Parent-initiated activities in support of Swedish year-one children’s learning of mathematics: age-appropriate complements to school?

Jöran Petersson a, Judy Sayers b,c, Eva Rosenqvist c and Paul Andrews c,d

aFaculty of Education and Society, Malmö University, Malmö, Sweden; bFaculty of Education Social Sciences and Law, University of Leeds, Leeds, UK; cDepartment of Mathematics and Science Education, Stockholm University, Stockholm, Sweden; dVIA University College, Aarhus, Denmark

ABSTRACT
In this paper, motivated in part by evidence that Swedish teachers are sceptical of parents’ abilities to offer appropriate support, we present an exploratory investigation of the activities Swedish parents initiate to facilitate their year-one (first grade) children’s learning of mathematics. Data, derived from 25 semi-structured interviews conducted with parents from three demographically different schools, were subjected to constant comparison analyses and yielded three broad categories of activity. These concerned the use of games in the learning of mathematics, contextualised mathematics activities like cooking and shopping, and decontextualised mathematics activities like systematic counting. Collectively, the results indicate that while parents of year-one children are confident supporting their children’s learning of mathematics, they are also conscious of the need to avoid both undermining schools’ efforts and exacerbating educational inequity. With few exceptions, the activities parents described were age-appropriate and more likely to complement teachers’ actions than not.

ARTICLE HISTORY
Received 9 February 2021
Accepted 25 June 2021

KEYWORDS
Year-one pupils; parental involvement; mathematics learning; home-initiated activity; Sweden; semi-structured interview

Introduction
Internationally, acknowledging that parents are their children’s first teachers, recent studies have focused on how parents support children’s learning of mathematics during the pre-school and early school years (Huntsinger, Jose, and Luo 2016; Kleemans et al. 2012; LeFevre et al. 2009; Missall et al. 2015; Skwarchuk, Sowinski, and LeFevre 2014). Much of this top-down quantitative research has been based on assumptions about what parents do. In this paper, by way of contrast, we present a bottom-up investigation of the number-related activities initiated by the parents of children in the first year, hereafter year-one, of Swedish compulsory school.

Such an investigation is warranted, internationally and nationally, in several ways. First, a recent critique (Andrews, Petersson, and Sayers 2021) found a field dominated by top-down analyses of self-report questionnaires, whereby researchers have...
assumed what forms of activity parents are likely to initiate. Bottom-up investigations in which parents describe what they do are relatively rare and typical focus on families of minority groups at risk of disenfranchisement (See, for example, de Abreu and Cline 2005; Remillard and Jackson 2006). Second, important in the context of Sweden, while year-one children generally receive reading homework, few, to the annoyance of some parents, receive mathematics (Sayers et al. 2021), typically because Swedish teachers construe mathematics homework as a threat to educational equity (Sayers et al. 2020). Consequently, as found in England (O’Toole and de Abreu 2005), parents’ natural desire to support their young children’s learning may lead them to rely, perhaps inappropriately, on their own mathematics-related intuitions and experiences. Third, reflecting similar concerns internationally (Goddard, Tschannen-Moran, and Hoy 2001; Janssen et al. 2012; Karlsen Bæck 2010), understanding how parents support their children matters, because Swedish teachers position themselves as educational experts, who are not only sceptical of parents’ abilities to offer appropriate support but concerned that such interventions may compromise educational equity (Björk and Browne-Ferrigno 2016; Sayers et al. 2020). Thus, unless parents are asked directly about any home-initiated activities, teachers’ fears are likely to remain rooted in speculation and prevent them from offering parents ‘proper information and advice on the beneficial practices supporting the development of their children’s skills’ (Aunio et al. 2016, 65). Fourth, an American study found that while parents of young children try to connect home-initiated activities to their children’s interests and experiences, they do so with little confidence (Cannon and Ginsburg 2008). Thus, acknowledging Swedish teachers’ approval of parents who create number-rich home environments without explicit teaching of mathematical content (Sayers et al. 2020), investigating what Swedish parents do would seem timely.

Fifth, returning to the international literature, quantitative studies have been less than equivocal in their conclusions with respect to the relationship between what parents may do and their children’s mathematical learning. For example, from the perspective of kindergarten children, there are studies showing that parent-initiated numeracy activities and expectations are ‘uniquely related to early numeracy skills’ (Kleemans et al. 2012, 476). Alternatively, there are studies showing, even when a large number of parental activities are examined, no relationship between parental involvement and numeracy (Missall et al. 2015). Andrews, Petersson, and Sayers (2021) have suggested that one explanation for this ambivalence is that many such studies examine the impact on achievement of aggregate scores derived from items loosely connected by factor analyses of data from diverse sets of predetermined categorisations of activity (See Huntsinger, Jose, and Luo 2016; Kleemans et al. 2012; LeFevre et al. 2009; Missall et al. 2015; Skwarchuk, Sowinski, and LeFevre 2014). Problematically, when colleagues interpret the activities that comprise these factors as direct or indirect (LeFevre et al. 2009), formal or informal (Huntsinger, Jose, and Luo 2016), advanced or basic (Skwarchuk, Sowinski, and LeFevre 2014), they are frequently discussing similar entities but rarely explain why particular activities are construed as direct, formal or advanced, when related activities are construed as indirect, informal or basic (Andrews, Petersson, and Sayers 2021).
Parent-initiated activity and young children’s learning of mathematics

Looking beyond the limitations of factor-analytic studies, research on the impact on young children’s learning of specific parent-initiated activities has been less than definitive. On the one hand, studies conducted in Canada and the United States respectively indicate that young children of parents who instruct their children on, for example, counting or simple addition, perform better on tests of achievement than children of parents who do not, and that within these cultural groups, children of ethnically Chinese parents achieve higher still (Lefevre, Clarke, and Stringer 2002; Huntsinger et al. 2000). On the other hand, an American study of low-income mothers of differing ethnicities found that similar activities had no impact on children’s achievement, a finding the authors attributed to mothers’ limited range of instructional strategies (Leyva, Tamis-LeMonda, and Yoshikawa 2019).

