hands, along with the movements and actions of children's hands such as lifting, stretching, holding smartphones, and touching the game board, were seen as engaging in embodied entanglements with each other. Building on Haraway (2016)'s term, *sympoietic*, which means "making-with" or "thinking-with" (p. 58) and implies the ongoing becomings of both human and nonhuman bodies, the two authors further reconfigured the child in literacy practices as a *sympoietic phenomenon* that is "always already assembled in human and more-than-human company" (p. 46).

The Agency of the Materials and Contexts: Representational and Non-representational Resources

Studies draw on the posthuman approaches acknowledge the mutually-constitutive relationship of children, materials, and contexts. With the posthuman lens, the scope of materials for children's literacy construction has been expanded by including all matters, both tangible (such as semiotic and digital) and non-tangible (such as actional, sonic, and emotional) resources. Most of the research in the stream moves beyond the conventional, prevalent representational materials for children's literacy learning such as pens and books to include a wide range of semiotic objects such as sticks, ribbons, and the untimely dead bird, digital technologies embedded in children's daily practices for current times (e.g., Crescenzi, Jewitt, & Price, 2014; Lemieux & Rowsell, 2020; Lenz Taguchi, 2010). As well, the posthuman reading of early literacy recognizes literacy practices as ongoing, unstructured, and fluid, moving the understanding of children's literacies from children wielding materials to meanings generating through entanglement between children and the more-than-human materialistic world, including actions, movements, sounds, and words.

Picture books. In early literacy, teachers often use texts such as picture books to support children's reading. A small number of researchers have re-examined the traits of children's picture books with the new materialist lens and discussed how to include picture books to generate intra-actions of children, space, text, and other objects emerging more children's experiences and literacies practices through these engagements.

From the human-decentered perspectives, You (2019) examined the significance of diverse forms of depicting the animal gorilla in children's picture books *Gorilla* and *Zoo* composed by Anthony Browne. In Browne's picture books, the gorilla and other zoo animals were endowed with diverse anthropomorphic emotions and behaviours, representing the author's ethical position against the dominant human gaze to the nonhumans. The anthropomorphic gorilla described in the books entangled with and contrasted to children's previous experience of animals imprisoned in the zoo cages, further inviting them to ponder the animal issues with "an emergent sense of ethical responsibility" (You, 2019, p. 34). When children encounter the human-animal contact intertangled at the realistic and allegorical levels in the books, they can gain "a renewed intellectual and affective sense of environmental care", rather than just symbolically read the book.

Focusing on Browne's another book *Little Beauty*, Murris's (2016) study demonstrates how the "silent" materiality (e.g., colours, lines, and drawing styles) of picture books saliently affects the ways of constructing meaning through unpredictable, dynamic, and material-discursive entanglements between children and the picture book. By reinterpreting the data of a home-reading activity between two girls (6-year-old and 8-year-old) and their mother on *Little Beauty*, Murris noted that the realist imaginary drawings in the book, the colour selected in one specific drawing, and the storyline prompted children to ponder and question human-animal, real-life-made-up, and truth-telling-lying distinctions, to connect with their prior experience and knowledge, and to create an empathetic relationship with the gorilla. The posthuman reading of the reading activity also indicated that the picture book provides both the adult (the mother) and children (two girls) with creative opportunities to destabilize discriminatory binaries as provocations for communities of enquiry, and thereby disrupts the adult/child dichotomy by valuing children's capacities of knowledge construction. As a result, children's processes of knowing/becoming/doing literacies are facilitated by the probing, open-ended questions emerging in equal adult-child interactions built on the book.

Representational and semiotic resources. To date, several studies have focused on non-digital materials, including traditional pens and papers and other semiotic resources, surrounding and entangling with children in producing knowledge and practices in specific time and space. The resources encompass a wide range of human-nonhuman entities ranging from a small one (e.g., a yellow lemon) to a large item such as a dump truck with big tires.

