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What Do Teachers Think About Finger-Counting?

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Abstract

The aim of this study is to determine preschool, special education, elementary school teacher and mathematics teachers' views of finger-counting in mathematics teaching. The study was conducted with case study design. The sample of the study consisted of 34 teachers. Data were collected using an 8-item written form, and content analysis was performed. The findings of the study indicate that most participants use fingers as manipulatives in the teaching of numbers and counting but use them very little when teaching the four operations. Most participants state that finger-counting should be used at ages 4-8 / 4-11 while some state that there should not be any age limit. According to the participants, the advantages of finger-counting are that it is practical and accessible, facilitates retention and internalization, and makes the arithmetic more concrete while its disadvantages are that it restricts and slows down the execution of the four operations, prevents the development of mental arithmetic skills and turns into a habit. They state that students who insist on finger-counting have high anxiety, poor memory, and low self-confidence and achievement. Some participants encourage their students to perform mathematical calculations without using pen and paper to help them break the habit of finger-counting and also receive parental support during the process. The fact that students have different characteristics should be taken into account when addressing the use of finger-counting in mathematics teaching because the use of fingers in counting and calculation may be a necessity rather than a choice for some students.

Keywords: Teachers' views, finger-counting, finger counting strategies

1. Introduction

Mathematics contains numerous abstract concepts, and manipulatives are often used in its teaching. Manipulatives facilitate the understanding and internalization of mathematical abstract concepts and the execution of arithmetic operational steps. Manipulatives varying according to mathematical subjects and concepts contain almost all physical objects such as beans, marbles, pattern blocks, beads, buttons, counting scales, matchstick, decimals, base blocks and fingers (Sternberg & Grigorenko, 2004;

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Mink, 2010). Fingers are physical manipulatives and are part of human body. Different counting strategies could be developed using fingers, and finger-counting has close neural connections in the brain. It has, therefore, attracted attention and become the subject of numerous studies in many areas such as education, educational psychology and educational neuroscience in recent years.

Ifrah (1985) regards fingers as the first counting and calculating machine of humanity, while Dantzig (2005) states that finger-counting either precedes or accompanies any counting technique. Finger-counting is a very old method used by all communities (Conant, 1896) because almost all children first use their fingers to count. In the early stages of development, children learn the basic principles of counting and arithmetic with the help of their fingers (Butterworth, 1999; Jordan, Hanich, & Uberti, 2003). Fingers play a key role in the development of the decimal system (Fuson, 1998; Richardson, 1916 as cited in Lindemann, Alipour & Fischer, 2011).

Recent research on brain imaging technologies shows that finger and number representations are found in proximal neural networks in the brain (Piazza et al., 2002; Kaufmann et al., 2008), indicating that the same or adjacent regions are active in the brain when fingers are used in general or when they are used to count (Butterworth, 1999). This explains why children intuitively use their fingers when counting.

Unlike mathematics educators, educational neuroscientists do not consider fingers to be different physical manipulatives from blocks, balls etc. Instead, they argue, based on the concept of embodied cognition, that finger-based representations are natural numerical representations that depend strongly on sensory-physical experience and are valid even when more abstract or conceptual representations are generated (Moeller et al., 2011). According to the theory of embodied cognition, cognitive and linguistic structures and processes - including basic patterns of thinking, information representation and methods of organizing and expressing information - are affected and limited by perceptual systems and bodily characteristics. Simply put, cognition depends on physical possibilities and limitations (Alibali & Nathan, 2012). Mathematics teaching in embodied cognition-based educational environments involves classroom activities that encourage students to play with objects and turn them into numerical sequences with their hands or whole bodies (Yalvaç, Soylu & Arıkan, 2011).

A series of the studies based on the theory of cognition and educational neuroscience focuses on finger gnosia and mathematical interaction. Research shows that finger gnosia and arithmetic are interrelated and that finger gnosia predicts math achievement (Noel, 2005; Penner-Wilger et al., 2007; Chinello et al. 2013; Newman, 2016). Finger gnosia is defined as the ability to sensually distinguish between fingers and to mentally represent bodily representations. During a finger gnosia test, the participant puts both hands palm down on a flat surface (e.g. table). An object (e.g. box) is placed between his/her hands and eyes so that he/she cannot see his hands. The experimenter then touches the participant's fingers on one hand and asks him/her to indicate which finger he/she touched by moving the corresponding finger on the other hand. Alternatively, the experimenter may ask the participant to tell the name of the finger that he/she touched (Authors, 2018).