That said, studies of less formal activities seem to have been more definitive. For example, at ages four (Vandermaas-Peeler, Ferretti, and Loving 2012) and five (Ramani and Siegler 2008), children of American parents who both initiate and offer appropriate support during the playing of board games like snakes and ladders acquire a numerical competence lacking in other children. Similarly, an intervention study designed to improve the quality of the home numeracy environment, found that children of Australian parents who engaged didactically with dice-based counting games performed significantly higher on a test of mathematics achievement than children in the control group (Niklas, Cohrssen, and Tayler 2016). Other forms of home-initiated activities have also been shown to impact positively on young children’s acquisition of mathematical competence. For example, Vandermaas-Peeler et al. (2012) invited American parent–child dyads to complete the same cooking recipe. However, experimental dyads also received numeracy activities to include at different stages of the recipe’s implementation, while control dyads did not. They found that the four-year old children in the experimental dyads learned to behave in more mathematically sophisticated ways than their control dyad peers. Other studies have shown American parents’ number talk to be a significant predictor of later cardinal number knowledge (Levine et al. 2010), with children of American parents who engage them in counting sets of present and visible objects developing a more robust cardinal-number knowledge than children of parents who do not (Gunderson and Levine 2011). Also, a study of American mothers found the mathematical quality of mealtime conversation to be implicated in children’ mathematical competence, even after variables like mothers’ education had been controlled for (Susperreguy and Davis-Kean 2016).

Finally, a number of studies have examined the impact on learning of the orientation of parents’ activities. In this respect, studies of American parents (Leyva, Tamis-LeMonda, and Yoshikawa 2019), Canadian parents (Lukie et al. 2014) and Finnish mothers (Aunola et al. 2013) have found autonomy-supportive interactions to be more productive than controlling interactions in promoting young children’s interest and achievement in mathematics. Importantly, highlighting the importance of researchers clarifying which forms of home-initiated activity are implicated in children’s learning, ‘mere rehearsal or direct teaching of mathematics can be maladaptive if perceived as controlling’ (Aunio et al. 2016, 65). Moreover, in the latter context, a strong reciprocal relationship has been found between year-one children’s mathematics achievement and parental beliefs in their children’s competence (Aunola et al. 2003).
In this paper, our goal is to identify and evaluate the appropriateness of the parent-initiated mathematics-related activities offered to year-one children in Sweden. In so doing, we attend to three questions, one of which is addressed empirically through the exploratory study presented below and two by means of our discussion of the empirical results. These are

- What forms of mathematics-related activity do parents of year-one Swedish children initiate?
- How do such activities compare with what the literature has shown to be effective?
- Are Swedish teachers’ concerns about inappropriate parent-initiated activities warranted?

**Methods**

The data on which this paper is based derive from semi-structured interviews conducted with parents of year-one children from the region in and around Stockholm, the capital of Sweden. The interview addressed a range of issues concerning parents’ roles in relation to their children’s learning and one broad question, on which this paper is based, asked parents about the mathematics-related activities they initiate at home. In addition, motivated by the results of interviews with Swedish teachers (Sayers et al. 2020), a broad question concerning the role of homework was included.

Procedurally, the principals of several schools, located in demographically different areas in and around Stockholm, were approached to elicit their support and invited to act as conduits through which parents could be contacted. The first three schools to be contacted agreed to participate. Due to their locations within the Stockholm region, we have labelled the schools Centre, Suburb and Satellite. It is important to note that in the context of Stockholm, city centre schools typically cater for families of relatively high socio-economic status, suburban schools serve ethnically mixed communities of relatively low socio-economic status, while the satellite town reflects a mixture of all characteristics.

The three schools yielded 25 semi-structured individual interviews, a number sufficient for establishing thematic saturation in such contexts (Guest, Bunce, and Johnson 2006). With the principals’ support, 22 interviews were timed to coincide with parents’ visits to schools for their children’s twice-yearly development talks (utvecklingsamtal) and undertaken in private rooms at the different schools, while a further three were held at parent’s workplaces. Parents, informed of their rights, gave written consent to participate. With one exception, interviews, which lasted between 20 and 30 min, were conducted in Swedish by native speakers of Swedish. The single exception concerned a recent immigrant, who asked for her interview to be conducted in English. All interviews were recorded for transcription, which was undertaken by native speakers of Swedish who are also fluent in English.

Each transcript was read and any utterance concerning home-initiated number-related activities was copied and pasted into a new file for each interview. Acknowledging the exploratory nature of the project, these new files, whose content was solely related to parent-initiated activities, were subjected to the constant comparison analytical process of the grounded theorists, whereby a random file was read and themes identified and
coded. A second script was examined for evidence in support of themes identified earlier and any new themes, in which case previous files were reread to see if the new themes had been missed on the first reading. The process was repeated until all transcripts had been coded. Importantly, to minimise any loss of contextual meaning and honour as far as is practicable the integrity of informants’ contributions, analyses were undertaken on the Swedish texts before quotes selected for inclusion in this paper were translated into English. This latter process frequently entailed transforming Swedish idioms into forms recognisable to an English-speaker without losing the speaker’s intended meaning.

