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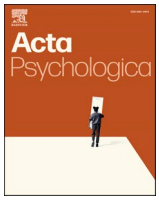

French preschool and primary teachers' attitude towards finger counting

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ABSTRACT

Teachers' beliefs and attitudes are known to guide the type of activities they implement in their classrooms. A traditional conception that finger counting is merely a back-up when children fail to use more sophisticated and efficient strategies could therefore prevent teachers from encouraging children's use of fingers in arithmetic tasks. However, the potential benefit of finger counting for young learners has been recently documented and setting aside its practice within classrooms may hinder children's mathematical skill development. It is therefore important to establish whether there is a discrepancy between teacher's beliefs regarding finger counting and the latest discoveries in this field of research. To this aim, we interrogated 413 teachers from preschool to Grade 5. We found that, despite being generally positive towards finger counting, teachers think that finger counting is typical of children who present math difficulties or lack of confidence, even during the first years of learning. These results are discussed considering what is known and what remains to be determined in the current scientific literature.

1. Introduction

Teachers' knowledge, beliefs, and attitudes towards learning in general or learning of a specific subject are known to guide their practices or, in other words, the way they teach (e.g., Nespor, 1987; Wilkins, 2008). More precisely, it has been shown in the domain of mathematics that teachers' conceptions about the nature of mathematics and about the nature of teaching and learning mathematics play a crucial role on the type of activities that they think is appropriate to implement in classrooms (Ernest, 1989; Thompson, 1984). Accordingly, and as pointed out by Thompson (1984), "any attempt to improve the quality of mathematics teaching must begin with an understanding of the conceptions held by the teachers and how these are related to their instructional practice" (p.106). The present paper is a first attempt in this way concerning finger calculation.[1] More precisely, this study aims to investigate teachers' attitudes towards the potential benefits or disadvantages of using finger counting, as well as the potential impact of instructing this method on children's arithmetic learning and performance. This question is timely because several recent studies have demonstrated the benefits of finger counting on arithmetic performance (see Neveu et al., 2023 for a review), whereas a more traditional approach considered this method as less favorable during learning (Albayrak, 2023; Koenker, 1958). Providing that teachers' conceptions not only impact their practices but that, in turn, teachers' conceptions and practices impact students' performance (e.g., Behar-Horenstein et al., 1996), we think that an overview of the situation was needed. As we will see based on the current literature, prohibition or even avoidance of finger counting in classrooms might potentially have detrimental effect on teachers' educational projects.

Indeed, it is now established that kindergarteners between 5 and 6 years who use their fingers to calculate are more efficient in arithmetic than children who do not use them (Dupont-Boime & Thevenot, 2018; Jordan et al., 2008). Moreover, at this stage and as operationalized by a working memory test, children who use their fingers to solve additions are more cognitively efficient than those who do not. Therefore, the most efficient and cognitively developed children at the age of 5½ years are more likely to use their fingers than less efficient children in arithmetic. This supports the view noticeably developed by Baroody (1987)

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[1] For the sake of simplicity, we will use the term "finger counting" in this paper because it is a common term used in the literature. Nevertheless, the finger counting activity at the centre of our interest is finger calculation, which is the strategy used by children to solve arithmetic problems with their fingers (see Guedin et al. (2018) for a review in French and Neveu et al. (2023) for a review in English). As it will be described in our Method section, the exclusive focus on finger calculation in our survey was clearly communicated to the teachers we interrogated through the question asked.

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that discovering the finger counting strategy is a difficult task requiring the mobilization of specific mathematical concepts such as the one-to-one correspondence (Alibali & DiRusso, 1999) or the cardinality principle (Fayol & Seron, 2005). Using fingers to solve arithmetic problems could not only benefit to performance but could also promote a transition towards more internalized, economic, and quick solving procedures. First, using fingers to represent numbers and to manipulate them can constitute a first step towards abstraction because it reveals that children have understood that a quantity can be represented through different codes (Sinclair & Pimm, 2015). Second, the shift from finger counting strategies where the two operands of the problems are represented on fingers to strategies where only one operand is represented on fingers while the other is represented mentally (i.e., count-on strategy such as $4 + 3 = 5, 6, 7$ by raising one, two, and three fingers) could facilitate the shift to strategies where the two operands are represented mentally (Baroody, 1987). This hypothesis has found recent support in a longitudinal study where 5- to 6-year-old children who solve arithmetic problems early during development using count-on finger strategies are the most likely to have completely internalized the strategy two years later (Poletti et al., 2022).

Despite the proven benefits of finger counting practice during the first years of schooling, it is possible that teachers still adhere to a more traditionalist belief, in which the use of fingers to solve problems is not well-regarded (Moeller et al., 2011). It would explain why it is not seldom to see children hiding their hands when they use their fingers to solve calculations (Dupont-Boime & Thevenot, 2018). As explained above, it is therefore important to determine whether teachers' beliefs are up to date with recent findings of the literature. As of now, the only study addressing this question is the one by Mutlu et al. (2020) in a limited number of 34 Turkish teachers. Given the significance of the question, we thought that it was crucial to adapt and extend their study in a different country with a much larger number of teachers. To this aim, we conducted a survey involving 413 French teachers from pre-Kindergarten to Grade 5 and interrogated them about their beliefs, opinions, and pedagogical practice about finger counting. Conducting this survey in France is of particular relevance because whereas in French school curriculum, explicit guidelines are formulated concerning the representations of numbers with fingers (i.e., finger montring, Noël, 2005), such precise recommendations are missing concerning finger counting. Teachers are then left with their own beliefs about this strategy, and they are unknown so far.