The literature contains many finger-counting methods, the most common of which are classical finger-counting, finger knuckles counting and Chisanbop. In the classical finger-counting method, each finger amounts to 1 and goes up to 10, and sometimes a number is kept in mind and the second number is added or subtracted. In the finger knuckles counting method (Pabsay) (Mutlu, 2018), numbers are counted rhythmically using finger knuckles to perform the four operations (Figure 1). In Chisanbop, the right thumb is valued as 5, right fingers each as 1, the left thumb as 50 and left fingers each as 10 (Figure 2). In this way, numbers up to 99 can be represented to do arithmetic calculations (Mutlu, 2018).

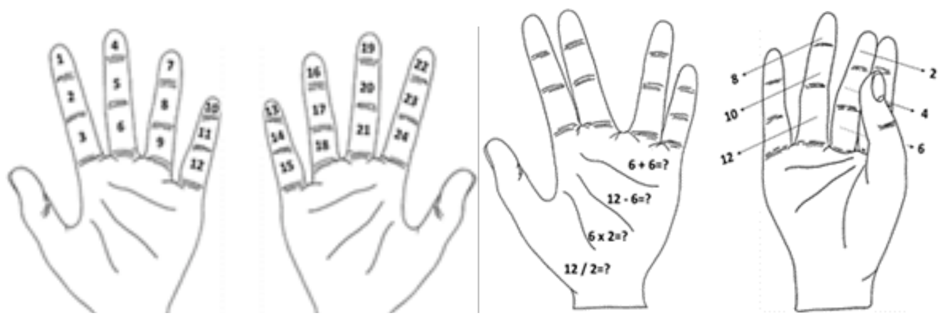

Figure 1. Finger Knuckles Counting Method (PabSay)

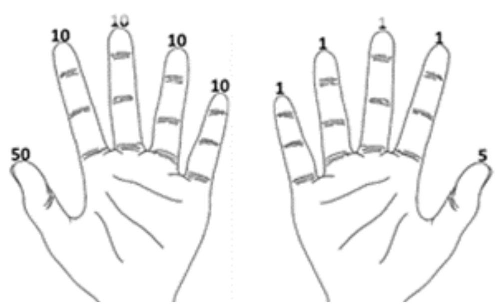

Figure 2. Chisanbop Method

Fingers are essentially well-associated manipulatives with internal representations. They are part of the body and can be manipulated just like number scales or fraction models. Fingers enhance memory and understanding and allow physical interaction with numbers (Glenberg et al., 2004). Fingers, when properly used, are a natural and already existing toolkit for modeling and reflecting digital information (Guha, 2006; Andres et al., 2008). The experimental studies confirm the positive effect of finger-counting in mathematics teaching. Gracia-Bafalluy and Noel (2008) state that finger-counting education improves mathematics performance while Stegeman and Grunke (2014) report that Chisanbop not only increases numerical, arithmetic, and problem-solving skills but also improves second-year students' attitudes towards mathematics. Guha (2006) states, based on teachers' views, that the Knucount is an effective tool in counting and calculating. Moeller et al. (2011) report that finger-based representations improve children's ability to use symbolic figures and develop their numerical and numerical skills while Wasner et al. (2015) state that finger-counting is effective in teaching basic counting principles such as quantity, order numbers, cardinal numbers and 1-1 counting. There are, on the other hand, some studies that focus on encouraging students to abandon finger-counting. For example, Albayrak (2010) states that using concrete objects such as beans and buttons instead of fingers is better for students when they do basic arithmetic.

The number of studies on finger-counting has increased significantly over the last two decades. Educational psychology and neuroscience studies emphasize the importance of finger-counting in counting and calculating, while educators are cautious about it as they believe that it causes students to do arithmetic more slowly, turns into a habit and delays the improvement of mental arithmetic skills (Albayrak, 2010; Moeller et al., 2011; Stegemann & Grünke, 2014). It is, however, necessary to determine whether educators' views of finger-counting differ by age, branch and personal characteristics. Within this context, the aim of the study is to determine preschool, special education, elementary school teacher and mathematics teachers' views of the use of finger-counting in mathematics teaching.

2. Method

Case study, which is a qualitative approach, was used in the study. The case study is one of the types of systematic design that includes steps such as gathering information, organizing the collected information, interpreting and reaching the findings of research (Merriam, 2013). The opinions of pre-school, special education, class and mathematics teachers about the finger counting method in mathematics teaching were obtained.