**Results**

To preserve anonymity, all parents were given codes determined by their child’s school and a unique reference number. Thus, the one parent from Satellite School was designated Sat1. The fifteen parents from Suburb School were designated Sub2 through Sub16, while the nine parents from Centre School were designated Cen17 through Cen25. Ordinarily, and to honour participants’ contributions, we would have used pseudonyms. However, 25 pseudonyms would be as anonymous as the codes we have used and, furthermore, mask which schools were represented by the individual parents. Also, truly honouring parents’ contributions would have necessitated using Swedish forenames, many of which are likely to be unfamiliar to readers of IJEYE. Finally, because we are reporting on parents’ utterances, and to facilitate the reader’s navigation of the text, any numbers spoken during interview have been written as words and not symbols.

While the principal aim of this study on how parents support their children’s learning of mathematics, it is important to note that every parent commented on how they supported their child’s reading. This was unsurprising as reading homework was not only given to all children but generally well-received. Typical of others, Sub7 noted that her son gets reading homework (and) should read ten minutes a day … We try for a quarter to twenty minutes every night, but not at the weekends … I think it’s pretty good with the homework. He should read aloud from a book and talk about what he has read.

However, mathematics homework was a rarity, prompting some parents to express uncertainty as to what mathematics their children were learning and how they could support it. For example, Cen22 commented that ‘the subject is a tad invisible … it would be good to see what … what they are doing’. This uncertainty appeared a barrier to some parents’ involvement, as seen in Sub10’s comment that ‘it is so difficult to know what level one should work on. It could be the clock, it could be what is four times three?’. But what level should you put it on?’. Finally, summarising many parents’ concerns, Cen18 observed that

I have also been thinking about whether we should start practising more at home. Or is there something I can do to help her … But there is a concern in me; I feel that I do not want her to fall behind … but I do not know how they teach and I do not want to influence it for her. It is a difficult balance precisely because I feel that she has such resistance to mathematics while the teacher says that everything is fine.

Acknowledging such uncertainties, all parents spoke in various ways about what they did at home with their children. In this respect, the analytical process described earlier
yielded three broad categories of parent-initiated activity, concerning the use of games, contextualised mathematics activities and decontextualised mathematics activities. In the following, we present each of these three broad themes in turn.

**The role of play in children’s learning of mathematics**

Few parents did not mention the role of play in their children’s learning of mathematics. Some spoke only in general terms, as in Sub11’s comment that ‘we support his mathematical knowledge because he has a natural interest in it. So, we hook on with play or fun stuff’. Others were a little more specific. For example, Cen21 commented that her son ‘wants to continue with mathematics, he wants to memorise all the times tables. He told me, ‘I will play a game with you; if I give you this, minus this, how much I will get?’ So, we practice’. Similarly, Cen25 commented that ‘I think about when we sit and do other things and so one says, ‘shall we talk a little about ten friends?’ And then it becomes … like a little game almost’.

Others spoke of playing school, as exemplified in Sub12’s comment that ‘we sometimes play school at home’. Sub4 expanded on this theme, commenting that ‘we play school sometimes; we do these simple plus and minus games’, before adding that ‘we sit at a board; one is a teacher and is sitting at a whiteboard, and then we write numbers and stuff. She thinks it’s fun to play school’. A small number spoke of how they used the external environment as a space for learning. In this respect, Cen17 commented that ‘we usually play when we are out walking … for example, take the number two. I say two and she says three … and she says six, and so on’, while Cen18 spoke of ‘counting trees, cones and stones, to make it more practical … so that it becomes more playful’.

However, the dominant play-related theme concerned the use of commercially produced puzzles and games that parents believe provide informal support for their children’s learning of mathematics. For example, in addition to talking of ‘spontaneous things like counting steps’, Sub11 mentioned playing games of ‘Memory; how many pairs do you have and how many pairs do I have? Who has the most and the least and who won?’. However, the comments of most were typified by Sub13:

> If you look at mathematics in a wider context … Uno, Yatzy, there are counting games, Pass the pig … I have tried to get her interested in such maths games on her tablet as well. Sometimes she’ll say, ‘I have nothing to do’, then she gets to play maths games.

Indeed, mathematical games or apps were mentioned by several. For example, Sub10 commented that ‘maybe one may actively make sure that they play more with apps that have a little learning function’, while Cen18, seemingly conscious of a need to prevent her daughter realising she was doing mathematics, said that

> We have a game, which she got as a Christmas present, a math game, based on simple numbers … Then she has an app, which I downloaded … I thought she might need to play with this because I did not want to say that ‘now we are going to study maths’.

All that being said, Sub3 spoke in a less than enthusiastic manner, saying that

> The motivation for pursuing mathematics studies in our home is quite low. So, we’re bad at it, spontaneously playing maths at home. I think I see why you ask that. It must be the easiest way to get young children to understand maths.
Overall, the majority of parents seemed not only confident that playing number-related or strategy-related games enhances their children’s learning of mathematics but also that games have the potential to subordinate learning to being able to share enjoyment together.

Activities involving contextualised mathematics

Throughout the transcripts examples of contextualised activities parents believed would facilitate their children’s learning of mathematics. For some, these were explicitly tied to helping children count, as in Sub13’s comment that they ‘do practical things at home, ‘how many steps is this?’ and ‘Which is in the middle?’. ‘How many above and below?’ and Cen17’s assertion that they ‘count, everyday things like when you go to the store … or that, now we are three, how many do we need. Now we are five at home, how many should we have?’’. Similarly, Sub14 commented that her children are lucky to have a father who is very interested in mathematics. He has always counted with them … or given them maths in everyday life, like, ‘If you have two here and four there, how many do you have?’