Lenz Taguchi's (2010) study focused on the agentic role of children's play sticks in contributing to 2-3-year-old preschoolers' literacy development. The study documented the agentic forces of various material realities such as wooden sticks, shiny papers, and coloured ribbons that propelled children to

discursively think about and creatively transform the stick as guns, swords, and stick-dolls in intra-active processes between children, the teacher, and materials. Simultaneously, the discursive transformations of the sticks played an active role in shifting patterns of children's play. When children, especially boys, entangled with wooden sticks as guns and swords, children's play became war games; while children encountered with the stick, the thoughts of naming the stick, and coloured ribbons/papers, the play was transformed from aggressive to warm and inclusive, further attracting girls to take part in the stick-doll-making process. Subsequently, along with the doll-making play, children began to wonder about how the stick had been one part of a tree and how the tree as a part of nature depended on natural elements such as sunshine and soil. Lenz Taguchi thus stressed that "it is the material-discursive forces and intensities that emerge in the intra-actions in-between the child and the materials in the room that together constitute the learning that can take place" (p. 36).

In Schulte's (2019a) study, the material that served as an active actant in producing literacies was an untimely-dead bird that suddenly emerged near a playhouse at the far end of a playground. The study vividly depicted how children's bodies detached from their previous contexts scattering in the expansive playground to the magnetic space where the bird fell. Schulte noted that the sudden death of the bird "effectively transformed the children's interests" and entirely "redirected the focus of their endeavouring" (p. 73). The complicated encounter of the bird, children, space, and time generated newness and differences of children's thoughts, emotions, movements, and actions, further transforming the patterns of children's becomings and knowing individually and collectively. For the individual shifts, a boy became a little scared with a tense body and partially hid his body behind one girl, while a girl showed her sorrow and readied a dandelion to place on the bird's head. For the collective shift, a discussion of the reasons why the bird died emerged among children, further evolving as a mining of children's prior memories and experiences with similar occurrences and an exploration of life and death. Meanwhile, a collaborative work of digging the bird's grave was done by the children. With the posthuman interpretation of the encounter between children and the bird, Schulte affirmed the vibrant agential role the death of the bird played in generating a material occasion and potential literacies for young children.

Another research of Schulte (2019b) documented how humans and nonhumans intra-acted with each other to produce "undeniable signifying forces" (Iovino & Oppermann, 2012, p. 2) in the drawing practices of a four-year-old boy, Andrew, in a childcare center. In the study, a dump truck occasionally idling outside of the classroom window served as a key operator and a decisive agency that catalyzed the interlocked transformations of Andrew's body, mind, and his drawing, for instance, the emergent dilemma of whether to draw a truck as the truck appearing, the eyes fixed on the intersection to check if the truck would re-appeared, the exciting shout bursting when the truck showed up, and the newly-added lines, circles, and dots in the drawing which represented the truck, the road, and the rock carried by truck. Similarly, Bendiksen, Østern, and Belliveau (2019) re-read three literacy events that occurred from writing play activities for children between three and five years old. Barad's agential realism scaffolded the researchers to recognize the performative nonhuman agents such as the treasure chests, the yellow lemon smell and taste, the flat iron, the mood of expectancy, the blackboard that intra-acted with human agents such as teachers, children, and the researchers in producing practices, knowledge, and experiences concerning linguistic awareness, handwriting, and meaning-making. Both of the two studies added evidence to the vital agential force of materials in producing literacies for the child.

