Teaching mathematics with children's literature in Finland

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Abstract

The Finnish school system will transfer to the new Core Curriculum for Basic Education 2014 in 2016. The new curriculum emphasizes integration of subjects. In Finland, mathematics and the mother tongue are the two subjects which are taught in bilingual and monolingual speaking countries,

teacher *the extent to which they use children's literature in teaching mathematics in primary school and how to efficiently use children's literature in teaching mathematics in primary school*. This study was a part of an international research project in Hong Kong, Australia, and Finland. The aim was to

which this benefits learning. Data collection was conducted via online questionnaires translated into Finnish from spring to autumn 2015. Mixed method data analysis showed that teachers/teacher mathematics teaching, but they still recognize various ways to implement it into their teaching. Previous studies on the use

literature are presented in an engaging and approachable manner.

Keywords: Mathematics, teaching.

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1. Introduction

beliefs on the in

akes integration of different contents more effective, and enhances attitudinal changes towards mathematics and literature from the perspective of teachers of different personal and professional characteristics in England, Hong Kong, Australia and Finland (e.g. mathematics and literature, Billings & Beckmann, 2005; Caparo & Caparo, 2006).

mathematics learning from the perspective of Finnish class teachers and teachers. Two subjects, mathematics and the mother tongue, are taught the most in Finland. These two subjects

education in Finland is to be revamped by the end of 2016, and this will involve changing the educational approaches toward more holistic education. This study is based on the new curriculum, since the aim of the holistic approaches is to offer students integrated learning experiences by integrating school subjects together (Finnish National Board of Education 2014). Literature and literacy could offer major resources to different holistic approaches. Some researchers even suggest that fictional literature could be central to all learning (Toivonen, 2009). At best, holistic approaches

attitudes, thinking, and evaluation methods (FNBE, 2014). Since mathematics and the mother tongue play a significant role in every subject-based approaches to integrate these two subjects together.

There is already some research-based evidence on the possibilities of using literature in mathematics lessons, but unlike English-speaking

different learning capacities (Courtade, Lingo, Karp, & Whitney, 2013).

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1.1. Fiction in primary school mathematics lessons

1.1.1. The natural connection of mathematics and literature

erature, they probably will not immediately associate it with mathematics. However, teachers of different levels have started to recognize the the use o

problems and equip children with problem-solving models. This is connected to the fact that reading can be comprehended as a problem-solving process and a constructive process, meaning that integrating mathematics and literature could be effective: integration not only develops mathematical skills but also literacy, mathematical language, and problem solving (Wiburne & Napoli, 2008).

According to Anderson, Anderson, and Shapiro (2004), using literature for learning about mathematical thinking and mathematical concepts starts before children enter school. In many families, bedtime reading is an occasion where mathematical questions are discussed, since the conversations after shared reading sessions may focus on mathematics. This means that children are already used to posing mathematical problems through literature before entering school. However, each family has its own tradition of connecting mathematics to reading, and interfering with this tradition might threaten the enjoyment of shared reading and discussing mathematical problems.

re in English which is specially aimed at teaching

that are specially written for facilitating mathematics teaching. Perhaps the most popular book, and the only book published as a fiction work for older students, is the novel *Talvi maassa* (*Mission in Earth*, 2010). It is a story about Finnish children who are not interested in mathematics. The children are being helped by an alien from the planet Mathia. The book is written by a math teacher

mathematical contents are either meant to be learning materials or targeted at small children who are just learning about numbers. In addition, Finnish schoolbooks for mathematics often include small stories for teachers to use. However, the common type of mathematics teaching in Finnish elementary school can be considered to be strongly schoolbook centered, and there is a very strong tradition of using other material in lessons (Leino, 2008). Despite the small amount of literature aimed at learning mathematical concepts in Finland, there are a lot of books which could be used as a part of mathematics lessons, as one of the definitions of mathematics literature is that it is any piece of literature that has the potential to engage children in mathematical conversations (Nesmith & Cooper, 2010; Flevaris & Schiff, 2014).