In discussing their counting-related activities, all three of Sub13, Sub14 and Cen17 alluded to everyday calculations, a theme picked up by others. For example, Sub2 spoke of posing problems like, ‘you have five hairclips and take away three, how many do you have left?’, while Sub16 said that ‘if they have money for example. If you have five, is it more or less? So that you always have to think ‘Do you have enough money or do you have insufficient money?’, before adding that ‘one tries constantly to bring mathematics into the environment. That’s probably what we do most’. Similarly, Sub6 mentioned that ‘when we go out, we may ask, ‘if I buy this and pay one hundred kronor, what do I get back?’ There can be many such everyday examples’.

A very different form of contextualised activity concerned the preparation of food to facilitate children’s engagement with mathematics. For some, such occasions provide concrete opportunities for children to engage with quantities, as seen in Cen17’s comment that they look for ‘everyday things … especially at the food table … A lot about food because that is very good, because it will be very concrete for her’. Others spoke in ways indicative of an awareness, not always made explicit, that preparing food embodied key mathematical concepts. For example, Sub5 implied that food preparation involved simple arithmetical operations, saying, with respect to her daughter, that ‘if you’re going to cook and if we are going to look at recipes and such, you know she is juggling a little and thinking and taking away and adding and such like. Others alluded to proportion, as found in Sub15’s comment concerning ‘cooking porridge; two decilitres of water, one decilitre of porridge’ and Sub6’s comments about the baking of buns, ‘should we double this recipe? If we’re going to make twice as many buns. How many should there be then?’ Measurement was implied in Sub3’s comment that ‘we bake; measuring everything, volume, weight’, while estimation was found in Sub4’s assertion that ‘perhaps it (a recipe) says a tablespoon. Then she asks, ‘how much is that?’ Then maybe I show that you can estimate it by hand instead of measuring’. In addition, Cen23 alluded to both measurement and estimation when saying that
I do not know if it is so conscious from my and my partner’s side but we do that. My partner likes to bake quite a lot and then my daughter, she thinks it is very interesting to be in the kitchen and help cook and bake and so on. So, then there is a lot to measure and mix. Then it will be approximate. It is seldom exactly when you should have a decilitre of flour. So that’s enough, it comes in pretty much naturally.

Interestingly, several of these parents also indicated that their involvement with their children’s mathematics would end with the kitchen. In this respect, having spoken of porridge making, Sub15 added, ‘but no more than that’, while Sub3, having spoken about the relation between baking and measuring, added ‘but not in any other way. Not, for example, in everyday life. Not that we say ‘now we’ll check how many chairs there are around the table’.

One further theme involved parents speaking about helping their children understand estimation and comparisons. For example, Cen24 spoke of talking with her daughter about the number of children who attend school. She said, ‘how many go to school? Yes, it’s several million or something like that. A thousand no, it might be a few hundred, you notice. A thousand is difficult, I think’, while Sub13 spoke of distance and the use of familiar measures, saying

Distance … they asked ‘how far is it there?’ and we replied ‘it’s kind of like going to school and home’ to get an idea of distance. We get questions like, ‘How long is forty minutes?’, and answer, ‘approximately like a lesson’.

In a related manner, Cen20 offered spoke of how she encourages her son to consider notions of what may or not be reasonable. She said,

We talk a lot about reasonableness. There is a children’s program on UR (Sveriges Utbildningsradio, a public service education broadcaster) called Maths Land. There they have talked about reasonableness; ‘Is it reasonable to order nine potatoes for ninety people?’ So that’s exactly the term we use; ‘Is it reasonable?’

However, while the above were located in familiar contexts and typically offered age-appropriate learning opportunities, one parent, Cen25, described activities that, we argue, are age-inappropriate and may even work against his child’s learning in both the short and the long term. He began by asserting that

I think the one-hundred-year line, he has a line of one hundred years because I thought he would get a sense of what time is. That grandfather was born in the thirties and here you were born. So that you get some kind of … in relation to.

In such an activity, which we concede may be didactically sound for an older child, is a clear assumption that a one-hundred-year number line is cognitively accessible to a year-one child. However, this may be less a concern than what followed. Cen25 said that

he has a hard time grasping quantity in comparison. It can be one million or it can be one hundred. How much does it cost? Does it cost one million? No, it does not cost one million, it does not, it costs one hundred kronor.

Expectations that a year-one child can comprehend what is meant by a million, beyond knowing that it is a very large number, seem problematic. However, what makes Cen25 such a telling case is the narrative presented alongside the tasks. He said, of his own experiences as a young child, that ‘my teacher was annoyed with me because I worked
too fast. I guess it was hard for her to keep the class together when I had nothing to do’. In such an utterance it is possible to see a person with not only little understanding of age-appropriate mathematics tasks but also a failure to understand his son’s readiness for such material, a possibility supported by a further comment that his son ‘thinks maths is boring and difficult, and doesn’t want maths’.

In sum, the majority of parents who described contextualized mathematical activities did so in ways that acknowledged their children’s cognitive readiness and complemented rather than challenged what children would be learning in school. These parents, particularly with respect to food preparation, indicated an awareness that several core concepts of mathematics are implicated in such activity. However, as in the case of Cen25, forcing a child with a clearly articulated dislike of mathematics to engage with age-inappropriate tasks is problematic and may help explain Swedish teachers’ reluctance to engage parents explicitly in their children’s learning.