In addition to various non-digital resources for early literacy, a growing number of early childhood education research also seeks to develop a better understanding of how the differences between the conventional paper-based resources and digital tools lead to different ways of child-material entanglements and therefore different ways of children's being/knowing/doing with literacies. For instance, Baroutsis and Woods (2019) considered both print and digital materials (such as papers and digital devices) and proposed makerspace (usually a collaborative workspace in the schooling contexts) as a pedagogical approach. They designed three problem-solving activities to discover how the materials of a makerspace altered the composition of first graders growing-up in a high-poverty community. Specifically, the three play-based makerspace activities are respectively themed by the Hansel and Gretel

fairy tale, children's prior experiences about something interesting happened last week, and the life in a fish tank. In Baroutsis and Woods's posthuman observation, different materials acted as active agents and took part in the construction of multiple realities (including children's written stories), producing ample practices and encouraging children to highly engage in writing and become more efficient and effective thinkers. For instance, during the second activity, the interesting things occurring in the previous week, the children, the papers, ribbons, glues, etc. intertwined with each other and generated new forms of practices (e.g., making a spaceship, moving around the room to check other peers' work, and writing sentences to describe the artifacts created), emotions (e.g., children's enjoyment in the play-based activities; the pride that children demonstrated in their writing), and material realities (e.g., a spaceship, an alien, and a written text about the alien sighted last week).

Besides, Crescenzi et al. (2014) explored the role of screen touch in preschool children's learning to use an iPad versus paper interaction. To compare how touch features in painting with a tablet versus painting with paper, the researchers found that while digital mobile devices afforded children a wider variety of touch-based interactions, they also cause some "losses" that need further considerations in education for young children.

Children's non-representational practices: Movement and sound. Existing literature also explored how movements scaffold children's literacy learning by reconsidering the active moving-space-material actants in human-nonhuman interactions, which produce new patterns of literacy practices and learning for young children. The posthumanist perspective re-reads children's movements as unfolding relations in which space, time, and matter are always entangled (Barad, 2013). In other words, movements are rhizomatic, unprepared, and improvisational child-material interactions existing in the past, present, and future. Particularly, sound is defined as a vibrational movement at a molecular level (Gershon, 2013). Therefore, a growing number of existing literature in this vein turn to explore the dynamic and contingent child-object-matter-space encounters such as movements and sounds that generate discursive practices and literacies for children in specific spaces such as museums, galleries, and forests (e.g., Hackett & Somerville, 2017; Harwood & Collier, 2017; MacRae et al., 2018; Procter & Hackett, 2017).

Hackett and Somerville (2017) reported two studies of emergent literacies conducted in the UK and Australia. For the year-long UK study, they drew data from monthly visits of a group of two-year-old children in a local museum and captured some "child-led traditions" such as marching while banging the drum that repeatedly emerged during the children's visits. The posthumanist analysis showed that different locations in the museum (e.g., a small gallery and corridors) and the drumstick played a crucial role in the production of movements (e.g., drumming, marching) and sounds (e.g., banging, shoe scuffing). The movements and sounds further synergically created diverse and influential affective responses between children, materials, and the museum. The affective properties of movements and sounds consisted of children's non-linguistic utterances, which collaboratively produced representative and communicative practices and participated in the world-forming moment by moment. For the Australian study, two six and seven-year-old girls' stories, sentences, and commentaries emerging during play with mud nearby a river were incorporated. Drawing on Barad's (2007) concept of agential realism, Hackett and Somerville regarded the sounds and words as vibrations driven by the mud and the water. Both the two studies revealed that different repertoires of literacy practices emerged spontaneously through the shared becomings of children (humans), materials such as the drum, the water, the mud (nonhumans), and the more-than-human world that sounds and movements partially constituted. As the researchers noted, "posthuman readings of early childhood literacy offer the possibility to shift the narrative and to re-conceptualize emergent literacy in ways that reconcile with young children's being in the world" (p. 389).

Another example of children's movements is Harwood and Collier's (2017) research that aimed to illustrate interactions among children and nonhuman others in a forest setting by detailing the ways of how sticks coexisted with children's bodies, elicited actions, sounds, movements, and relations, and produced new possibilities for children to learn literacies and develop identities. The authors argued that matters such as sticks and movements with sticks in the forest played as powerful agents to children's playful literacy practices that were "constantly in flux" (p. 350), thus inviting infinite possibilities for

literacy teaching and learning. They concluded that the world of a forest which was awash with human and nonhuman forces had enriched resources and capacities of early literacy education.

