Opportunities for learning in parent-child discussions about written numbers in everyday life

Chronoula Voutsina, Lois George, Stephanie Flack

Opportunities for learning in parent-child discussions about written numbers in everyday life

Chronoula Voutsina[1], Lois George[2] and Stephanie Flack[1]

[1]University of Southampton, Southampton Education School, Southampton, UK; cv@soton.ac.uk

[2] The University of The West Indies, Mona Campus, School of Education, Kingston, Jamaica

This paper presents findings from the 'Written Numbers in Everyday Life' project, that has been implemented with families of 3–5-year-old children in the UK and Jamaica. The project aims at empowering families to utilise opportunities for talk about written numbers on everyday objects in their environment. We conducted a qualitative thematic analysis of 72 posts (39 from the UK, 33 from Jamaica) that participating families uploaded to an online platform. Three themes emerged in discussions that parents reported that they had with their child: comments with a conceptual focus, comments with a conceptual and mathematical/numerical focus, comments with a conceptual and social purpose focus. The findings provide insights into the wide-ranging opportunities for learning that arise when parents are prompted and supported to recognise and use numerals in the everyday environment, as a learning resource.

Keywords: Written numbers, preschool, home environment, family engagement with learning.

Introduction

Family engagement is an early influencing factor on children's knowledge and dispositions towards mathematics, which, in turn, are linked with early and persistent attainment gaps (James-Brabham et al., 2023). The frequency of intentional parental engagement (Napoli & Purpura, 2018) and parental talk about number (Levine et al., 2010), have been highlighted as important for early mathematics development. Furthermore, positive dispositions, such as curiosity and interest in mathematics ideas are key factors in children's mathematics learning (Ginsburg et al., 2008), and these too are influenced by home experiences (Gervasoni & Perry, 2017). However, research has shown that some parents may be reluctant to engage with mathematics (Gervasoni & Perry, 2017) and parental engagement may be best achieved by incorporating early maths "within parents' overall, existing roles and responsibilities" (Mazzocco & Claessens, 2020, p. 3).

This paper presents findings from the 'Written Numbers in Everyday Life' project, that has been implemented with families of 3–5-year-old children in the UK and Jamaica. The project aims at empowering families to recognise and utilise everyday opportunities for talk about written numbers and their multiple meanings. The study that is reported here is part of the wider project. It is underpinned by the idea that the everyday knowledge and skills that are developed by diverse families' everyday experiences need to be recognised as 'funds of knowledge' (Moll et al., 1992), that can be built upon and used as resources for supporting learning. Thus, we explore the opportunities for learning that can emerge within family-based activities that prompt and support intentional adult-child talk about numerals in everyday environments, within two different cultural contexts. Eason et al. (2022) highlight the need to understand how diverse family contexts and activities can enhance early engagement with mathematics. This study addresses this critical gap in

early mathematics learning by seeking to answer the following research question: What themes emerge in adult-child conversations about the meanings of written numbers in everyday life, as reported by parents in the UK and Jamaica?

Fostering intentional parental talk about numerals in the environment

Written numbers, that is, Hindu-Arabic numerals in digit form (e.g., 8, 63) are cultural artefacts that represent quantitative and non-quantitative ideas (Brizuela, 2004). Research exploring young children's experiences with number in the family context has focused mainly on the impact of mathematically focused family activities on competencies such as counting and computational skills (e.g., Levine, et al., 2010). However, children see "very few examples of the computational use of written numbers before they come to school" as "written numbers, in our society, represent a large variety of numeral and/or quantitative concepts, as well as being exploited for other purposes." (Sinclair & Sinclair, 1984, p. 174). In everyday life, preschool children encounter numerals on everyday objects, such as, food/games packaging, books, the TV, and various kinds of signs that may have quantitative meanings (e,g., representing cardinality) and also numerals that have "social uses" and "nonquantitative purposes" (Tolchinsky, 2003, p. 110), such as, numbers on buses, phone numbers and barcode numbers, which are underpinned by social knowledge and communicate meanings that help us organise our lives. The role of adults (carers, teachers) in supporting children to make connections between their knowledge about numerals at preschool/school and the social knowledge about the use of numerals outside school, is important, for minimizing the risk of school mathematics becoming an alienating experience (Munn & Kleinberg, 2003).