Activities involving decontextualised mathematics

In half the interviews, parents spoke about mathematical activities independent of any context. For some, these related explicitly to the learning of multiplication tables, as with Sati’s comment that ‘we actually started with multiplication yesterday. We did the two and the three times. He was pretty good at it’ and Sub10’s comment that ‘we try to reel off the multiplication tables and so on at home. Sometimes we throw some number out in the car … “what is two times ten?”, “three times twenty” and such things, as far as possible. Yes, or something like, twelve minus five or twenty-three minus five’. For others, such activity was a consequence of dinner table conversations with older siblings, as seen in the comment of Sub9, who said that ‘since she has a big sister, she joins in. It may be that we do multiplication tables at the dining table and then she does that too’.

Others spoke about posing tasks to encourage the development of arithmetical competence, as in Sub16’s assertion that ‘we try to do some mathematics at home too … A little plus, minus and times’. Others were a little more explicit, with activities ranging from simple addition and subtraction tasks, as seen in Sub2’s comment that, ‘we may say, “what is two plus two”, or other small numbers to add or subtract’ to more complex tasks such as those indicated by Cen24, who said,

I write long lines with a little easier addition and a little yes both plus and minus and now she wants some times. A little multiplication and then I just write … five plus seven and, yes, up to one hundred we have gone now. So, she gets to sit and play with that. She can do that.

In a related vein, and possibly indicative of parents’ concerns over their children’s mathematical development, several parents spoke of providing additional resources. For example, Cen23 mentioned that her partner produces booklets, which her daughter ‘can sit and calculate in’, while Cen20 said that

There are some kind of exercise books they get. I don’t think they have them in school. It should be a little fun, as you know. Now we are in the second book, which is addition in the range ten to twenty, which he is doing now.

Finally, Sub12 spoke of asking his daughter to engage, albeit implicitly, with place value. He said, ‘you can merge thousands with hundreds and tens with units … and things like that’.
In sum, parents described various activities thought to contribute to their year-one children’s mathematical learning. For a few, as with in Sub2’s addition and subtraction of small numbers, these we construe as complementary to those found in school. However, the majority introduced number-related learning outside what would typically be expected of year-one children, particularly any emphases on multiplication tables, the arithmetic of large numbers and place value. Interestingly, one parent, Sub6, challenged explicitly the teaching of tables, saying at these ages you should probably do it (mathematics support) as physically as possible, as visually as possible. So those cubes [in the classroom] I like. A graphic showing what an odd number is. And even numbers can be built with Lego bricks. I like that. I think that is much more important than studying tables. When you see it visually, you get a little feeling for it.

Discussion

Our goals in this paper were three-fold. The first was to elicit the forms of mathematics-related activities parents of year-one children in Sweden initiate. The second was to evaluate those activities against what the literature has indicated is likely to be effective and the third was to consider whether teachers’ beliefs that parents act inappropriately were warranted. In the following, we discuss the results of the first and, in so doing, address the latter two. However, it is important to acknowledge, due to the possibility of bias, that parents who volunteer for interview are typically more positively involved in their children’s schooling than parents who do not.

In all interviews, parents spoke similarly about how they read with their children. They did so with confidence and assurance, in accordance with earlier studies (LeFevre et al. 2009). However, since every represented child received reading homework, the commonality of response was unsurprising. The diversity of parents’ responses, frequently motivated by a lack of mathematics homework, emerged from their comments about home-initiated mathematics activities. Indeed, the extent to which all parents spoke of home-initiated mathematics-related activities may distinguish Swedish parents from their American counterparts who generally construe language development as more important than mathematical (Musun-Miller and Blevins-Knabe 1998). The analytical process described above yielded three forms of activity, concerning the role of games in the learning of mathematics, contextualised mathematics activities and decontextualised mathematics activities. Taken together, they indicate that, unlike their American peers (Cannon and Ginsburg 2008), parents of Swedish year-one children are confident supporting their children’s learning of mathematics. In the following we discuss each in turn against the available literature with the second and third research questions in mind.

With respect to the role of games in year-one children’s learning of mathematics, the majority of parents seemed not only confident that playing board games not only enhances children’s learning of mathematics but creates time for shared enjoyment. Such views accord with earlier research that counting games like snakes and ladders influence significantly young children’s mathematical development (Ramani and Siegler 2008). Indeed, such games, which present informal opportunities for children to work on counting and basic number sequencing, as well as simple arithmetic and
number patterns, each of which is a necessary foundation for later arithmetical learning (Andrews and Sayers 2015), confirm that parents should engage their children in such activities (Niklas, Coehrsen, and Tayler 2016). In other words, it is difficult to imagine why teachers would be sceptical of such activities. In a related vein, several parents spoke of simulating school with their children, which evidence suggests may have a long-term impact on achievement (Worthington and van Oers 2016).

That being said, while simple board games may have a transparent significance with respect to the support parents may provide their children, the role of games on electronic devices is somewhat opaque. For example, while young children believe tablet games enhances their learning of mathematics (Dunn et al. 2018), research on learning outcomes is ambivalent. Children invited to play a suite of number-related games were no more mathematically successful than children invited to play on tablets without the games (Parks and Tortorelli 2020). Importantly, the authors conjectured that the failure of the tablet games to deliver success was partly due to teachers’ lack of confidence with the number games applications. By way of contrast, Schacter and Jo (2017) found that children invited to play a suite of tablet-based games were mathematically more successful than children in a control group that received conventional instruction. In short, the impact of tablet games is difficult to discern, research is ambivalent and teachers are unclear as to how they should be used. Perhaps the only key message for parents is that they should try to ensure that the games they encourage are mathematically age-appropriate and avoid accelerating children’s learning, particularly in countries like Sweden with its strong commitment to educational equity.