A small amount of the posthuman research focuses on the lesser-known modal resource such as sound in early writing (e.g., Wargo, 2017, 2018). Thinking with conceptual approaches of sound studies and the posthuman ways of being/knowing/doing/becoming, Wargo (2017) analyzed a digital audio clip and a tableau that documented first graders' writing with sound in the classroom and the sensations and thoughts emerging alongside children's composition. Through investigating the rhythmic rituals of "emergent listening", Wargo emphasized that the sound and the sonic (e.g., a chorus of classroom claps and tapping the canvas with fingers) as the explicit material referent actively effected on generating different forms of embodied encounters (e.g., inviting children to collaboratively come together, creating boundaries of place and community for children as readers or writers, or shifting acoustic ambience of the classroom) when children and other nonhuman entities such as the mass-produced microphone Yeti, hands, shoes, and the laughter entangled with each other in the classroom. Wargo further encouraged researchers and educators of early literacy to ponder the modal affordances of sounds to pedagogical shifts to generate new creative energies of knowing and doing literacies in the classroom.

Rethinking Children's Play: Literacies, Emotions, and Literacy Desirings

Building on inquiries about the relationality between bodies and the otherness or the materials, a group of scholars sought to use the posthuman lens to understand the process of "bringing-into-relation" (Weheliye, 2014, p. 13) emerging between these entities, particularly the impromptu, entangled, and fluid encounters during children's play (e.g., Hackett & Rautio, 2019; Lenz Taugchi, 2013; Sintonen, 2020). In this context, children's play is seen as a space where children, objects, and places play with and are played back by each other in and with material-discursive contexts (e.g., Jones & Holmes, 2014; Lenz Taguchi, 2014).

Literacies emergent in and through play. Hackett and Rautio (2019) analyzed children's grass-hill rolling in the UK and running in a pine tree forest in Finland to understand what multimodal meaning-making might emerge. Approaching children's running or rolling as forms of correspondence or relationship with the tree, the steep grassy hill, and the other things existing in children's surroundings, the researchers discovered the children produced particular kinds of embodied multimodal meaning-making, in response to the pine tree, bugs, the wind and the sand while running or rolling, a process that was collaboratively "brought into being" between the human (children) and more-than-human participants (tree, bugs, sand, hill etc.) involved in the relationships. In this "process of growth and ongoingness" (p. 1026), a shared meaning emerged over time without pre-intended goals. Hence, Hackett and Rautio emphasized the non-predetermined and emergent nature of involvement of the more-than-human multimodal meaning-making, which was not productions or skills that children possessed or intended to possess. Instead, it should be understood as "pathways and channels… for the voices and stories of the world" (p. 1025).

Drawing on the same framework, Leander and Boldt (2013) studied a ten-year-old Japanese boy's one-day out-of-school practices—reading and playing with texts from the Japanese manga series *InuYasha* and *Naruto*. While the boy was reading, the researchers observed constant and unpredictable non-representational and unconscious actions (e.g., the boy retrieved one headband from his bedroom, frequently touched or adjusted the headband, practiced hand gestures, and rearranged knives while reading the manga), feelings (e.g., the boy articulated, "I love this so much" at times), and movements (e.g., the boy and his friend moved freely from the living room to the front yard, swung the sword at each other, and played the scenes from the manga book). These assemblages of discursive things presenting in the reading and play (such as the performing scene) transformed the boy from being identified as a struggling reader and writer to a book fan who sank into the chair and read and thought for a couple of hours. Therefore, as the authors noted, to the boy, literacy activities were not "projected toward some textual endpoint" but "living in its life in the ongoing present" (p. 27). In short, literacy practices for children can be produced "through an emergent moment-by-moment unfolding" (p. 29).