As part of a previous study that adopted a phenomenographic approach (Voutsina & Stott, 2023), we found that, to make sense of the messages/meanings that numerals communicate in their everyday environment, preschool children combine knowledge of the following: Recognition of *a numeral* as a number (and not as a letter, for example), recognition of *the object* on which a numeral appears, recognition of *the context/location/situation* within which they encounter a numeral, and recognition *of other symbols* that may accompany a numeral, denoting its meaning (e.g., £, Kg, ml). Based on this evidence, we designed the "Written Numbers in Everyday Life' programme that aims to foster children's curiosity and awareness about the multiple meanings of written numbers outside the classroom, and support family talk about written numbers in everyday life. The programme involves a sequence of family-based Number Spotting challenges that prompt families to look for, at home or outside, either a specific numeral on different objects and in different contexts/locations that represents different concepts and communicates different meanings (e.g., the written number 4 on different objects representing, age, size, price etc.), or look for different written numbers that represent the same, specific concept (e.g., look for different written numbers that all show size on items of clothing/shoes, or different numbers that show age, or numbers that show quantity etc). In designing the challenges that aim at making children aware of the multiple meanings that numerals have in life outside the classroom, we drew from elements of Variation Theory (Björklund, 2016). We used variation and invariance to contrast examples of numerals, objects, contexts, other symbols and the multiple concepts/meanings that numerals represent, in order to support discernment of each of the aforementioned elements separately, as well as simultaneous discernment of more than one of the above elements and their relationship. All challenges are included in a set of printed family

activity postcards. Each postcard includes the same three prompts that adults are encouraged to use in conversations with their child about the spotted number: *What* does the number tell us? *Who* needs to know this? *Why*?

Implementation and method of data collection

Teachers in participating preschools send two activity postcards to each family every week, for 6-7 weeks. For each classroom, the researchers create a unique link to a Padlet board (Padlet is a software that provides access to shared digital boards where individuals or groups can upload and share visual/textual material). The instructions given to parents are to upload a photograph of the numeral that their child spotted as part of each challenge, showing the object and the location where it was spotted, together with a short comment on what they discussed about the number with their child. The Padlet enables us to collect data that provide insights on how different families engage with the programme, including the contexts, locations, activities and interactions that parents report.

We have introduced the programme to families of 3–5-year-old children in the UK, as well as in Jamaica, as we were interested in examining its transferability to a different cultural context. Jamaica was selected because English is the official language of teaching and the curriculum is still broadly aligned with the English curriculum. For this paper, we focus on the Padlet data that we collected from: three preschools (3–4-year-old children) and one Reception class (4–5-year-old children) in the UK, and two preschools (3–5-year-old children) in Jamaica, during the first year of piloting the use of the Padlet. Ethics permission was granted by the Ethics Committee of the University of Southampton (ERGO 80253) and the University of The West Indies, Mona campus (CREC-MN.099, 2023/2024).

Data analysis

Family engagement with the Padlet was voluntary and varied. Some families who participated in the programme did not post on the Padlet at all or did not post regularly. Parents' comments in posts varied in detail, focus and length. We received a total of 127 Padlet posts from UK families and 105 posts from parents in Jamaica over the course of seven weeks. To address the research question, we focused our analysis on a selected sample of 72 posts (39 from the UK and 33 from Jamaica). These were posts with comments that provided information on the discussion that parents reported that they had with their child about the meaning of the spotted number. Posts with comments related to numeral recognition/identification (e.g., "AC noticed there was a 2 and a 5 on our door!") or other brief comments with no reference to the parent-child discussion, were not included. All posts were anonymous. Therefore, we do not have data on how many different families provided the analysed comments. To analyse the comments, we applied inductive thematic analysis (Braun & Clarke, 2006). Through a "compare-and-contrast" approach (Boyatzis, 1998), we grouped comments under categories based on the aspects of the meaning of numerals that parents focused on in their reported discussions with children.