2. Materials and method

2.1. Participants

All the teachers involved in our research voluntarily took part. They were recruited via a digital pedagogical and collaborative network of teachers: http://www.lea.fr; Nathan©. This platform offers free educational resources and classroom activities and hosts several research projects about education. Amongst the 447 voluntary French teachers who took part in the survey, 34 of them were teaching outside metropolitan France and were not retained in our sample. Amongst the 413 remaining respondents, 64 were teachers in pre-Kindergarten (pupils between 4 and 5 years), 92 were teachers in Kindergarten (pupils between 5 and 6 years), 75 were teachers in Grade 1 (pupils between 6 and 7 years), 67 were teachers in Grade 2 (pupils between 7 and 8 years), 41 were teachers in Grade 3 (pupils between 8 and 9 years), 40 were teachers in Grade 4 (pupils between 9 and 10 years), and 34 were teachers in Grade 5 (pupils between 10 and 11 years).

2.2. Procedure

The platform was also used for the data collection of the survey. A forum where teachers could ask their potential questions was available during data collection. Teachers were asked to answer the survey between the 16th of September and the 3rd of November 2021.

As already stated above, the questions that we used in our survey were adapted from Mutlu et al. (2020) and it is therefore important to explain how they were constructed and on which rationale. Given the substantially higher number of teachers involved in our study compared with Mutlu et al.'s one, a first adaptation was to use Likert scales for some of the questions instead of leaving them opened. Concerning, the wording of the questions, a series of adaptations were also done. More specifically, Mutlu et al. asked their participants whether they think that finger counting has negative effects on students learning mathematics. Similarly, we asked our participants whether they think that calculating on fingers could be a harmful method to solve arithmetic problems. Using the same structure of questions and to get a more complete picture of teachers' opinions, we also asked them whether they think that calculating on fingers is a useful method to solve arithmetic problems and also whether they think it is a necessary method to develop mathematical skills. Because we wanted to relate teachers' opinions with their practice, we additionally asked them whether they think that calculating on fingers should be encouraged or discouraged in their classrooms. Then, in Mutlu et al., 18 of their 34 participants stated that they had already used finger counting to teach addition and subtraction. Based on this question and results, we also asked the teachers in our survey whether they had already explicitly taught finger counting in their classrooms. Then, exactly as Mutlu et al., we asked the teachers whether they think that there is an age limit where children should no longer use their fingers to calculate. We finally asked an exploratory open-ended question about the characteristics thought to be associated with children who calculate on their fingers. This question was exploratory in the sense that its reliability could not be guaranteed based on Mutlu et al.'s survey, where a slightly different question was asked. Indeed, they asked teachers to report the characteristics of children who insist on using their fingers to calculate. Our question was therefore broader than theirs. Because the questions we used were formulated in a different language than in Mutlu et al.'s survey and because we sometimes operated small modifications in the way we asked our questions, we adopted the same approach as Mutlu et al. and asked a specialist to review and improve the wording of our questions when necessary. More specifically, this assessor (i.e., third author of the paper) is specialized in neuro-education and works full time in collaboration with teachers to develop pedagogical interventions in their classrooms.

More practically, the survey was created in a Google Form and included 11 short questions divided in three parts (see Annex A for a precise description of the questions with the possible associated responses). Generally, the first part of the survey was related to teachers' experience and observations in their classroom and teachers were asked to respond depending on their previous year of teaching. This was done because our survey took place at the very beginning of the school year and, at this point, teachers did not have enough knowledge concerning their new pupils. The second part of the survey was related to teachers' general conception of finger counting. The third part of the survey was related to what teachers think about children who use their fingers to calculate.

It is important to note that in all the questions asked to the teachers, there was an explicit mention of finger calculation (see Annex A). There was therefore no ambiguity on the fact that the questions referred to the strategy consisting in solving arithmetic problems with the help of fingers and not to other behaviors associating fingers with numbers such as montring (e.g., Crollen, Mahe, et al., 2011) or keeping a record of a count (e.g., Lucidi & Thevenot, 2014).

2.3. Analyses

For all our analyses except one where school grades were considered separately, pre-Kindergarten and Kindergarten children were considered altogether as preschool children. Similarly, the results concerning children from Grade 1 and 2 were merged into early primary school

sections and Grade 3, Grade 4, and Grade 5 children were considered altogether as belonging to late primary school sections. As in the US, teaching in preschool years in France is considered as informal because, despite being given some recommendations, the teachers are not bound to strictly adhere to a specific curriculum. It is only from Grade 1 onwards that the education becomes formal.

As already stated, the last question of our survey was an open-ended question where teachers had to indicate which characteristics they associate with children who calculate on their fingers in their classroom during the previous teaching year. Each of these characteristics was manually recoded to harmonize the terms or expressions used by teachers. For example, "Cannot abstract", "Lack of abstraction", "Have trouble in abstracting", "Problem of abstraction" or "Difficulties to abstract" were recoded into "Abstraction difficulties". More generally, all the expressions sharing the same notion and valence (e.g., abstraction associated with a negative term (e.g., lack, difficulties, problem with, trouble in, failure in …) were grouped under the expression most often provided by teachers (in our example, Abstraction difficulties). For our analyses, we first considered the expressions that were provided in more than 5 % of the cases by teachers and represented them on word clouds for each school sections (i.e., preschool, early and late primary school sections). Then, and to get a more precise pictures of teachers' beliefs, we considered all the expressions reported, except those with an occurrence of less than 2 %, and classified them as positive, neutral, or negative. Four different judges operated the classification and fully agreed about it (e.g., Positive expressions: strategic, clever, motivated, capable of abstraction; Negative expressions: lack of attention, impossibility of abstraction, careless, non-strategic; Neutral expressions: perfectionist, persistent, beginner, academic).