Selection of literature for mathematics lessons must be done carefully. In order to help teachers to choose suitably motivating reading material for mathematics lessons, Hellwig, Monroe, and Jacobs

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few books score high in all criteria, but the criteria will still help to determine the strengths and weaknesses of certain books. There are also more criteria for evaluating the potential of

developmental appropriateness of math contents (e. g. Hunsander 2004). Some researchers focus on the illustrations in problems for learners, especially if there is a correspondence between the text and illustrations (Marston, 2010; Oers, 2013). According to Flevaris and Schiff (2014), teachers should obtain guidance

1.1.2. Pedagogical approaches to enhance the use literature in mathematics teaching

There are various pedagogical approaches to connect ch Literature engages and socializes children in shared reading and learning in mathematics lessons.

visualize the formation

connections may happen spontaneously, but it might sometimes be wise to support the emergence of this connection using the help of a more advanced reader and more skillful mathematicians

and hands-on activities (Flevaris & Schiff, 2014). An important aspect of using literature in mathematics lessons is the fact that the act of reading and discussing literature includes modeling activities and may help to pose problems, provide information, offer a context, and provide compelling characters for modeling (English, 2010).

Haapasalo (2008) writes that mathematics learning often involves the dictation of procedural and conceptual knowledge. Procedural knowledge includes algorithms and procedures in order to complete the task but it does not require understanding of a concept. Conceptual knowledge is a semantic net which requires one to understand the logic and connections of the subject being learned. It should be acknowledged that both procedural and conceptual knowledge are essential to the learning process. The integration of two subjects which in turn requires the conceptual knowledge approach.

In addition to learning specific mathematical concepts, literature is considered a powerful tool for developing children's feelings, situations, and actions (Hynd, 1990; Nussbaum, 1995). Contemporary literature education emphasizes that literature be frequently used to support the maturation process and provide information on different aspects of life (Nikolajeva, 2013; Rikama, 2005). Learning through fiction can be more efficient than learning through facts because the reader is more involved in the process of making sense of the text. The dual effect of learning involves participating in the process of learning through conscious and subconscious understanding and thereby enhancing the learning to make it more effective (Piazzoli & Kennedy, 2014). By empathizing with the characters of a certain story, children can learn valuable features and models of behavior for their future life. According to Hong (1996), children towards mathematics learning and children show increased preference for mathematics after an intervention with picture books.

As mentioned earlier, literature used in mathematics lessons for educational purposes must be selected carefully. It is, of course, vital to confirm that the mathematical concepts are correct but it is also important to select literature appropriate for children of different backgrounds (Edels, 2012). According to prior research, literature can form an especially effective tool for those with different native tongues and for those from lower socioeconomic backgrounds, and for girls (Hefflin and Barksdale-Ladd, 2001; Hellwig, S. J., Monroe, E. & Jacobs, J. S., 2000). It is worth noting that there is

2. Research design and analysis

This study used a qualitative research design which was supported with quantitative data (see e.g. Cohen, Manion, & Morrison, 2007; Creswell, 2012; Teddlie & Tashakkori, 2011). This study approached the data using mixed methods analysis by observing both open-ended questions and recoding them into numeric expressions in a quantifying way (Teddlie & Tashakkori, 2011). This was done to observe the possible statistical relations of the data. To preserve the validity of the research, the researchers both coded the open-ended questions separately into categories which were later compared between the researchers and then combined after discussion.