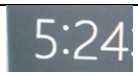
Findings

Three themes emerged: comments with a conceptual focus, comments with a conceptual and mathematical/numerical focus, and comments with a conceptual and social use/purpose focus.

Comments with a conceptual focus

With comments grouped under the conceptual focus category (examples shown in Table 1), parents reported having a discussion with their child about the concept that the spotted numeral represented, such as, the cost of items in the supermarket (e.g., post 1, Table 1), the age or size communicated by numerals on clothing labels (post 2, Table 1), without any further detail about the discussion.

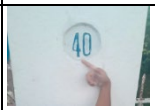
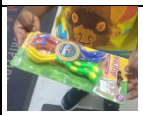
Table 1. Comments focusing on the concept that the numeral represents

1		Whilst out shopping, we discussed the numbers on the shelves and the symbols next to them that show it means the price of the item. Theo was able to identify single numbers, such as 7, 6 etc. (UK)
2		CM saw that there was a number on her sandal. She did not know what the number meant. We had a discussion about shoe sizes. (JM)
3		We found the number 10 at the park and we spoke about how it is used as a date every month! (UK)
4		He visited my work and whilst on the laptop he says mommy I see the number 5. I said, yes, it's the time. (JM)

Comments with a conceptual and mathematical/numerical focus

Some comments indicated parent-child discussions that extended to mathematical/numerical-related notions and skills, such as counting, and/or references to specific attributes of the spotted numerals (e.g., naming of 2- or 3-digit numbers, discussing digital numbers). For example, parents reported prompting their child to count items in a box with the numeral 5 on, or practice verbal counting up to the spotted number (post 1, Table 2), or supporting their child's reading of 2-digit numbers (post 2, Table 2). The third post in Table 2 includes reference to multiplicative ideas ("two of each"), while post 4 reports the parent's use of the opportunity arising from spotting numeral 3 on a digital clock, to explain about analogue and digital representations of time and notions such am/pm, day and night. After a child's query whether 10.2 that they spotted on a thermostat is a 10 or not (post 5, Table 2), the parent uses this as an opportunity to discuss decimal numbers and the symbol for degrees Celsius, making a link with how the temperature that is represented by the numeral is experienced by them at home. Posts 6 and 7 (Table 2) are indicative of discussions extending to notions such as shorter/longer width in the context of spotting numeral 3 on a ruler, and references to comparing higher/lower values and to the notion of weight, based on numerals spotted on children's clothes.

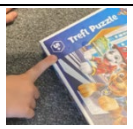
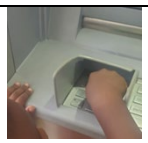
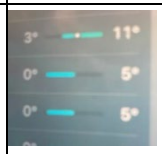
Table 2. Comments that include conceptual and mathematical/numerical focus

1		We found a bath toy in the pharmacy. I asked him to count the items in the package and he did so correctly. I then asked him how many toys are in the package and he said 5. I then asked him to show me the number 5 on the package and he did. We talked about the fact that the number says how many things are in the package. (JM)
2		Caria spotted this number on the column of my coworkers house all on her own and showed it to me. She said "mommy, it's a 4 and 0" I told her the number is 40 and we had a discussion about addresses/street numbers. (JM)
3		We talked about the fact the number 2 appearing twice is because it is saying that two of each item is in the package. (JM)
4		We talked about the time during the day and at night (am and pm), we tell you why sometimes the clock shows the number 15 instead of 3. (UK)
5		“Is that number 10 or not?” We found lots of 10s. This is the only one Jacob questioned if he had found one or not. We had a conversation about decimal place and the symbol of °c relating to temperature. He thought 10.2°C felt cold, which it certainly did. (UK)
6		She looked around the house and selected numbers found on clothing and shoes. She took a few pictures and we talked about the difference in numbers (higher value vs lower value). (UK)
7		“Put it up here and it’s longer, put it down here and it’s shorter.” Margot learning to measure the wall after spotting the number 10. (UK) Akeem and I spoke about the different clothes size, that each represents measurement and that the smaller number is for someone who weighs less. (JM)

Comments with a conceptual and social use/purpose focus

The examples of posts included in Table 3 are indicative of opportunities recognised and used by parents to further extend their discussions of the meaning of numbers to the social use of the spotted numerals, that is, the socially shared rules and conventions that numerals communicate in everyday situations, which inform and shape everyday behaviours, such as, driving behaviour (post 1), identifying locations (post 2, Table 3), protecting information (posts 3 and 5) and deciding what to wear (post 6, Table 3).