2.1. Participant characteristics

Appropriate identification of research participants is critical to the science and practice of psychology, particularly for generalizing the findings, making comparisons across replications, and using the evidence in research syntheses and secondary data analyses. If humans participated in the study, report the eligibility and exclusion criteria, including any restrictions based on demographic characteristics.

Participants were selected using maximum variation sampling, which is a purposeful sampling method used to make sure that the widest possible variety of subjects are represented in order to capture different themes. The maximum variation was the sampling of choice as the study is based on the premise that people's views of "finger-counting" differ by age and that it can be discovered by selecting teachers from different levels (preschool, special education, elementary school teacher and mathematics). The sample consisted of 34 teachers who voluntarily participated in the study. To ensure confidentiality, preschool teachers were coded as P1, P2, P3 etc., special education teachers as S1, S2, S3 etc., elementary school teacher as C1, C2, C3 etc. and mathematics teachers as M1, M2, M3 etc. Table 1 shows the characteristics of the participants.

Table 1. Characteristics of participants

Code	Gender	Branch	Degree	Term of Employment (Years)
C1	Female	Elementary School Teacher	Bachelor's	8-12
C2	Female	Elementary School Teacher	Bachelor's	0-4
C3	Male	Elementary School Teacher	Bachelor's	0-4
C4	Male	Elementary School Teacher	Bachelor's	>12
C5	Female	Elementary School Teacher	Bachelor's	>12
C6	Female	Elementary School Teacher	Bachelor's	5-8
C7	Female	Elementary School Teacher	Bachelor's	0-4
C8	Male	Elementary School Teacher	Bachelor's	0-4
C9	Male	Elementary School Teacher	Bachelor's	>12
C10	Female	Elementary School Teacher	Bachelor's	0-4
C11	Male	Elementary School Teacher	Bachelor's	0-4
C12	Male	Elementary School Teacher	Master's	5-8
C13	Male	Elementary School Teacher	Bachelor's	5-8
C14	Male	Elementary School Teacher	Master's	>12
C15	Female	Elementary School Teacher	Bachelor's	8-12
S1	Female	Special Education	Bachelor's	0-4
S2	Female	Special Education	Bachelor's	0-4
S3	Female	Special Education	Bachelor's	0-4
S4	Female	Special Education	Bachelor's	5-8
S5	Male	Special Education	Bachelor's	0-4
S6	Male	Special Education	Bachelor's	5-8
S7	Female	Special Education	Bachelor's	>12
M1	Female	Mathematics	Bachelor's	0-4
M2	Male	Mathematics	Bachelor's	0-4
M3	Female	Mathematics	Bachelor's	0-4
M4	Female	Mathematics	Bachelor's	0-4
M5	Male	Mathematics	Bachelor's	8-12
M6	Male	Mathematics	Bachelor's	5-8
P1	Female	Preschool	Bachelor's	8-12
P2	Female	Preschool	Bachelor's	8-12
P3	Female	Preschool	Bachelor's	5-8
P4	Female	Preschool	Bachelor's	0-4
P5	Female	Preschool	Bachelor's	0-4
P6	Female	Preschool	Master's	>12

The most important data collection technique in a case study is eliciting information on views. A written form was used to elicit information on how participants experience, make sense of and explain the phenomenon of finger-counting. The form consisted of 8 open-ended questions (items) developed based on the literature review. The items were also assessed by an educational specialist who has conducted studies on dyscalculia. It was concluded that the items had sufficient content validity to investigate the phenomenon of finger-counting. Moreover, a Turkish language specialist assessed the items and found them sufficient in terms of clarity and wording. Afterwards, a pilot study was conducted with two teachers using the form, which was then finalized as the main form based on the two teachers' feedback on clarity, wording, relevance and comprehension.

2.2. Data analysis

Data were analyzed using descriptive analysis, which is a qualitative data analysis method. The items in the form were the themes of the study. The participants' responses to the items were separately analyzed by three researchers, who compared their findings and developed common codes and categories later on. The first author was consulted in case of disagreement, and the researchers reached a consensus. Data analysis reliability was calculated using [((Consensus / (Consensus + Disagreement))*100] (Miles & Huberman, 2014). The reliability was found to be [((85 / (85 + 6))*100 = 95%]

2.3. Credibility and transferability

For credibility, codes, categories and themes were presented to some participants for confirmation after data analysis. They were asked to read them and asked whether they would like to reword, add or remove any of them. Data analysis was finalized following their feedback. The researchers paid particular attention to consensus at every stage of the research (choosing a design, developing a written form, collecting and analyzing data, interpreting results). For transferability, teachers from different branches were gathered to investigate finger-counting. In other words, a wide variety of participants were gathered using maximum variation sampling in order to capture different views and opinions about finger-counting. Direct quotes were used to provide an accurate and coherent picture of participants' views, and the findings and researchers' interpretation were presented in the findings section.