Irrespective of their comments about games and play, few parents did not speak of contextualised opportunities for their children to engage in mathematics learning. In so doing, most seemed aware of what would be age-appropriate and, importantly, likely to complement rather than challenge what children would be learning in school. The activities they described were informal, lacking in explicit didactical intent but rooted in concrete experiences that allow children to engage in simple measuring activities and, typically, some sense of proportional reasoning. Importantly, not only do such activities impact positively on young children’s acquisition of mathematical competence (Vandermaas-Peeler et al. 2012) but the quality of such round-the-kitchen conversations, particularly with mothers, has been implicated in children’s mathematical competence, even after variables like mothers’ education had been controlled for (Susperreguy and Davis-Kean 2016). In other words, it would seem that parents’ round-the-kitchen table activities are not only age-appropriate but should be of no concern to teachers worried about inappropriate activities being undertaken at home. In other cases, parents spoke of counting games undertaken while out walking or simple arithmetic tasks like the hairclips example mentioned by Sub2. Such activities, typically involving relatively small numbers are entirely appropriate for year-one children and should complement what teachers do in school (Andrews and Sayers 2015).

There are exceptions, but these should not be seen to undermine the quality and appropriateness of most parents’ contextualised activities. For example, particularly as working with numbers up to and including 20 should be considered a reasonable goal for year-one children (Andrews and Sayers 2015), inviting children to work with large sums of money, as in the Sub6’s example, may not be age-appropriate. Of greater concern, perhaps, are the examples cited by Cen25. On the one hand, his talking of

INTERNATIONAL JOURNAL OF EARLY YEARS EDUCATION 841
inviting his son to count in fives through the use of five kronor pieces could be construed as didactically sound. On the other hand, however, his discussion of the one-hundred-year line and his son’s inability to grasp the nature of one million may be problematic, not least because around half of all adults incorrectly locate one million halfway between one thousand and one billion on a number line (Landy, Silbert, and Goldin 2013). In such circumstances, parents offering children such age-inappropriate tasks may help explain Swedish teachers’ reluctance to engage parents explicitly in their children’s learning.

With respect to decontextualised activities, a third of all parents spoke of how they encouraged children to learn multiplication tables. Such activities resonate with a study of English parents, who not only initiate interventions focused on children’s learning of multiplication tables, initiatives at odds with schools’ aims, but also imposed different algorithms from those taught at school, particularly subtraction (de Abreu and Cline 2005). Such activities are problematic, not least because multiplication is likely to be conceptually beyond most year-one children, who are unlikely to have acquired an adequate understanding of, for example, repeated addition. By way of contrast, those parents who spoke of posing addition and subtraction tasks, typically situated in the range 1-20, may have a stronger conception of age-appropriateness in accordance with research-derived expectations for children at that age (Andrews and Sayers 2015). Thus, the substantial proportion of parents encouraging the learning of multiplication tables, and other competence, may have contributed to teachers’ failure to trust parents’ interventions in ways that mask the age-appropriate activities of the minority.

Irrespective of the mathematical efficacy of the activities they initiate, it is likely that parents’ engagement with their children will reduce children’s mathematics-related anxiety (Vukovic, Roberts, and Wright 2013) and impact positively on academic socialisation, which has been shown to have a strong association with academic achievement (Hill and Tyson 2009). However, as the utterances of some parents have shown, their interventions may be located in limited conceptions of mathematics (Remillard and Jackson 2006), not least because their prior experiences of mathematics influence, both consciously and unconsciously, how they respond to and support their children’s learning of the subject.

In closing, before turning attention back to our research questions, it is important to acknowledge that despite the demographic variation of the three participating schools, most parents were relatively well-educated. Consequently, caution should be exercised in interpreting any insights to emerge from what may have been an atypical and largely self-selected group of parents. That being said, the data yielded by our interviews do offer some insights in relation to our three research questions. First, Swedish parents of year-one children initiate a range of activities they believe will enhance their children’s learning. They do so because, like all parents, they want their children to succeed in school. The three forms of activity identified above, concerning games, contextualised mathematics activities and decontextualised mathematics activities, offer different opportunities for children to learn and, importantly, engage in the maintenance of productive familial relationships. Second, most of the activities parents initiate (particularly those related to board games, most contextualised tasks and some decontextualised tasks) are not only age-appropriate and known to enhance children’s mathematical learning but are more likely to complement teachers’ efforts than not. However, the impact of
computer games remains unclear and decontextualised activities focused on multiplication tables are likely to be inappropriate for most children. Third, while there is evidence that teachers’ concerns are not without some substance, overall parents’ activities do not undermine schools’ efforts and confirm the need for teachers to engage more openly with parents on such matters (Goddard, Tschannen-Moran, and Hoy 2001). However, the age-inappropriate tasks initiated by some parents are problematic and point us towards our concluding thoughts. In order to fully understand the impact on learning of different forms of parent-initiated activity, colleagues need to abandon their preconceptions and determine what parents actually do before looking to evaluate their efficacy.

Disclosure statement
No potential conflict of interest was reported by the author(s).

Funding
The authors acknowledge the financial support of Vetenskapsrådet, project grant 2015-01066, without which the work reported in this paper would not have been possible.

ORCID
Jöran Petersson http://orcid.org/0000-0001-5609-0752
Judy Sayers http://orcid.org/0000-0002-9652-0187
Paul Andrews http://orcid.org/0000-0003-3679-9187

References
Andrews, Paul, Jöran Petersson, and Judy Sayers. 2021. “A Methodological Critique of Research on Parent-Initiated Mathematics Activities and Young Children’s Attainment.” Educational Studies in Mathematics. Advance online publication. doi:10.1007/s10649-021-10080-x.