Table 3. Comments that include conceptual and social use/purpose focus

1		We talked about how here the speed limit of the road is 50mph but on the bend part of the road there is a lower maximum speed as you need to drive slower on the bend to safely keep control of the car. (UK)
2		We visited a pharmacy. She noticed the numbers hanging above each aisle and started counting. She was able to identify all the numbers. When she finished counting, I led her back to aisle #3 where I explained to her that in a store, things that are similar are placed together so that we can find them easily. "Like the toy aisle; all the toys are in aisle #2 over there". (JM)
3		We found the number "3" on one of my daughter's toys. We realized that numbers are like keys. They help unlock secrets, like combinations to locks. We decided to remember the number “3” and maybe use it as a passcode to open a drawer (3.3.3). (UK)
4		Number 5+ on this picture tells us that these puzzles are for children from 5 year and over otherwise it could be dangerous. Children under that age should not be playing with it. (UK)
5		We went to the ATM to get some cash. I showed him how to enter the PIN, I told him the numbers. He correctly entered the PIN! I told him these numbers stop the bandits from stealing our money. (JM)
6		Harper helped to check the weather on Mam’s iPad. He found the temperature was 5 Degrees C on two days. We talked about checking the weather before we do outside activities so we know what to wear. (UK)

The examples of posts included in Table 3 are indicative of opportunities recognised and used by parents to further extend their discussions of the meaning of numbers to the socially shared rules and conventions that numerals communicate in everyday situations, which inform and shape everyday behaviours, such as, driving behaviour (post 1, Table 3), identifying locations (post 2), protecting information (posts 3 and 5) and deciding what to wear (post 6).

Comments that included two or all three of the identified foci of discussion were categorised under more than one theme. Numerical analysis of the occurrences of the three themes in parental comments (Table 4) shows that overall, a focus on the social use of numerals was the most frequently included aspect of meaning within the analysed sample of posts, as it was identified in 44% of all analysed comments. A focus on the represented concept only, was reported in 28% of comments from the UK and 39% of comments from Jamaica. Discussions extending to a numerical/mathematical focus when talking about the meaning of a numeral were reported slightly more frequently in the UK sample (33%) than the sample of comments from Jamaica (27%).

Table 4: Number of parent comments under each theme of meaning related to spotted numerals

Theme	UK (39 posts)	Jamaica (33 posts)	Total (72 posts)
Conceptual focus only	11 (28%)	13 (39%)	24 (33.3%)
Numerical/Mathematical focus included	13 (33%)	9 (27%)	22 (30.5%)
Social use/purpose focus included	19 (48%)	13 (39%)	32 (44.4%)

Conclusion

Parents' self-reporting posts may have been affected by factors, such as, time commitment and what parents recall or choose to report. Acknowledging the limitation that parental posts do not constitute a direct record of discussions that may or may not have occurred, our aim is not to draw generalised conclusions about parental discussions. Rather, the contribution of this study is in unearthing and delineating the qualitative nature of opportunities for learning that can arise, and parents recognised and reported, within the two cultural contexts of our project. The study, thus, addresses the need for understanding the potential that diverse everyday contexts have for family engagement with number-related ideas (Eason et al., 2022). Our analysis revealed examples of reported parent-child discussions that addressed conceptual, mathematical as well as social aspects of written number meanings, across both cultural contexts. This provides important insights into the multifaceted and wide-ranging opportunities for learning that can emerge in the home environment when parents are prompted and supported to use written numerals that appear on everyday objects, as a learning resource, for drawing children's attention on numbers as attributes of their environment and triggering early discussions about different aspects of their meaning. A focus on the socio-cultural meanings and uses of written numerals in everyday situations provides a fruitful and powerful channel for empowering an inclusive approach to family engagement with various aspects of number. This is because knowledge of the messages that environmental numerals communicate and their social purposes in organising everyday life is knowledge that is socially developed (Moll et al., 1992) and most families have, within their own cultural contexts and environments. We thus concur with Eason et al., (2022) who note that embedding activities within the families' everyday life and diverse contexts can provide the potential for context-based and socio-culturally relevant intervention for all children and families.