3. Results

The sets of data from which the following analyses have been conducted can be found here: https://osf.io/t5n84/?view_only=43327be7ca95441e98b997a0d7409ca7

3.1. Teachers' experience and observations in their classrooms

For the first question, only 2 % of the teachers responded that they have not observed any child using their fingers to solve calculations in their classrooms (i.e., "None of the children" category). The distribution in the other categories of responses was distributed as follow: 33 % for "Very few children", 27 % for "Some children", 27 % for "The majority of children", and 11 % for "Almost all children". As it would have been expected, this distribution strongly varied depending on school Grades (see Table 1). In Grade 4 and Grade 5, most teachers (52 % in Grade 4 and 65 % in Grade 5, respectively) agreed that "Very few children" use their fingers to calculate. This observation was confirmed by a Chi-square test showing that the distribution of the teachers' responses in each category of responses was not evenly distributed ($\chi^2(2, N = 40) = 19.70$, $p < .001$ in Grade 4; $\chi^2(2, N = 34) = 50.20$, $p < .001$ in Grade 5). Stated differently, this Chi-square confirmed that the percentage of responses in the "Very few children" category was higher than in the other proposed categories of responses. In contrast, pre-Kindergarten teachers' responses were not as consensual, which was attested by the fact that they were evenly distributed in each category ($\chi^2(3, N = 64) = 0.61$, $p = .895$). Just like in Grade 4 and Grade 5 and as indicated by an additional series of Chi-square tests (see Table 1), Grade 1, Grade 2, and Grade 3 teachers' responses were always more prevalent in one category compared to the others. More precisely, 49 % of the teachers responded that the "The majority of children" calculate on their fingers in Grade 1, 39 % of the teachers in Grade 2 responded that only "Some children" use this strategy, and 37 % of the teachers in Grade 3 responded that "Very few children" use their fingers to solve calculation. Still, it has to be noted that, for this school Grade, 34 % of the teachers also estimate that "Some children" use their fingers to count and that, therefore, the agreement between teachers was not optimal.

Teachers' responses to the second question revealed that 74 % of them (305 teachers) have never discouraged children from using their fingers to calculate in their classroom (see Table 2). As attested by the result of a Chi-squared test, this percentage is larger than the percentage of teachers who already have discouraged this behavior ($\chi^2(1, N = 413) = 23.04$, $p < .001$). This result was obtained whatever the level of the school sections considered. On average 78 % of teachers in preschool sections responded that they never have discouraged children to use their fingers to calculate, $\chi^2(1, N = 156) = 31.36$, $p < .001$, they were 65 % in early primary school sections, $\chi^2(1, N = 142) = 9.00$, $p = .003$, and 79 % in late primary school sections, $\chi^2(1, N = 115) = 33.64$, $p < .001$). A Chi-squared test confirmed that teachers in the preschool sections did not report to have discouraged children to use their fingers to calculate more than teachers in the early or in the late primary school sections ($\chi^2(2, N = 413) = 1.65$, $p = .439$).

For the third question, 357 teachers (85 %) responded that they have

Table 2
Percentages of teachers who have never discouraged children to use their fingers to calculate depending on school Grades and sections.

Section	Grade	Percentage
Preschool	pre-Kindergarten	81
	Kindergarten	75
	Mean	78
Early primary school	Grade 1	67
	Grade 2	64
	Mean	65
Late primary school	Grade 3	78
	Grade 4	85
	Grade 5	74
	Mean	79

Table 1
Teachers' response distribution (%) in the different categories to the question of the observed frequency of children counting on their fingers in their classrooms depending on school Grades.

School grade	None of the children (0 %)	Very few children (between 1 and 25 %)	Some children (between 26 and 50 %)	The majority of children (between 51 and 75 %)	Almost all children (between 76 and 100 %)	Chi-Squared
pre-Kindergarten	3	27	23	22	25	$p = .895$
Kindergarten	0	16	25	38[a]	21	$p = .014$
Grade 1	0	11[a]	24	49[a]	16	$p < .001$
Grade 2	0	24	39[a]	28	9[a]	$p < .001$
Grade 3	0	37[a]	34	24	5[a]	$p < .001$
Grade 4	3	52[a]	28	17[a]	0	$p < .001$
Grade 5	6	65[a]	17[a]	12[a]	0	$p < .001$
Mean	2	33	27	27	11	

[a] Indicate that, as attested by Pearson standardized residuals ($z = \pm 2$) of the Chi-square tests, the percentages of teachers' responses in the categories for a specific school Grade are statistically different from the theoretical distribution.

already explicitly taught children to use their fingers to calculate (see Table 3). As attested by the result of a Chi-squared test, this percentage was higher than the percentage of teachers who have never taught this strategy ($\chi^2(1, N = 413) = 49.00$, $p < .001$). This result was observed whatever the school sections considered. For the preschool section, 94 % of teachers responded that they already have explicitly taught the finger counting strategy, $\chi^2(1, N = 156) = 77.44$, $p < .001$. They were 84 % in the early primary school sections, $\chi^2(1, N = 142) = 46.24$, $p < .001$, and 77 % in the late primary school sections, $\chi^2(1, N = 115) = 29.16$, $p < .001$. A Chi-squared test confirmed that teachers in the preschool sections have not explicitly taught the finger counting strategy more than teachers in the early or in the late primary school sections ($\chi^2(2, N = 413) = 1.72$, $p = .424$).