Wohlwend et al. (2017) added further argument for the strength of the posthuman notions in interpreting children's play as emergent early literacy learning processes by re-examining the previously overlooked moments filtered out as meaningless and mess during children's play in a preschool makerspace. They recognized the fluid meaning production during the nonsensical play by tracking the emergent and transient flows of interactions between children, materials, and the preschool makerspace. Through a new materialist lens, Wohlwend and her colleague granted these overlooked moments such as non-representational experiences and the free-wheeling nonsense existing in children's play as literacies that are "both sense-making and sensory" (p. 445). Thus, instead of the conventional and extended interpretations of children's play, they brought newness to the notion of early literacies during play.

Emotions in the playful childhood. Affect and emotions, particularly for young children, have close interconnections (Shouse, 2005) as emotion is "the capacity to affect and be affected" (Massumi, 2002, p. 15). Much research in early educational studies have been directed towards shaping children's emotional worlds through play-based approaches, seeing children's play as a therapeutic mean of helping children to regulate their emotions (e.g., Savina, 2014; Zachariou & Whitebread, 2015). Different from these approaches, the new materialist research turns to emotions and bodily sensations as offering agencies in understanding the significance of children intra-acting with place and materials with play encounters (e.g., Pahl, 2014; Procter, 2013; Rowsell, as cited in Leander et al., 2017), seeking to develop the attributes associated with emotional wellbeing such as emotional literacy.

A notable example of work in this area is Procter and Hackett's (2017) study on the "dark emotions", such as fear, showing that how emotionally-textured play of children, materials, and spaces is mediated within material-discursive contexts. Procter and Hackett brought together two case studies to understand the emotion of fear in children's play encounters. One example regarding young children recorded a two-year-old boy's movement and emotion trajectories during one museum visiting: He repeated to express his fear while keeping moving in and out of place to explore a natural history exhibition. The exhibition's materiality, including light and exhibits, induced the boy's intensities and propelled his bodily movements to enter and leave the space. In the two play episodes, Procter and Hackett found that the emotion of fear was "bounded in place" (p. 220). The bodily experience of the place and materials worked on children, evoking certain emotions that, in turn, acted on characterizing and categorizing human and nonhuman bodies. In this case, Procter and Hackett foregrounded the agential role of the complicated material-discursive forces in the more-than-human world, calling for extensive attention to the possibilities and conditions produced by the place and materials for establishing children's experiences. The study implies that educators need to take seriously children's emotional experiences in place and how the emotional experiences connect with children's body, objects, the play, and the space in order to offer opportunities for children's practices including both metanarratives and representations "of self and other, of what counts as human and less-than-human" (p. 223).

Literacy desirings. Seeing play as the process of children becoming literacies opens spaces for children to live out their literacy desirings or "the present processes of producing—a force, a becoming, a coming together of flows and intensities" (Kuby & Rucker, 2015, p. 315) through entanglement with intangible and tangible others in their realities. For instance, in their 2015 study, Kuby and Rucker tracked the process of production and becoming a writer of a boy, Neil, who showed no passion for writing before. Through a human-decentered lens, researchers witnessed the boy's intra-acting with papers, scissors, pencils, and tape that generated peers' interests in Neil's 3D artifacts—a station and a train, and the emergent Neil-peer-teacher questions and conversations about how the artifact worked and how Neil's story of the train would be composed). Significantly, the process brought shared becomings of the materials (papers transforming and being transformed into the 3D artifacts) and Neil himself shifting from a student who did not like writing to both a confident expositor and a writer who desired to share the information of his creation. These unexpected and off-task moments emerging from the intra-actions between children, materials, and others in the writers' studio served as spaces where the ongoing process of production was realized and simultaneously opened up new possibilities of producing literacy desirings.