3. Results

This section presents, first, the general findings, and then, the fourteen conceptual categories.

Table 2. Participants' views of finger-counting

Category	Subcategory	Code	Participants	f
Do you use finger-counting when teaching numbers to students?	No, I do not.		C8, C9, C13, P1, M2, M3, M4, M6	8
	Yes, I do.	Getting students to count from 1 to 10 using fingers with games and songs	C2, C1, C11, C14, S1, S2, S3, S5, S6, S7, P2, P4, P5, P6	14
		Getting students to add or subtract one rhythmically using fingers	C3, C4, C5, C6, C7, C10, C12, C15, S4, M1, M3, M5, P3	13
		Getting students to count multiples of any number from 1 to 9	C5	1
		Total		36

C8, C9, C13, P1, M2, M4 and M6 stated that they did not use finger-counting when teaching numbers. Half of the rest of the participants justified their responses under the code of “Getting students to count from 1 to 10 using fingers with games and songs,” meaning that they used finger-counting to teach numbers. Most of these participants were special education and preschool teachers. The other half justified their responses under the code of “Getting students to add or subtract one rhythmically using fingers,” meaning that they used finger-counting when teaching numbers. Most of these participants were elementary school teachers and mathematics teachers. C5 justified her response under the codes of “Getting students to add or subtract one rhythmically using fingers” and “Getting students to count multiples of any number from 1 to 9,” meaning that she uses finger-counting when teaching numbers. The responses of C5, M3, C14 and S5 are as follows:

I don't use finger-counting when teaching numbers, but I use it with students who have difficulty in doing basic arithmetic and I get them to do addition and subtraction (M5).

Yes, I do. I ask the student how many fingers are open to get him to count the opened fingers (S5).

Yes, I do. I get the student to count from the thumb to the tenth finger (C14).

Yes, I do. I get the student to count up or down or count the multiples of a given number (C5).

Table 3. Participants' views of using finger-counting when teaching addition and subtraction

Category	Code	Participants	f
How do you use finger-counting when teaching addition and subtraction?	Getting students to open as many fingers as the number and add it to or subtract it from the other number	C5, C6, C10, C14, S3, S7, P2, P3, P5	9
	Getting students to keep in mind the greater one of the given numbers and to count it up or down by opening or closing their fingers	C2, C4, C7, C9, C11, C12, S4, S5, S6	9
	Total		18

18 participants stated that they allowed their students to use finger-counting for addition and subtraction. Half of these participants justified their responses under the code of "Getting students to open as many fingers as the number and add it to or subtract it from the other number" while the other half justified their responses under the code of "Getting students to keep in mind the greater one of the given numbers and to count it up or down by opening or closing their fingers." The responses of S7, C2 and C4 are as follows:

I get them to open as many fingers as the number and add it to the other number. Again, I get them to count down as many numbers as the opened fingers (S7).

I get them to keep the greater number in mind and count up as many fingers as the small number to add or get them to count down as many fingers as the small number to subtract (C2).

I get them to keep the greater number in mind and count as many fingers as the small number and add it to or subtract it from the greater number (C4).

Table 4. Participants' views of using finger-counting when teaching multiplication and division

Category	Code	Participants	f
How do you use finger-counting when teaching multiplication and division?	Getting students to open as many fingers as one of the multipliers and rhythmically count the other multiplier as many as the opened fingers (Multiplication)	C1, C2, C4, C5, C6, C7, C14, S5	8
	I teach them to multiply by 9 (Multiplication)	C6	1
	I teach multiplication for numbers after 5. (Multiplication)	C9	1
	I get students to count rhythmically from 3 to 12 for 12:3. (Division)	C2, C14	2
	Total		12

12 participants stated that they used finger-counting when teaching addition and subtraction. Most of them stated that they taught multiplication by getting their

students to open as many fingers as one of the multipliers and rhythmically counting the other multiplier as many as the opened fingers. C2 and C14 said that they got their students to count rhythmically from 3 to 12 for 12:3. C6 said that she taught how to multiply by 9 while C9 stated that he taught multiplication for numbers following 5. Direct quotes from C2, C6, C9 and C14 are as follows:

Since we get them to use their fingers to count rhythmically, we get them to use their fingers to multiply and divide as well. For example, I teach them to multiply by getting them to count 5 fingers by twos (2 x 5=10) or teach them to divide by getting them to count by twos until 10 (10 : 2=5) (C2).