The data were collected using a questionnaire survey, which was the same across the project countries. In this study, the questionnaire survey was translated to Finnish and, to increase the trustworthiness of the study, back-translated to English. The questionnaire included both open-ended and structured, closed questions. The use of closed questions provided frequencies and categories to observe and test the data using statistical methods (Cohen et al., 2007). The questionnaire aimed to determine the current practices and abilities with regard to literature use in mathematics teaching and the attitudes towards literature use. The questionnaire was distributed through Facebook groups as a part of the courses offered by the University of Turku at the Department of Teacher Education in Rauma, and through e-mail. The participants answered through Webropol, which is a web-based system for making questionnaires.

knowledge, lack of materials, and the feeling that only small children will benefit from the integration of mathematics and children’s literature (Table 1) It should be acknowledged that many respondents listed more than one reason and thus were coded and observed separately in comparison to other teachers and teachertrainees.

The lack of ready-made pedagogical materials was the mode, as 16 out of respondents next most frequent reason was lack of time lessons, which was included in 11 of the replies. Concerning the main reason lack of time, there is a statistically significant dependency ($p = 0,014$) between teachertrainees/teachers and the reason. er, the third most

er, these results imply that if pedagogical materials were available, this would reduce the time needed for the planning and increase knowledge, and therefore enable the use

Table 1. The main reasons preventing the use of children’s literature in teaching mathematics ($n = 44$).

	Teachertrainee		Teacher		-tailed) p -value
	No	yes	no	yes	
Lack of need	22	1	16	5	0,088
Lack of time	21	2	12	9	0,014**
Extended dependency on subject’s school books	21	2	18	3	0,658
Impossibility of integration	17	6	20	1	0,097
Lack of knowledge	15	8	18	3	0,169
Lack of materials	14	9	14	7	0,761
Feeling that only small children will benefit from the integration of mathematics and children’s literature	18	5	20	1	0,188

**Statistically significant at 0,05 level.

3.3. The main approaches to using children’s literature in mathematics lessons in Finland

Even though there is no specific education on literature and mathematics in Finland, teachers have positive attitudes towards the use of fiction, as 52 out of 64 teachers pointed out that it could be

books in primary education use fictional stories as new teaching content in order to motivate students. The teachers also pointed out that children usually like stories and stories support motivation and help children to concentrate and visualize learning contents. However, it is uncertain whether the short stories in materials for teaching mathematics could be classified as literature.

the early grades of primary schools. This is partly due to the fact that it is easier to find literature for

smaller children and some picture books clearly aim to teach children mathematical contents. In addition, picture books seem to bring the elements of child-centeredness and playfulness to mathematics lessons. The teachers mentioned a few specific mathematical contents which are easily connected to literature. These contents are natural numbers, mathematical symbols, multiplication

natural numbers (7 out of 12 teachers used them), which refer to real everyday numbers and are used to point out quantity and order, and to name things (naming such as Bus 34). The responses from the procedural perspective (Haapasalo,

particular. It also seems unlikely that children would benefit from this method.

4. Discussion

The pedagogical approach to mathematics needs further development, which is the case in English-speaking countries as well (e.g. Capraro & Capraro, 2006; Young-Loveridge, 2004). It seems that teachers in Finland are not aware of the possibilities of

important to develop appropriate materials and guides for teachers and make them easily accessible. It is also important to develop such materials and guides for Finnish teachers in particular, as the teaching practices that are effective in one country may not be effective in another cultural context (e.g. Hatano & Inagaki, 1998).

In Finland, there is not enough suitable literature for mathematics lessons and no research-based information on the subject matter. Therefore, it is unsurprising that teachers and student teachers are

teaching is somewhat easily implementable from the perspective of both literature and pedagogical approaches, but they are unable to find time when such literature is not provided as part of the curriculum study books. This

literature, reading, and mathematics.

It is necessary to acknowledge that the current results should be observed carefully and that a greater sample size is needed in order to obtain more competent results.

In mathematics lessons in Finland, the need for research

Finland, since the new mathematics curriculum is very strict and there are many other new pedagogical approaches to mathematics teaching in the new curriculum (FNBE, 2014). At the moment, many teacher trainees and teachers feel that both planning and using literature-based lessons in mathematics is too time consuming, given the lack of materials.

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