Acknowledgment

The 'Written Numbers in Everyday Life' programme has been developed by Chronoula Voutsina and Debbie Stott, University of Southampton, UK, with funding from Research England: Participatory Research Fund 2023. We are grateful to all participating families.

References

Björklund, C. (2016). Challenges and virtues of theory-driven education – a meta-study of variation theory implemented in early childhood mathematics education. *Education Inquiry, 7*(4), 405–419. https://doi.org/10.3402/edui.v7.28773

Boyatzis R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage.

Braun V., & Clarke V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brizuela, B. (2004). *Mathematical development in young children. Exploring notations*. Teachers College Press.

Eason, S. H., Scalise, N. R. Berkowitz, T., Ramani, G. B., & Levine, A. C. (2022). Widening the lens of family math engagement: A conceptual framework and systematic review. *Developmental Review, 66*, 101046. https://doi.org/10.1016/j.dr.2022.101046

Gervasoni, A., & Perry, B. (2017). Notice, explore, and talk about mathematics. *Advances in Child Development and Behavior, 53*, 169–225. https://doi.org/10.1016/bs.acdb.2017.04.001

Ginsburg, H. P., Lee, J. S., & Boyd, J. S. (2008). Mathematics education for young children: what it is and how to promote it. *Society for Research in Child Development Social Policy Report, 22*(1), 3–24. https://doi.org/10.1002/j.2379-3988.2008.tb00054.x

James-Brabham, E., Loveridge, T., Sella, F., Wakeling, P., Carroll, D. J., & Blakey, E. (2023). How do socioeconomic attainment gaps in early mathematical ability arise? *Child Development, 94*, 1550–1565. https://doi.org/10.1111/cdev.13947

Levine, S. C., Suriyakham L. W., Rowe M. L., Huttenlocher J., & Gunderson E. A. (2010). What counts in the development of young children's number knowledge? *Developmental Psychology, 46*(5), 1309–1319. https://doi.org/10.1037/a0019671

Mazzocco, M., & Claessens, A. (2020). Parents supporting early mathematics thinking. *Early Childhood Research Quarterly, 50*, 1–3. https://doi.org/10.1016/j.ecresq.2019.07.007

Moll, L., Amanti, C., Neff, D., & Gonzalez. N. (1992). Funds of knowledge for teaching: using a qualitative approach to connect homes and classrooms. *Theory into practice, XXXI* (2), 132–141. https://doi.org/10.1080/00405849209543534

Munn, P., & Kleinberg, S. (2003). Describing good practice in the early years – A response to the third way. *Education 3-13, 31*(2), 50–53. https://doi.org/10.1080/03004270385200221

Napoli, A. R., & Purpura, D. J. (2018). The home literacy and numeracy environment in preschool: Cross-domain relations of parent-child practices and child outcomes. *Journal of Experimental Child Psychology, 166*, 581–603. https://doi.org/10.1016/j.jecp.2017.10.002

Sinclair, A., & Sinclair, H. (1984). Preschool children's interpretation of written numbers. *Human Learning, 3*, 173–184.

Tolchinsky, L. (2003). *The cradle of culture and what children know about writing and numbers before being* (1st ed.). Psychology Press. https://doi.org/10.4324/9781410607195

Voutsina, C., & Stott, D. (2023). Preschool children's conceptions of the meanings and use of written numerals in everyday life: A phenomenographic study of the nature and structure of qualitative variation. *Educational Studies in Mathematics, 114*, 249–275. https://doi.org/10.1007/s10649-023-10232-1