I teach multiplication, so it is also related to division. I get them to count the multiples of 5 with 6 fingers and get them to count rhythmically from 3 to 12 for 12:3 (C14).

Yes. I group them and teach them to multiply by 9 (C6)

I use fingers to multiply the numbers following 5 (C9).

Table 5. Participants' negative views of finger-counting

Category	Subcategory	Code	Participants	f
Do you think that finger-counting has a negative effect on students learning mathematics?	Finger-counting is limited in terms of calculations	Limited number of fingers negatively affects calculations.	C1, C13, P1	3
		They have a hard time using finger-counting and adapting to a new method as the number of steps increases and as multiplication and division problems become more complicated.	C3, M4	2
	Finger-counting prevents doing arithmetic mentally	If it is not supported with materials, it affects negatively and reduces mental processes.	C12,	1
		As students become older, they use finger-counting more than doing arithmetic mentally because they find the former easier.	C4, C10	2
	Finger-counting turns into a habit	Students should prefer to do arithmetic mentally; otherwise they need concrete examples in every mathematical operation they have to perform.	C5, C8	2
		Finger-counting turns into a habit and students use it even in the easiest operations.	C2, C11, S5, S6, M2	5
	Finger-counting slows down the operations	If finger-counting is excessively used, students become dependent on it as it prevents them from doing arithmetic fast.	C7, C9, M1, M3, M5	5
	Total			20

20 participants responded the question "Do you think that finger-counting has a negative effect on students learning mathematics?" 5 participants stated that finger-counting limited the mathematical operations while 3 participants stated that it prevented students from doing arithmetic mentally. According to 7 participants, finger-counting turned into a habit while 5 argued that it slowed down the operations. Most of the participants with negative views of finger-counting were elementary school teachers and mathematics teachers, and they mostly made statements under the codes of "Finger-counting turns into a habit, and students use their fingers even in the easiest operations" and "If finger-counting is excessively used, students become dependent on it as it prevents them from doing arithmetic fast." Direct quotes from C11, C2, C12, C10, C13 and M4 are as follows:

The finger-counting method can be used for students to understand the subject. But I am against turning it into a habit. Those who turn it into a habit may use it in every problem, which may prevent them from doing arithmetic mentally (C11).

Yes, I'm afraid it does. Students who turn it into a habit use it even in the easiest operations. For example, they cannot calculate and say "6 + 1 = 7" or "5 + 5 = 10" mentally but instead use their fingers (C2)

It has a negative effect if it is not used with some other materials. Using finger-counting all the time reduces and deadens the mental arithmetic skills (C12).

I find it negative because there are students who prefer using finger-counting to doing arithmetic mentally more and more as they get older (C10).

It may affect the image of limitless world of mathematics negatively because we have a limited number of fingers (C13).

I think that it has disadvantages because students use finger-counting to do arithmetic even with one and two digit numbers. However, they have difficulty in using finger-counting and don't know what to do when the number of operational steps increases and when multiplication and division problems become more complicated, and they have a hard time adapting to a new method too (M4).

Table 6. Participants' views of finger-counting

Category	Subcategory	Code	Participants	f
Does finger-counting have any advantages?	Finger-counting makes the arithmetic more concrete	It has an advantage only for first-year students or in the early days to make a subject matter more concrete and understandable.	C4, C8, C9, C11, C12, C13, S6, M1, M4, M5, M6	11
		It facilitates learning by touching.	C2, C10, S1, S2, S4, S5, S7, P3	8
		It turns the abstract into the concrete resulting in meaningful learning.	C5,C7	2
	Finger-counting is practical	It makes counting practical.	C1, C15, M3, P1	4
		It is a tool that students always have with them when they need it.	C3, C6, S3, M2, P2, P5, P6	7
	Finger-counting enhances retention	I think it is more permanent.	C14, S5, P4	3
	Finger-counting results in embodied cognition	They can internalize a subject more easily as they use their own body when they learn it.	P5	1
		Total		36

All participants gave positive answers to the question "Do you think that finger-counting has a positive effect on students learning mathematics?" 21 participants made statements under the category of "Finger-counting makes the arithmetic more concrete." 10 of the remaining participants emphasized the practicality aspect while 3 highlighted the high retention aspect of finger-counting. P5 made explanations regarding the embodied cognition aspect of the method. Direct quotes from P11, S1, C15, S5 and P5 are as follows:

I don't think it has disadvantages. Of course, it has advantages. It has worked for all my students so far. Since it involves gestures, it has a positive effect on learning retention (C14).