Andrews, Paul, and Judy Sayers. 2015. “Identifying Opportunities for Grade One Children to Acquire Foundational Number Sense: Developing a Framework for Cross Cultural Classroom Analyses.” Early Childhood Education Journal 43 (4): 257–267. doi:10.1007/s10643-014-0653-6.

Aunio, Pirjo, Anna Tapola, Riikka Mononen, and Markku Niemivirta. 2016. “Early Mathematics Skill Development, Low Performance, and Parental Support in the Finnish Context.” In Early Childhood Mathematics Skill Development in the Home Environment, edited by Belinda Blevins-Knabe, and Ann Berghout Austin, 51–70. Springer. doi:10.1007/978-3-319-43974-7_4.

Aunola, Kaisa, Jari-Erik Nurmi, Marja-Kristiina Lerkkanen, and Helena Rasku-Puttonen. 2003. “The Roles of Achievement-Related Behaviours and Parental Beliefs in Children’s Mathematical Performance.” Educational Psychology 23 (4): 403–422. doi:10.1080/0144341032000096274.

Aunola, Kaisa, Jaana Viljaranta, Erno Lehtinen, and Jari-Erik Nurmi. 2013. “The Role of Maternal Support of Competence, Autonomy and Relatedness in Children’s Interests and Mastery Orientation.” Learning and Individual Differences 25 (June): 171–177. doi:10.1016/j.lindif.2013.02.002.

Björk, Lars, and Tricia Browne-Ferrigno. 2016. “Parent-School Involvement in Nordic Countries: A Crossnational Comparison.” International Journal of Pedagogies and Learning 11 (2): 103–117. doi:10.1080/22040552.2016.1227251.
Cannon, Joanna, and Herbert Ginsburg. 2008. ““Doing the Math”: Maternal Beliefs About Early Mathematics Versus Language Learning.” *Early Education and Development* 19 (2): 238–260. doi:10.1080/10409280801963913.

de Abreu, Guida, and Tony Cline. 2005. “Parents’ Representations of Their Children’s Mathematics Learning in Multiethnic Primary Schools.” *British Educational Research Journal* 31 (6): 697–722. doi:10.1080/01411920500314869.

Dunn, Jill, Colette Gray, Pamela Moffett, and Denise Mitchell. 2018. “It’s More Funner Than Doing Work”: Children’s Perspectives on Using Tablet Computers in the Early Years of School.” *Early Child Development and Care* 188 (6): 819–831. doi:10.1080/03004430.2016.1238824.

Goddard, Roger D., Megan Tschannen-Moran, and Wayne K. Hoy. 2001. “A Multilevel Examination of the Distribution and Effects of Teacher Trust in Students and Parents in Urban Elementary Schools.” *The Elementary School Journal* 102 (1): 3–17. doi:10.1086/499690.

Guest, Greg, Arwen Bunce, and Laura Johnson. 2006. “How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability.” *Field Methods* 18 (1): 59–82. doi:10.1177/1525822x05279903.

Gunderson, Elizabeth, and Susan Levine. 2011. “Some Types of Parent Number Talk Count More Than Others: Relations Between Parents’ Input and Children’s Cardinal-Number Knowledge.” *Developmental Science* 14 (5): 1021–1032. doi:10.1111/j.1467-7687.2011.01050.x.

Hill, Nancy, and Diana Tyson. 2009. “Parental Involvement in Middle School: A Meta-Analytic Assessment of the Strategies That Promote Achievement.” *Developmental Psychology* 45 (3): 740–763. doi:10.1037/a0015362.

Huntsinger, Carol, Paul Jose, Shari Larson, Dana Balsink Krieg, and Chitra Shaligram. 2000. “Mathematics, Vocabulary, and Reading Development in Chinese American and European American Children Over the Primary School Years.” *Journal of Educational Psychology* 92 (4): 745–760. doi:10.1037/0022-0663.92.4.745.

Huntsinger, Carol, Paul Jose, and Zupei Luo. 2016. “Parental Facilitation of Early Mathematics and Reading Skills and Knowledge Through Encouragement of Home-Based Activities.” *Early Childhood Research Quarterly* 37 (4): 1–15. doi:10.1016/j.ecresq.2016.02.005.

Janssen, Marije, Joep Bakker, Anna Bosman, Kirsten Rosenberg, and Paul Leseman. 2012. “Differential Trust Between Parents and Teachers of Children from Low-Income and Immigrant Backgrounds.” *Educational Studies* 38 (4): 383–396. doi:10.1080/03055698.2011.643103.

Karlsen Bæck, Unn-Doris. 2010. “‘We are the Professionals’: A Study of Teachers’ Views on Parental Involvement in School.” *British Journal of Sociology of Education* 31 (3): 323–335. doi:10.1080/01425691003700565.

Kleemans, Tijs, Marieke Peeters, Eliane Segers, and Ludo Verhoeven. 2012. “Child and Home Predictors of Early Numeracy Skills in Kindergarten.” *Early Childhood Research Quarterly* 27 (3): 471–477. doi:10.1016/j.ecresq.2011.12.004.

Landy, David, Noah Silbert, and Aleah Goldin. 2013. “Estimating Large Numbers.” *Cognitive Science* 37 (5): 775–799. doi:10.1111/cogs.12028.