3.2. Teachers' general conception about finger counting

For the first question, 293 teachers (68 %) responded that they think that finger counting is a learning method to be promoted. As attested by the result of a Chi-squared test, this percentage is larger than the percentage of teachers who think that this method should not be promoted ($\chi^2(1, N = 413) = 12.96$, $p < .001$). However, this observation was modulated by school sections (see Table 4). In preschool and early primary school sections, finger counting was viewed as a method to be promoted by the vast majority of teachers (93 % of teachers in preschool sections, $\chi^2(1, N = 156) = 73.96$, $p < .001$ and 70 % of teachers in early primary school sections, $\chi^2(1, N = 142) = 16.00$, $p < .001$). However, in late primary school sections, the opposite view was predominant with 58 % of teachers thinking that finger counting is a method that should not be promoted, $\chi^2(1, N = 115) = 4.84$, $p = .028$.

Teachers were then asked three different questions about their negative or positive conception concerning finger counting in arithmetic. A majority of teachers (79 %) agreed that finger counting is useful for learning, 16 % moderately agreed, and only 5 % disagreed, $\chi^2(2, N = 413). = 95.66$, $p < .001$. This result was observed whatever the school sections considered (see Table 5) (91 % of agreement in preschool sections, $\chi^2(2, N = 156). = 149.78$, $p < .001$; 74 % in early primary school sections, $\chi^2(2, N = 142). = 78.26$, $p < .001$ and 68 % in the late primary school sections, $\chi^2(2, N = 115). = 57.02$, $p < .001$). A Chi-squared test showed that teachers in the preschool sections did not find finger counting more useful than teachers in the early or late primary school sections do, $\chi^2(2, N = 326). = 3.67$, $p = .160$.

In the same line, most teachers (71 %) disagreed that this method is harmful for learning, 19 % moderately agreed, and only 10 % agreed, $\chi^2(2, N = 413) = 65.06$, $p < .001$. This result was observed whatever the school sections considered (see Table 6). For the preschool sections, a majority of teachers (80 %) disagreed that finger counting is harmful for children, $\chi^2(2, N = 156). = 100.16$, $p < .001$. In the early primary school sections, 65 % of teachers disagreed, $\chi^2(2, N = 142). = 45.50$, $p < .001$. In the late primary school sections, 63 % of teachers disagreed, $\chi^2(2, N = 115). = 41.42$, $p < .001$ (see Table 6). Finally, a Chi-squared test across school sections showed that teachers in the preschool sections do not disagree more that finger counting is harmful for learning than teachers in the early or in the late primary school sections, $\chi^2(2, N = 42). = 2.49$, $p = .288$.

Finally, when teachers were asked whether finger counting is necessary for learning to solve calculations, only half of them agreed (52 %), 34 % moderately agreed, and 14 % disagreed. A Chi-squared test revealed that the percentage of teachers' responses was not evenly distributed between categories, $\chi^2(2, N = 413) = 21.68$, $p = .001$. A series of analyses per school section (Table 7) revealed that this was true for each school section ($\chi^2(2, N = 156). = 48.50$, $p < .001$, $\chi^2(2, N = 142) = 12.14$, $p = .002$, $\chi^2(2, N = 115) = 9.98$, $p = .007$ for preschool, early and late primary school sections respectively). However, the distribution was not the same across school sections, $\chi^2(4, N = 413) = 12.71$, $p = .013$. More precisely, whereas a small majority of preschool teachers think that finger counting is necessary (65 %), teachers' opinions in the later school sections were less contrasted. Their responses

Table 3
Percentages of teachers who have already explicitly taught children to use their fingers to calculate depending on school Grades and sections.

Section	Grade	Percentage
Preschool	pre-Kindergarten	92
	Kindergarten	97
	Mean	94
Early primary school	Grade 1	89
	Grade 2	79
	Mean	84
Late primary school	Grade 3	85
	Grade 4	73
	Grade 5	74
	Mean	77

Table 4
Percentages of teachers considering that finger counting is a method to be promoted depending on school Grades and sections.

Section	Grade	Percentage
Preschool	pre-Kindergarten	94
	Kindergarten	92
	Mean	93
Early primary school	Grade 1	76
	Grade 2	64
	Mean	70
Late primary school	Grade 3	49
	Grade 4	45
	Grade 5	32
	Mean	42

Table 5
Percentages of teachers considering that using fingers to calculate is useful for developing math skills depending on school Grades and sections.

Section	Grade	Category		
		Agree	Moderately agree	Disagree
Preschool	pre-Kindergarten	92	5	3
	Kindergarten	90	7	3
	Mean	91	6	3
Early primary school	Grade 1	77	18	5
	Grade 2	70	25	5
	Mean	74	21	5
Late primary school	Grade 3	73	20	7
	Grade 4	72	20	8
	Grade 5	59	29	12
	Mean	68	23	9

Table 6
Percentages of teachers considering that using fingers to calculate is harmful for developing math skills depending on school Grades and sections.

Section	Grade	Category		
		Agree	Moderately agree	Disagree
Preschool	pre-Kindergarten	3	16	81
	Kindergarten	5	15	80
	Mean	4	16	80
Early primary school	Grade 1	16	19	65
	Grade 2	13	21	66
	Mean	15	20	65
Late primary school	Grade 3	10	27	63
	Grade 4	15	22	63
	Grade 5	15	23	62
	Mean	13	24	63

Table 7
Percentages of teachers considering that using fingers to calculate is necessary for developing math skills depending on school Grades and sections.

Section	Grade	Category		
		Agree	Moderately agree	Disagree
Preschool	pre-Kindergarten	66	22	12
	Kindergarten	63	29	8
	Mean	65	25	10
Early primary school	Grade 1	40	41	19
	Grade 2	46	40	14
	Mean	43	40	17
Late primary school	Grade 3	51	39	10
	Grade 4	47	28	25
	Grade 5	35	44	21
	Mean	44	37	19

were indeed evenly distributed in the "Agree" and "Moderately agree" categories. Finally, a Chi-squared test revealed that, across school sections, the response "Agree" was more represented in preschool than in the later school sections, $\chi^2(2, N = 213) = 6.09$, $p = .048$.