It definitely has advantages in special education. Since there is little to keep in mind, finger-counting both makes the arithmetic more concrete and more permanent (S5).

Students can internalize a subject more easily as they use their own body when they learn, and they can use it whenever they need it. So, I find it useful (P5).

I think the method is useful for middle school students until they develop arithmetic skills. I think it speeds up mathematical operations until they develop the necessary skills to do arithmetic mentally (M3).

Our students tend to forget quickly because they are special. So, it is an indispensable method. They want to see and touch. Taking out their fingers and counting by touching helps them learn the operation better (S4).

I think it has advantages. It makes counting practical (C15).

It affects learning in the early days positively because it makes what is learnt more concrete (C12).

Table 7. Participants' views of finger-counting in terms of students' ages

Category	Code	Participants			f
		For students 4-8 years of age	For students 4-11 years of age	For students 4 years of age and older	
What should the age limit be for using finger-counting for mathematical operations? Why?	Until students understand the logic behind arithmetic operations	S6, S3			2
	No age limit for special education students			S3, S4, S6, S7	4
	Since every student has different thinking skills, there should be no age limit.			C11, P3	2
	Abstract thinking begins.	C13, S1, P6	C1, C5		5
	There is a risk of it being permanent.	C2, P2			2
	It is impractical and a waste of time.	C7, S2, M3	M4		4
	It prevents the transition to doing arithmetic mentally.	C3, C4, C8, M3, P5	C9, C10, P4		8
	Its use might cause peer prejudice.	S5			1
	Others (age limit defined but no explanation made)	C6, C12, C14, C15, M6, P1	M1, M5		8
		Total			37

30 participants stated that the age limit for using finger-counting for mathematical operations should be 4-8 or 4-11 years. 8 of these participants provided no explanation for

their responses while others justified their responses under the codes of “Abstract thinking begins,” “It prevents the transition to doing arithmetic mentally,” “It is impractical and a waste of time” and “There is a risk of it being permanent.” S3, S4, S6, S7, C11, and P3, on the other hand, stated that there should be no age limit and justified their responses under the codes of “No age limit for special education students,” “Since each student has different thinking skills, there should be no age limit.” and “Until students understand the logic behind arithmetic operations.” Unlike other participants, S3 and S6 stated that there should be an age limit based on different criteria and justified their responses under the codes of “Until students understand the logic behind arithmetic operations” and “No age limit for special education students.” Direct quotes from S3, S5, C2, M3, C11 and P6 are as follows:

Once the students have grasped the logic behind addition or other operations and practiced enough, they should be gradually discouraged from using finger-counting. It is not possible to determine any age limit for students who require special education (S3).

As I have mentioned in the previous question, there should be an age limit before students turn it into a habit because otherwise it could cause peer prejudice (S5).

It can be used in first- and second-grades but should be abandoned in third-grade. Otherwise, it could turn into something permanent (C2).

It should definitely be abandoned before middle school. Not only does it prevent the development of mental arithmetic skills, but it is also a waste of time (M3).

There should be no age limit because every student has different thinking skills. Those who cannot think abstractly can use it (C11).

The limit should be second grade because students above second grade can do arithmetic mentally (P6).

Table 8. Participants' views of the general characteristics of students who insist on using finger-counting

Category	Subcategory	Code	Participants	f
The general characteristics of students who insist on finger-counting	Self-confidence	They are afraid of making mistakes.	C13,	1
		They never take risks (Lack of self-confidence)	C4, P3,	2
		They doubt about their solutions.	C10, M2,	2
	Memory problem	They have low perception	C9,	1
		They have high visual memory	C8, P4,	2
		They are distracted	C6, S4, S5,	3
		They are forgetful	S4, S5, C14	3
	Learning difficulties	They have low achievement and little interest in classes	C1, C2	2
		They cannot or do not want to think fast	P1, P4	2
		They have low capacity of doing arithmetic mentally	C3, C11, C12	3
		They have difficulty making interpretations and solving problems.	M5	1
		They lack high-level thinking skills	M1, M5	2
		They are slow learners	C2	1
	Anxiety	They are overexcited (They panic when they have to solve questions quickly)	C5, M4, C8	3
	Habit	They are accustomed to the convenience of finger-counting	C11, M3, M4	3
	Age	They are younger than grade age	C10	1
		Total		32

Participants were asked about the general characteristics of students who insist on using finger-counting. They mostly made explanations under the categories of "Self-confidence," "Memory problem," "Learning difficulties," "Anxiety," "Habit" and "Age." C10 made explanations under the categories of "Self-confidence" and "Age," C11 under the categories of "Learning difficulties" and "Habit" and M4 under the categories of "Anxiety" and "Habit." Direct quotes from C10, C11, M4 and other participants are as follows:

Those who are not sure about their operational steps and younger than the grade age insist on using finger counting (C10).