Also focusing on children's composition process, Wargo (2018) studied 12 early elementary-aged

children reauthoring Showers's picture book *The Listening Walk* in a 6-week creative writing camp in the US. The author was particularly interested in how children wrote creatively with the wearables—digital technologies such as iPads and GoPro with fundamental functions requiring connections with bodies. Through the more-than-human apparatus, including strategic sketches (Leander & Boldt, 2013) and emergent listening (Davies, 2014), the study looked into the relational assemblages of children, head harness, boom mic, and the sonic affordances of the GoPro wearable that worked to amplify the ambient acoustics of the father-child walk described in *The Listening Walk*. Wargo envisioned writing as a process of literacy desiring or an "ongoing series of relational encounters" (p. 504), rather than a practiced skill. The study's findings demonstrated that the intra-actions, or *the withness* between children, composition, and materials expanded children's literacy desirings and practices that effected their potentials of being and becoming a writer.

A Posthuman Approach to Early Literacy Instruction: Toward Material-oriented, Intra-active, and Flexible

The three strands of scholarship reviewed in the current paper provide important implications for early literacy instruction. Collectively, the studies move the field towards a material-oriented, intra-active, and flexible pedagogy that is open to possibilities and unexpectedness emerging in literacy teaching and learning for young children. Instead of the conventional anthropocentric (human-centered) and logocentric (language-focused) approach to early literacy (e.g., Akhter, 2016; Heider & Renck-Jalongo, 2014; Jesson, McNaughton, & Wilson, 2015), the posthuman stance beckons scholars to question the taken-for-granted conceptions about what counts as literacy for young children, to focus on the processes of becoming instead of the end products of meaning, and to move beyond 'justice-to-come" (Barad, 2009, n. p.) but the present, "a better, more just right now" (Kuby et al., 2019, p. 13).

From a posthuman perspective, children are regarded as parts of "an entangled web or network of relationships" (Lenz Taguchi, 2010, p. 152), who continuously intra-act with their peers, teachers, materials, and the other more-than-humans (e.g., practices and activities produced continuously by the child-material entanglements). For instance, as Murris's 2016 study noted, except for the content of pictures in the book, the colors, the painting styles and even patterns of lines used to sketch the contours of figures collaboratively contribute to children's empathic emotions to the gorilla and the communications about equity generated between the two girls and their mother. Also, Bendiksen et al. (2019) described how the strong smell and taste of a yellow lemon brought various sensuous experiences to children, then provoking children's impromptu writing practices with their fingers, the lemon juice "ink", and papers. In the two cases, the notion of the picturebook or the lemon moves beyond our conventional understandings of them as reading materials that are set out for children to read and comprehend or fruits that are wait to be described through children's textual outcomes. Instead, the material traits make them become "performative agents" (p. 15) that scaffold unpredictable practices when they are encountering with children, time, and contexts, opening up children's opportunities of accessing and producing literacies and therefore, increasing children's engagements in literacy events. These examples may guide early educators to rethink what counts as materials in early literacy education as flexible other than the conventional ones which are "closely connected to making" and "are often set out for children to make or create something with" (Pacini-Ketchabaw, Kind, & Kocher, 2017, p. 26). Hence, teachers need to be aware of how the context, time, and materials are organized and allocated and what kinds of knowledge, experience, learning, and practices might be produced within the intra-activities between children, materials, and the places where children and materials are engaging with each other and with the contexts (Leander & Boldt, 2013; Lenz Taguchi, 2010). That is, teachers need to "think with" materials (Pacini-Ketchabaw et al., 2017), being sensitive about the inclinations and potentials of different materials in producing in-the-moment practices such as bodily emotions and movements generating from child-material entanglements in certain contexts.

As well, teachers need to move beyond pursuing children's textual products as the endpoint of literacy practices and become attentive to the production process of children's in-the-moment practices.