LeFevre, Jo-Anne, Tamara Clarke, and Alex P. Stringer. 2002. “Influences of Language and Parental Involvement on the Development of Counting Skills: Comparisons of French- and English-Speaking Canadian Children.” *Early Child Development and Care* 172 (3): 283–300. doi:10.1080/03004430212127.

LeFevre, Jo-Anne, Sheri-Lynn Skwarchuk, Brenda Smith-Chant, Lisa Fast, Deepthi Kamawar, and Jeffrey Bisanz. 2009. “Home Numeracy Experiences and Children’s Math Performance in the Early School Years.” *Canadian Journal of Behavioural Science* 41 (2): 55–66. doi:10.1037/a0014532.

Levine, Susan, Linda Suriyakham, Meredith Rowe, Janelle Huttonlocher, and Elizabeth Gunderson. 2010. “What Counts in the Development of Young Children’s Number Knowledge?” *Developmental Psychology* 46 (5): 1309–1319. doi:10.1037/a0019671.
Leyva, Diana, Catherine Tamis-LeMonda, and Hirokazu Yoshikawa. 2019. “What Parents Bring to the Table: Maternal Behaviors in a Grocery Game and First Graders’ Literacy and Math Skills in a Low-Income Sample.” The Elementary School Journal 119 (4): 629–650. doi:10.1086/703104.

Lukie, Ivanna, Sheri-Lynn Skwarchuk, Jo-Anne LeFevre, and Carla Sowinski. 2014. “The Role of Child Interests and Collaborative Parent–Child Interactions in Fostering Numeracy and Literacy Development in Canadian Homes.” Early Childhood Education Journal 42 (4): 251. doi:10.1007/s10643-013-0604-7.

Missäll, Kristen, Robin Hojnoski, Grace Caskie, and Patrick Repasky. 2015. “Home Numeracy Environments of Preschoolers: Examining Relations among Mathematical Activities, Parent Mathematical Beliefs, and Early Mathematical Skills.” Early Education and Development 26 (3): 356–376. doi:10.1080/10409289.2015.968243.

Musun-Miller, Linda, and Belinda Blevins-Knabe. 1998. “Old Math, New Math: Parents’ Experiences with Standards-Based Reform.” Early Education and Development 9 (4): 370–383. doi:10.1080/10409289.1998.1076676.

Niklas, Frank, Caroline Cohrssen, and Collette Tayler. 2016. “Improving Preschoolers’ Numerical Abilities by Enhancing the Home Numeracy Environment.” Early Education and Development 27 (3): 372–383. doi:10.1080/10409289.2015.1076676.

Ramani, Geetha, and Robert Siegler. 2008. “Promoting Broad and Stable Improvements in Low-Income Children’s Numerical Knowledge Through Playing Number Board Games.” Child Development 79 (2): 375–394. doi:10.1111/j.1467-8624.2007.01131.x.

Remillard, Janine, and Kara Jackson. 2006. “Old Math, New Math: Parents’ Experiences with Standards-Based Reform.” Mathematical Thinking and Learning 8 (3): 231–259. doi:10.1207/s15327833mtl0803_3.

Sayers, Judy, Jöran Petersson, Gosia Marschall, and Paul Andrews. 2020. “Teachers’ Perspectives on Homework: Manifestations of Culturally Situated Common Sense.” Educational Review. Advance online publication. doi:10.1080/00131911.2020.1806786.

Sayers, Judy, Jöran Peterssson, Eva Rosenqvist, and Paul Andrews. 2021. “Swedish Parents’ Perspectives on Homework: Manifestations of Principled Pragmatism.” Educational Inquiry. Advance online publication. doi:10.1080/20004508.2021.1950275.

Schacter, John, and Booil Jo. 2017. “Improving Preschoolers’ Mathematics Achievement with Tablets: A Randomized Controlled Trial.” Mathematics Education Research Journal 29 (3): 313–327. doi:10.1007/s13394-017-0203-9.

Skwarchuk, Sheri-Lynn, Carla Sowinski, and Jo-Anne LeFevre. 2014. “Formal and Informal Home Learning Activities in Relation to Children’s Early Numeracy and Literacy Skills: The Development of a Home Numeracy Model.” Journal of Experimental Child Psychology 121 (May): 63–84. doi:10.1016/j.jecp.2013.11.006.

Susperreguy, Maria Ines, and Pamela. Davis-Kean. 2016. “Maternal Math Talk in the Home and Math Skills in Preschool Children.” Early Education and Development 27 (6): 841–857. doi:10.1080/10409289.2016.1148480.

Vandermaas-Peeler, Maureen, Erin Boomgarden, Lauren Finn, and Caroline Pittard. 2012. “Parental Support of Numeracy During a Cooking Activity with Four-Year-Olds.” International Journal of Early Years Education 20 (1): 78–93. doi:10.1080/09669760.2012.663237.

Vandermaas-Peeler, Maureen, Larissa Ferretti, and Sara Loving. 2012. “Playing the Ladybug Game: Parent Guidance of Young Children’s Numeracy Activities.” Early Child Development and Care 182 (10): 1289–1307. doi:10.1080/03004430.2011.609617.
Vukovic, Rose, Steven Roberts, and Linnie Wright. 2013. “From Parental Involvement to Children’s Mathematical Performance: The Role of Mathematics Anxiety.” *Early Education and Development* 24 (4): 446–467. doi:10.1080/10409289.2012.693430.

Worthington, Maulfry, and Bert van Oers. 2016. “Pretend Play and the Cultural Foundations of Mathematics.” *European Early Childhood Education Research Journal* 24 (1): 51–66. doi:10.1080/1350293X.2015.1120520.