As I have mentioned before, it should not turn into a habit. The students who insist on using finger-counting cannot usually do arithmetic mentally (C11).

My fifth graders still count fingers. For most of them, it is a habit. Generally, those that are excited can't do arithmetic mentally. So, they need to use finger-counting (M4).

They forget easily and are easily distracted (S4).

Those who are slow learners and readers, generally have little interest in lessons and low academic achievement (C2)

Those who are accustomed to the convenience of finger-counting do not do arithmetic or think or reason mentally (M3).

Those who do not want to think or who always try to think concretely as they have high visual memory prefer using finger counting (P4).

They are afraid of making mistakes (C13).

Those who are in competition and have to do arithmetic fast use it (C8).

Table 9. Participants' views of getting students to abandon finger-counting

Category	Subcategory		Code	Participants	f
Methods used to get students to abandon finger-counting	No method	Positive	I insist that my special education students use finger-counting instead of getting them to abandon using it.	S5	1
			I do not make my students abandon finger-counting because I do not find it dangerous.	C15,	1
		Others	There is no time during class to get students to abandon finger-counting.	M3,	1
			I do not have a method.	C1, C4, C5, C7, C12, S1, S2, S3, S6, M1, M2, M5, M6 P1, P2, P3, P4, P5, P6	19
	Method	Different Materials	I use different materials	C3,S5	2
			I get them to count objects with their eyes.	C8,	1
			I get students to play kendoku with one-digit numbers.	C10	1
		Simple Operations	I get students to do arithmetic mentally with one-digit numbers.	C2, C9, C10, C11, C14, M4	6
			I receive parental support to get students to do arithmetic mentally at home and at school often.	C6, S4	2
		Operations with large numbers	I get students to do arithmetic mentally with numbers that are larger and cannot be counted with fingers.	C13, M4	2
			Total		36

Participants were asked "Are there any methods that you use to get your students to abandon finger-counting?" More than half of the participants stated that they did not use any method to get their students to abandon finger-counting. Only C15 stated that she did not use any method because she did not find finger-counting bad for students. S5 made explanations under the codes of "I insist that my special education students use finger-counting instead of getting them to abandon it" and "I use different materials" while M3 made explanations under the code of "There is no time during class to get students to abandon finger-count." The methods that the other participants stated that they used were under the subcategories of "Different Materials," "Simple Operations" and "Operations with large numbers." Under the subcategory of "Simple Operations," most of the participants justified their responses under the codes of "I get students to do arithmetic mentally with one-digit numbers." and "I receive parental support to get students to do arithmetic mentally at home and at school often." The methods that C10 stated that she used were under the codes of "I get students to play kendoku with one digit numbers" and "I get students to do arithmetic mentally with one-digit numbers." Direct quotes from C15, S5, M3, C10, C8 and S4 under the codes are as follows:

I don't see finger-counting as something bad. I don't force my students to do arithmetic mentally. They can use finger-counting as long as they can find the solution. What is important to me is that they grasp the logic of mathematics (C15).

Students who still use finger-counting have less knowledge of mathematics than their grade level peers, and therefore, there is no time during class to get them to abandon it (M3).

My students are special education students, so, I get them to use finger-counting to ensure learning retention and to prevent forgetfulness. However, numbers should be made concrete using a variety of materials and other students should be discouraged from using finger-counting (S5).

I give my students a couple of small numbers and ask them to reach a solution (like the show "countdown") by playing kendoku (C10).

I ask my students to count with their eyes the images that I project on the smart board to get them to abandon finger-counting, and help them to get used to it so that they won't need their fingers after a certain point (C8).

I get my students to practice all the time and teach them how to do arithmetic mentally. Parental support is a must in this process (S4).