Additional analyses revealed that teachers' conceptions of finger counting are associated to their practice. For these analyses and to maximize variances in distributions, we considered teachers' responses to the questions relative to the usefulness, harmfulness, and necessity of finger counting on the original 5 categories on the Likert scale (i.e., "Strongly disagree" coded 0, "Disagree" coded 1, "Moderately agree" coded 2, "Agree" coded 3, and "Strongly agree" coded 4). The results revealed that teachers who agree that finger counting to solve calculation is useful or necessary are more likely to have already taught the finger counting strategy in their classrooms than teachers who do not agree with these statements (Question 3 in the previous section), $t(411) = 7.77$, $d = 1.11$, $p < .001$ for useful; $t(411) = 5.61$, $d = 0.81$, $p < .001$ for necessary. Conversely, teachers who think that finger counting could be harmful for learning are more likely to have never explicitly taught the finger counting strategy, $t(411) = -7.68$, $d = 1.10$, $p < .001$.

3.3. Teachers' views about children using finger counting

For the first question, teachers had to indicate an age limit around which they think that finger counting is a sign of math difficulties. Amongst the 413 teachers, 52 % considered that there is an age limit and 92 % of them (i.e., 197 teachers) provided an age range. A majority of teachers (53.3 %, 105 teachers) responded that between 8 and 9½ years, children should no longer use their fingers to calculate (see Table 8).

The second question was related to the characteristics that teachers think are associated to children who use their fingers to calculate. Out of the 413 teachers, 385 provided a minimum of one characteristic, for a total of 695 responses provided. A descriptive graphical representation of the results depending on school sections (i.e., preschool, early and late primary school sections) can be found in Fig. 1. The size of the font for each expression reflects its frequency amongst teachers' responses. As already mentioned in the Method section, the responses that were less frequent than 5 % were not coded at this stage.

This representation reveals that for late primary school section teachers, the characteristics of children who count on their fingers were all negative (see Table 6). Amongst these negative characteristics, "Math difficulties" and "Lack of confidence" were the expressions that were most represented (25 % and 26 % respectively). Concerning early primary school sections, most of the characteristics were also negative but some teachers reported positive expressions such as "Good pupils" (7 %). This last characteristic was predominant in preschool sections (25 %) followed by neutral expression such as "Average pupils" (15 %), and negative ones such as "Weak pupils" (15 %). As it will be more apparent in the following description, the majority of the characteristics reported by teachers remained however negative.

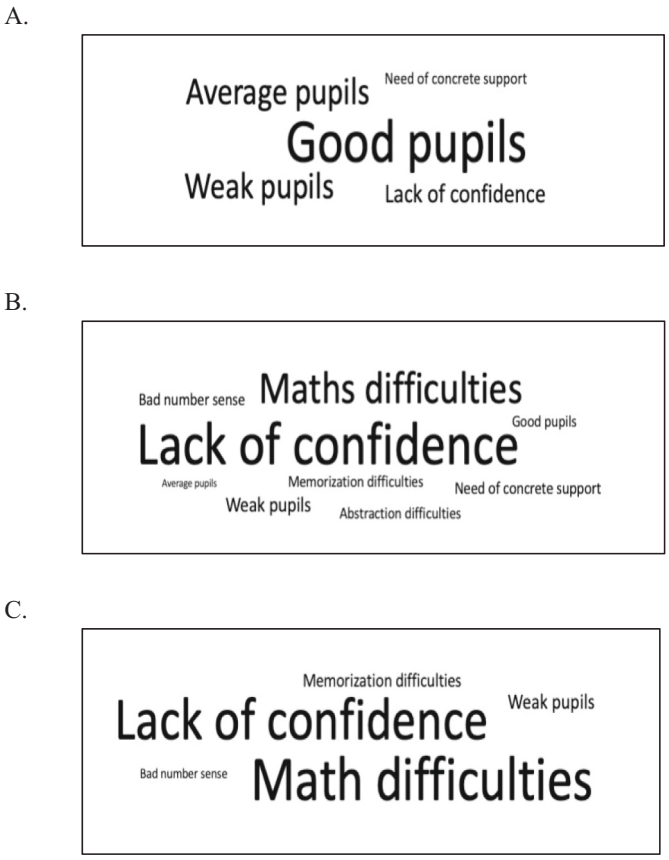

Fig. 1. Frequency of expressions reported by teachers to qualify children using their fingers to calculate in preschool (A), early primary (b), and late primary (C) school sections.

As already explained in our Method section (under Section 2.3. Analyses), we then considered all the expressions provided by teachers except those with an occurrence of less than 2 % (Table 9). We found that in late primary school sections, 93 % of the expressions were negative and 3 % were positive. For early primary school sections, 88 % of the expressions were negative and 7 % were positive. Finally, for preschool sections, 45 % of the expressions were negative and 36 % were positive. Although negative expressions were often reported for all school sections, a Chi-Square analysis showed that positive expressions were more often reported for children in preschool sections than in higher school sections, $\chi^2(2, N = 96) = 42.30$, $p < .001$.

4. Discussion

In this survey, we interrogated 413 teachers from French preschool and primary schools concerning their attitude towards finger counting. This was motivated by the results of recent research showing that finger

Table 8
Percentages of teachers' responses for each age limit provided.

Age	4½	5	6–6½	7–7½	8–8½	9–9½	10–10½	11	12	15
Response (%)	0.5	0.5	6.6	15.2	31.5	21.8	17.3	2.5	3.6	0.5

Table 9
Expressions (and % of mention) used by teachers to qualify children who use their fingers to solve calculations depending on school sections.