Sintonen (2020) showcased how teachers can pay attention to intra-activity in early literacy instruction through her reflective autoethnographic consideration of two distinct learning processes of creating artifacts, conventional acrylic painting and digital painting. Sintonen observed that compared with the conventional acrylic painting with papers, painting with digital tools involved more modes, affects, and affordances, therefore different intra-actions and meanings. Therefore, for young children, educators need to make a thorough consideration of how different materials are manifesting and modulating ways of meaning-making. In particular, Sintonen stressed the critical focus on the "sensory, embodied, experimental, and playful intra-actions" among "unforeseen smooth spaces and material invitations" (p. 1330). Furthering Sintonen's argument, Baroutsis and Woods (2019) proposed the concept of "literacy as material practices" (p. 250), which highlights the agentic role of the material (including the discursive and the virtual as well) working with the child and the more-than-human world in producing literacies. In their study, they closely observed how changing materials from non-digital such as ribbons to digital such as iPads changed and afforded the text production of children in a makerspace, suggesting "makerspace as a pedagogical approach" (p. 251) where teachers can shift the focus from materials to the dynamic and the discursive when children playing with various human and nonhuman bodies. Teachers, as the study suggested, may also abandon conventional desk-chair classroom-arrangement and hide themselves in "a mess bodies scattered across the room" (p. 263) to offer children's freedom to access other bodies and further make full use of the classroom space. By creating inclusive spaces and decentering teachers' roles in the play-based makerspace, children, especially the ones who are reluctant to write and disengaged with literacy learning, can gain increasing opportunities for literacy learning in the classroom.

Moreover, with a posthuman lens, early literacy instruction can become more inclusive by embracing the out-of-classroom world for children's literacy acquisition. The opportunities of children's becoming and knowing literacies can be generated as young learners encounter a bird falling down onto the playground, a wooden stick found in a forest, a truck occasionally passing outside of the classroom, a spatial museum gallery, or a grassy hillside. In a sense, the children's educational settings are "[fields] of possibility" (Koepke, 2015, n. p), presenting infinite possibilities of supporting children's literacy learning with the objects, the context, and experiences "that are at hand" (n. p.). In these contexts, the materials, the materiality of human bodies, and the more-than-human world can collaboratively serve as tools for the enacting of literacy education for children. In this sense, early literacy educators need to become cognizant of the human-nonhuman relationality and rearticulate their understanding of early childhood education as an assemblage of the child, materials, and the space, and knowledge as "a product of relation" (Hargraves, 2019, p. 192).

In addition to celebrating child-material entanglements and de-territorializing spaces, teachers also need to remain flexible and open to hear children's desirings, as well as allow children's literacy desirings to live out (Kuby & Rucker, 2015). Studies (Kuby & Rucker, 2015; 2020; Kuby, Rucker, & Darolia, 2017) advocated that teachers need to break the rigid structures of literacy instructions, embracing fissures occurring in the curriculum agenda. Teachers should not only value children's creations that were purposefully made for communications but also their "sometimes unpredictable…collaborative processes of creating and the assortment of artifacts they (might) produce" (2015, p. 326). Permitting children to use open-ended materials in ways that make sense to them would also generate more children-material interactions and subsequently produce expansive practices and activities concerning literacy in the classroom. That is, when given the material-time-space opportunities to pursue their desirings of literacy, students may then be/know/become literacies in the ways beyond our imagination.

Finally, several studies (e.g., Kuby & Crawford, 2018; Lenz Taguchi, 2010; Wargo, 2018) suggested several tangible practices for early childhood educators to study their own practices in creating in-the-moment improvisational unfolding of early literacy. For example, educators can work as educational researchers, watching, teaching, and learning with children, such as inviting children to participate in the design of the curriculum to listen to children's literacy desirings. Simultaneously, teachers can document their pedagogical and teaching experiences by using a mosaic approach (Clark & Moss, 2001), including educator journals, photos, and videos and flexibly letting children chronicle their own learning experiences