4. Discussion and conclusion

Many elementary school teachers confirm that students almost instinctively use their fingers for counting and calculation (Stegemann & Grünke, 2014). The majority of participants stated that they used fingers when teaching counting numbers. Guha (2006) reported that 9 out of 10 preschool teachers taught their students finger-counting. Of our participants, only four mathematics, three elementary school teachers, and one preschool teachers stated that they did not use finger-counting when teaching numbers. Primary school mathematics teachers' students are older, which might be the reason for why they do not use finger-counting when teaching mathematics. This might also be due to the fact that students do not feel the need to use finger-counting or that teachers are of the opinion that finger-counting is insufficient for this age group.

The majority of participants who stated that they used fingers when teaching counting also stated that they did not use finger-counting for the four operations (addition, subtraction, multiplication and division). The main difference between the two situations might be due to the fact that participants do not know much about the counting methods (PabSay, Chisanbop, etc.) or that some are of the opinion that finger-counting is a limited method of doing arithmetic.

According to the participants, the advantages of finger-counting are that it is easy to use and within reach, facilitates retention and internalization, and makes the arithmetic more concrete. Bender and Beller (2012) state that finger representations support the internalization of numerical knowledge. Research shows that fingers are much more effective, accessible and practical than other concrete instruments and that they help improve math skills (Glenberg et al., 2004; Andres et al., 2008; Gracia-Bafalluy & Noel, 2008). On the other hand, the participants reported some disadvantages of finger-counting. They stated that it prevented students from doing arithmetic mentally, turned into a habit and slowed down arithmetic calculations. The disadvantages of finger-counting have led some researchers to conduct studies on encouraging students to abandon it. For example, Albayrak (2010) recommends concrete objects be used to discourage students to use finger-counting. It is, however, noteworthy that preschool and special education teachers emphasize the positive rather than the negative aspects of finger-counting.

Research on mathematics education suggests that students be encouraged to abandon finger-counting at the end of the first grade or at the beginning of the second grade so that they could develop mental number representations (Moeller et al., 2011). Similarly, most of our participants stated that finger-counting should be limited to students 4-8 or 4-11 years of age and justified their reasoning based on the conceptions that "Abstract thinking begins," "There is a risk of it being permanent," "It is impractical" and "It prevents the transition from concrete to abstract thinking." On the other hand, some participants, the most of whom were special education teachers, were of the opinion that there should be no age limit for finger-counting, arguing that it should be used "until students understand the logic behind arithmetic operations" or because "every student has different thinking skills." In fact, the use of finger-counting for arithmetic calculations may indicate that mental processes are not developed enough to function without external/concrete support. This, however, does not mean that it is not worth getting the support of finger-counting strategies (Bender & Beller, 2011). On the contrary, it might be a sign that affective and cognitive factors, which form the basis of students' finger-counting needs, should be identified to perform long-term alternative educational interventions or to encourage students to use different finger-counting strategies.

The participants reported that students who insisted on using finger-counting had low self-confidence and achievement, poor memory and high anxiety. Beller and Bender (2011) also argue that fingers are, among other things, a very useful set of tools that eases the burden of working memory and enables students to perform better in complex numerical tasks. Some students; however, use finger-counting to perform basic arithmetic because they have turned it into a habit or are afraid of making mistakes. Some other students count by touching or matching objects since they fear that they will not be able to count otherwise (Brias and Siegerler, 1984 as cited in Albayrak, 2010).

Most participants stated that they did not have any method to encourage their students to abandon finger-counting. Unlike other participants, two participants (a class and a special education teacher) stated that they did not feel the need to use any methods to get their students to abandon finger-counting because they found it useful. Some other participants stated that they received parental support and got their students to perform arithmetic operations mentally so that they could abandon finger-counting. The participants' differing views of finger-counting actually reflect scientists' differing opinions about the phenomenon. On the one hand, neurocognitive research and embodied cognition theory argue that fingers are more useful manipulatives than other objects as the former make significant contributions to numerical comprehension. On the other hand, research on mathematics education suggests that finger-counting strategies should be limited to a certain age period.

Finger-counting is a normal and healthy intermediate stage in the development of complex problem-solving skills rather than a debilitating habit that should be given up immediately or suppressed by parents and teachers at all costs (Stegemann & Grünke, 2014). Students with different characteristics are at the center of the discussion of finger-counting in mathematics teaching because it may be a necessity rather than a choice for some students. Therefore, students' characteristics should be determined before they are encouraged to abandon finger-counting. Moreover, the limitation of finger-counting can be overcome by using different strategies (PabSay, Chisanbop etc.). Finger-counting should, therefore, be seen as a transition process rather than an obstacle to the development of mental arithmetic skills because people abandon finger-counting strategies once they develop cognitive and affective skills.

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