Section	Expression	Connotation	% of mention
Preschool	Motivated pupils	Positive	3
	Good number sense	Positive	3
	Good pupils	Positive	30
	Total Positive		36
	Math difficulties	Negative	3
	Abstraction difficulties	Negative	3
	Need of concrete support	Negative	8
	Lack of confidence	Negative	13
	Weak pupils	Negative	18
	Total Negative		45
	Average pupils	Neutral	19
	Total Neutral		19
Early primary school	Good pupils	Positive	7
	Total Positive		7
	Lack of mental representation	Negative	3
	Abstraction difficulties	Negative	7
	Memorization difficulties	Negative	7
	Need of concrete support	Negative	7
	Bad number sense	Negative	8
	Weak pupils	Negative	9
	Math difficulties	Negative	20
	Lack of confidence	Negative	27
	Total Negative		88
	Average pupils	Neutral	5
	Total Neutral		5
Late primary school	Good pupils	Positive	3
	Total Positive		3
	Dyscalculia	Negative	3
	Lack of concentration	Negative	3
	Abstraction difficulties	Negative	4
	Bad number sense	Negative	7
	Memorization difficulties	Negative	9
	Weak pupils	Negative	10
	Lack of confidence	Negative	28
	Math difficulties	Negative	29
	Total Negative		93
	Average pupils	Neutral	4
	Total Neutral		4

counting could be a useful and important tool at the beginning of learning (Dupont-Boime & Thevenot, 2018; Jordan et al., 2008), which could help children in the construction of their arithmetic knowledge (Poletti et al., 2022). These findings could conflict with a naïve belief that finger counting strategies should be discouraged at school because it would prevent children from shifting to more mature mental strategies. While it is established that teachers shared this belief in the past (Boaler & Chen, 2016 in American teachers), we did not know whether teachers still share it nowadays. The present research aimed at answering this question.

Our results revealed that 98 % of the 413 teachers involved in our survey already observed finger counting in their classrooms, which confirms that finger counting is a very common strategy amongst children (Butterworth, 1999). This also echoes Mutlu et al.'s (2020) results showing that most Turkish elementary teachers report that students almost instinctively use their fingers to count and calculate. As it could have been expected, the percentages of children reported as counting on their fingers by teachers decrease with school grades, which is also what is reported in the scientific literature (e.g., Jordan et al., 2008). However, still 29 % of teachers in Grade 5 report that at least 26 % of children still use their fingers to calculate (Table 1). This reflects the fact that finger counting is not a strategy that disappears early during development (see Neveu et al., 2023 for a review). The question of whether children who still use their fingers in such advanced grades correspond or are viewed as children with math difficulties will be taken up later in this Discussion. Another point to discuss here is that, somehow surprisingly, preschool teachers do not agree as whether finger counting is often or rarely observed in their classrooms. In a lesser extent, such disagreement was also observed in Grade 3, where the teachers' responses were evenly distributed in the category “Very few children” and “Some children”. The variations in teachers' observations may be attributed to potential differences in the socio-economic backgrounds of their pupils. Such differences have indeed been documented by Jordan et al. (2008) who showed a growth in finger counting frequency in low-income children in the first years of school but a decline of this frequency by Grade 2 in middle-income children. Future studies will therefore need to consider children's socio-economic status to examine this interpretation.

Second, 68 % of the teachers we interrogated think that finger counting is a strategy that should be promoted in classrooms. Nevertheless, and not surprisingly, the school Grade in which the teachers were working modulated this result. In Kindergarten, 92 % of teachers think that finger counting should be promoted (Table 4). This result shows that young children's teachers are aware that using fingers to calculate can be a helpful strategy. Teachers in Grade 1 and Grade 2 who think that finger counting should be promoted are still more numerous than teachers who think that it should not but, in Grade 3, the percentages of teachers supporting one conception or the other are equal. In Grade 4 and Grade 5, the percentages are reversed, and the teachers rather think that finger counting should no longer be promoted. These results are coherent with the fact that the most frequent answer given concerning the age at which children should have stopped using their fingers is 8 to 8½ years (Table 8). In Mutlu et al.'s (2020) survey, 22 teachers out of 37 responded that finger counting should be limited to children between the age of 4 to 8 years. There is therefore a difference between the two studies, with Turkish teachers placing the inferior cursor of the age limit lower than French teachers. As a matter of fact, French teachers' beliefs seem more in accordance with the scientific literature than Turkish's ones. Indeed, it is only from the age of 7 to 8 years, and not before, that the use of finger is associated with poor working memory and intellectual capacities (Poletti et al., 2022; Sauls & Beeson, 1976) and poor arithmetic performance (de Chambrier et al., 2018; Jordan et al., 2008).

Very interestingly, despite the fact that teachers think that finger counting should no longer be promoted from Grade 3, they also massively think that finger counting should not be discouraged, whatever the school Grade. This can be interpreted by the fact that teachers soundly reckon that if children still use their fingers by the end of primary school, it means that they are in difficulty but also that they still need them. In fact, this idea has not found definite support in the literature and researchers in the domain of numerical cognition still need to establish whether older children who still use their fingers to calculate would perform better or worse if they were prevented from using them (see Thevenot, 2022 for an extensive discussion of this point in French).