into the document. The pedagogical documentation is not about a recording of "knowledge or the progress of learning goals" but rather "…what questions have been produced…what kinds of materials and tools have been tried, and what are the potentials for continuing" (Kuby & Crawford, 2018, p. 22). Also, teachers can reimage the use of instructional tools and materials commonly used in daily literacy classroom, for instance, linking the picturebooks with the natural-cultural world by adding aural and actional dimensions to the figurative but static texts to open up children's subsequent practices such as discussions and play. Teachers can also include the out-of-classroom settings such as playground, museum, and forests as the place of instruction, inclusively viewing materials and the space as performative agents in leading pedagogies and embracing any potentials of materials and the place that learning may take place.

In sum, the posthuman lens encourages early childhood educators to combat the "institutionalized ageist practices" in early instruction (Murris, 2016, p. 1) and offer alternative pedagogical possibilities. Teachers of young children (as well as parents) need to become attentive to a broader range of materials, time, and spaces for literacy teaching and learning.

Conclusions and Future Research Directions

The review of research on early literacy revealed that the posthumanism perspective offers expansive possibilities for reconceptualizing the child, the materials or resources for early literacy, and the meaning of childhood and children's play. Researchers with a posthuman lens move beyond a humanist worldview that locates learning in individuals to see children's learning as "a cooperative and communicative activity" (Murris, 2016) in which children actively co-construct knowledge with the other human-nonhuman bodies and entities. This reconfiguration of the child shifts from viewing children as passively receiving knowledge, language, and concepts to valuing children's active role in being/knowing/doing knowledge moment-by-moment.

Posthuman researchers also expand the view of materials for children's literacy learning from predesigned and intentional resources for literacy (e.g., textbooks and teaching materials) to all tangible and intangible matters entangled within the process of producing literacies. These tangible and intangible matters can be sticks in the forest, emotions emerging in the museum, and sounds during the march with the drum. All these matters, intertwining with the specific places at the specific time, serve as agencies in the interactions between the matters and the children to produce moment-by-moment practices and literacies. The recognition of the agential power of matters and materials in producing literacies helps educators to reconsider what resources can be used to support children's literacy development and how the resources serve as part of the children's meaning-making.

This review revealed several gaps in the contemporary research and education of early literacy. First, with a few exceptions, most of the existing studies focused on toddlers and preschoolers. More studies on young children at the primary school age do literacies in both in- and out-of-school contexts, and how they reconcile with formal assessments are still required. Furthermore, whereas the researchers are productive in using the posthumanist lens to explore materials in contexts focusing on children's moment to moment becomings, few studies have taken up a critical view of the posthuman child and early literacy by examining the inequalities that may embody in the children's intra-active experiences. Thirdly, although emerging studies has demonstrated possibilities in grounding posthuman theories in early literacy pedagogy, future research still needs to explore how posthuman theories can transform educators' theoretical beliefs and practices in educational settings for young children.

Finally, it must be noted that one limitation of this review is that it did not touch upon research methodologies from a posthuman perspective. Future research must focus on methodological questions for conducting studies from a posthuman lens (e.g., Toohey et al., 2015). Major methodological questions may include, for example, 1) what are possible ethical issues when applying posthuman theories to research literacy education that is conventionally a human-oriented domain; 2) what interpretative dilemma we may have when moving from a traditional anthropocentric (human-centered), logocentric (language-centered) stance toward the ontological tenets of posthumanism, especially in thinking about

and researching children's literacy teaching and learning; 3) what alternative orientations and methods for data analyses are needed to address the ethico-onto-epistemological paradigmatic shift to open up newness about researching early literacy; and 4) what problems regarding reliability and accuracy may arise, for instance, how to document children's discursive, emergent, and complex non-representational communicative practices (e.g., emotions and movements) comprehensively and how to interpret the ongoing mutual becomings between the child and the outside world. More methodological discussions are needed to wrestle with these critical questions in the future.

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