All in all, it seems that French preschool and primary teachers are mostly positive about finger counting. This is especially true for teachers working with young children who massively reported having already taught finger counting in their classrooms. This echoes a result by Guha (2006) that 9 out of 10 preschool teachers in India have already taught finger counting to their students. This also echoes Mutlu et al.'s (2020) results in Turkey because, out of the 34 teachers involved in their survey, only 8 of them reported having never used finger counting to teach arithmetic. In Grade 5, still a considerable percentage of teachers from our survey (74 %) have already taught a child to use a finger counting strategy (Table 3). This high percentage of teachers in late primary school sections who use finger counting to teach arithmetic has also been reported in Mutlu's small sample of mathematics teachers (i.e., 3 out of 6). Of course, these results do not inform us about the profile of older children who were exposed to such explicit teaching, and it might be reserved to those with math difficulties or even disabilities. This will have to be investigated in future studies.

Next, through a series of three questions, we tried to learn more

about the vision that teachers have about finger counting by asking them whether they agree with three statements. This approach showed that teachers massively think that finger counting is useful and not harmful. This was true whatever the school section the teachers were teaching in. Mutlu et al. (2020) asked similar questions in their survey in Turkish teachers, and they reached the same results as ours. More precisely, preschool and special education teachers in their study emphasized the positive over the negative aspects of finger counting. The main advantages of finger counting that teachers reported were that it is easy to use, that it makes arithmetic more concrete and that it facilitates retention and internalization. The reported disadvantages were that it could prevent children from moving to mental procedures and that it can slow down the calculations.

Concerning the question related to the necessity of finger counting over development, teachers in our survey were more mitigated. Overall, 52 % of teachers thought that it is necessary, 14 % think that it is not, and 34 % are moderately in agreement with the statement. This result was however modulated by school sections as a larger consensus on the necessity of finger counting during development was observed in preschool teachers (65 %) than in teachers from later school grades. In fact, in early and late primary school sections, teachers' responses were evenly distributed in the "Agree" and "Moderately agree" categories. It is very interesting to note that this lack of agreement between teachers echoes the debate between researchers. In fact, Crollen, Seron, and Noël (2011) asked the very same question in the title of one of their articles (i.e., "Is finger-counting necessary for the development of arithmetic abilities?"). Without denying the importance of finger counting during development, the authors conclude that finger counting is not necessary because, amongst other arguments, children who do not use their fingers to count do not show atypical or delayed numerical development (see for example, Thevenot et al., 2014 in children with hemiplegia). In sharp contrast, other researchers reckon that finger use in arithmetic tasks is an inescapable stage of development for the establishment of the neural networks underlying numerical abilities (Butterworth, 1999; see Moeller et al., 2011 for a review). Still concerning teachers' vision about finger counting, our results also show that teachers' conceptions is translated into action because the more positive teachers are about finger counting, the more likely they are to have already explicitly taught finger counting in their classrooms. These results are in line with the fact that teachers' beliefs and attitudes usually guide the way they teach (e.g., Nespor, 1987; Wilkins, 2008).

The last question we asked was an open-ended one and we were interested in determining which characteristics teachers think are associated with children who count on their fingers. Despite the fact that more positive characteristics were reported for children in preschool (e.g., good pupils in 30 % of the occurrences) than in early and late primary school sections, the majority of the characteristics reported were negative rather than positive or neutral in the three school sections. Therefore, even though, as extensively developed in the present discussion, teachers have a positive attitude towards finger counting, they still associate it with delays or difficulties in mathematical development. Thus, it seems that finger counting is seen by a majority of teachers only as a crutch used when more advanced strategies are not yet implemented. This idea is not in accordance with the results of the literature according to which cognitively efficient young children are those who use their fingers to calculate (Dupont-Boime & Thevenot, 2018) or with the conception that finger counting constitutes the basis for the emergence of mental strategies (Baroody, 1987; Poletti et al., 2022). However, more in accordance with the results of the literature, the percentages of teachers' comments associating finger use and math difficulties increase with school grade. As already stated, this echoes the results reported by Jordan et al. (2008) showing that the correlation between performance and finger counting reverses at the age of 8.

5. Conclusion

To sum up, the results of our survey show that French teachers in preschool and primary school consider finger counting as a useful tool that could help children to develop good arithmetic skills. This echoes Cowan's (2013) conclusion that whereas American teachers of earlier generations tend to forbid the use of finger counting, the new generations are more sympathetic towards this strategy. In fact, the vast majority of teachers in our survey think that finger counting should never been discouraged. Nevertheless, the numerous comments made by the teachers of our survey, even in preschool and early primary school sections, associating finger counting with math difficulties reveal that finger counting is often considered merely as a crutch for children who present difficulties. These comments show that finger counting is not always considered as the most efficient strategy used by younger children. As already explained, this belief is at odds with some conclusions of the scientific literature. Because it is established that teachers' beliefs usually guide their practice (e.g., Thompson, 1984; Wilkins, 2008), which is also attested in the present study, these beliefs could negatively impact their pedagogical approach to mathematical learning. This is the reason why we think that during their training and in-service training, teachers should be more often and more deeply presented with experimental investigations related to finger counting. Such training could foster their view that finger counting is a precious tool on which early education program in arithmetic should be based (Ollivier et al., 2020). Of course, it is also up to decision makers to formulate explicit guidelines concerning finger counting in classrooms.

Before concluding, it is worth noting that the present study constitutes only a first step towards a more comprehensive view of teachers' attitudes and beliefs about finger counting. We have already stressed that children's SES can modulate their reliance on finger counting (Jordan et al., 2008) and therefore teachers' observations and conceptions. In the same line, the role of teaching environment and more precisely whether teachers are affiliated with priority zone of education or special education will be worth investigating. Given the present results showing that finger counting is often viewed as a crutch for children with math difficulties, teachers working with children with special needs may have a more positive attitude towards the use of fingers than teachers in mainstream education. Teachers' years of experience will also constitute an important variable to consider in future studies. It has indeed long been established that teachers with more or less professional experience differ in their attitude towards teaching (see for example Huettig & Newell, 1966 in the domain of modern math programs). These variables may offer partial explanation for some disparities found in teachers' attitudes and observations in our survey. Still regarding future research directions paved by the current study, similar surveys to the one presented here should be conducted in various countries. Indeed, our study is limited to French teachers and whether our results are generalizable to teachers in Anglo-Saxon or Asiatic countries is unknown so far. Whereas huge differences with Anglo-Saxon countries are not expected because school practices and curricula are similar, more different results could be obtained in Asian countries, noticeably in China, where more extensive practice and rote learning of arithmetic facts is promoted (Geary et al., 1992).

CRediT authorship contribution statement

All the authors designed the study; CP, ML and CT wrote the paper; CP analyzed the results.

Declaration of competing interest

None.

Data availability

Link to the data provided in the Result section

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Annex A.

List of the questions included in the survey (original French version in italic).

General information

Question 1
In which country do you teach?
Dans quel pays enseignez-vous ?
☐ France (*France*)
☐ Belgium (*Belgique*)
☐ Switzerland (*Suisse*)
☐ Luxembourg (*Luxembourg*)
☐ Other country (*Autre pays*) : .....

Question 2
Last year, what was the grade level of the classroom you were teaching in?
L'année dernière, quel était le niveau scolaire de la classe dans laquelle vous enseigniez ?
☐ pre-Kindergarten (*Moyenne Section Maternelle*)
☐ Kindergarten (*Grande Section Maternelle*)
☐ Grade 1 (*CP*)
☐ Grade 2 (*CE1*)
☐ Grade 3 (*CE2*)
☐ Grade 4 (*CM1*)
☐ Grade 5 (*CM2*)

Part 1 – Teachers' experience and observations in their classroom

Question 1
[In your classroom last year] Have you observed children using their fingers to solve arithmetic problems?
[Dans votre classe l'année dernière] Observiez-vous des enfants qui utilisaient leurs doigts pour résoudre des calculs ?
☐ None of the children (*Aucun enfant*)
☐ Very few children: between 1 and 25% (*Très peu d'enfants : entre 1 et 25%*)
☐ Some children: between 26 and 50% (*Certain enfants : entre 26 et 50%*)
☐ The majority of children: between 51 and 75% (*La majorité des enfants : entre 51 et 75%*)
☐ Almost all children: between 76 and 100% (*Presque tous les enfants : entre 76 et 100%*)

Question 2
Have you already discouraged a child from using their fingers to solve arithmetic problems in your classroom?
Avez-vous déjà découragé un enfant d'utiliser ses doigts pour résoudre des calculs dans votre classe ?
☐ No (*Non*)
☐ Yes (*Oui*)

Question 3
Have you already explicitly taught a child to use their fingers to solve arithmetic problems in your classroom?
Avez-vous déjà enseigné explicitement à un enfant à utiliser ses doigts pour résoudre des calculs dans votre classe ?
☐ No (*Non*)
☐ Yes (*Oui*)

Part 2 – Teachers' general conception about finger counting

Question 1
Do you consider that using fingers to solve calculations is a learning method to be promoted for the grade level you were teaching last year?
Considérez-vous que l'utilisation des doigts pour résoudre des calculs est une méthode d'apprentissage à valoriser pour le niveau de classe dans lequel vous enseigniez l'an dernier ?
☐ No (*Non*)
☐ Yes (*Oui*)

Question 2
Do you think that using fingers to solve a calculation is useful for developing math skills.
Selon vous, l'utilisation des doigts pour résoudre un calcul est-elle utile au développement des performances en calcul
☐ Strongly agree (*Tout à fait d'accord*)
☐ Agree (*D'accord*)
☐ Moderately agree (*Moyennement d'accord*)
☐ Disagree (*Pas d'accord*)
☐ Strongly disagree (*Pas du tout d'accord*)

Question 3
Do you think that using fingers to solve a calculation is neccessary for developing math skills.
Selon vous, l'utilisation des doigts pour résoudre un calcul est-elle nécessaire au développement des performances en calcul
☐ Strongly agree (*Tout à fait d'accord*)
☐ Agree (*D'accord*)
☐ Moderately agree (*Moyennement d'accord*)

(*continued on next page*)

(*continued*)

General information

☐ Disagree (*Pas d'accord*)
☐ Strongly disagree (*Pas du tout d'accord*)

Question 4

Do you think that using fingers to solve a calculation is harmful for developing math skills.
Selon vous, l'utilisation des doigts pour résoudre un calcul est-elle néfaste au développement des performances en calcul
☐ Strongly agree (*Tout à fait d'accord*)
☐ Agree (*D'accord*)
☐ Moderately agree (*Moyennement d'accord*)
☐ Disagree (*Pas d'accord*)
☐ Strongly disagree (*Pas du tout d'accord*)

Part 3 – Teachers' views about children using finger counting

Question 1

In your opinion, is there an age limit at which using fingers to solve calculations becomes a sign of math difficulty?
Selon vous, y a-t-il un âge limite auquel l'utilisation des doigts pour résoudre des calculs devient un signe de difficulté en mathématiques ?
☐ No (*Non*)
☐ Yes: please specify in « Other » (*Oui : précisez dans "Autre"*)
☐ Other (*Autre*) : ……..

Question 2

In your opinion, what are the characteristics (performance level, personality, character traits, ...) of children in your last year classroom who used their fingers to solve calculations?
Selon vous, quelles sont les caractéristiques (niveau de performance, personnalité, traits de caractère, ...) des enfants de votre classe de l'an dernier qui utilisaient leurs doigts pour résoudre des calculs ?
Write your response here (*Écrivez votre réponse ici*) ……..

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