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Content and organization of grade 0 mathematics education in the Faroe Islands

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In this paper we study the content and organization of preschool mathematics for grade 0 in the Faroe Islands from a formal and praxis point of view. We elaborate on motives for the genesis of grade 0 and unveil formal documents. We present data from two cases in which we interview two grade 0 mathematics teachers. The data is analyzed in relation to Bishop's six fundamental activities for mathematical enculturation and we report on the educational resources that are used in these activities. Our results show that the content and organization from a formal point of view is limited, while data from our cases indicate that mainly two of Bishop's activities are employed, and that the content is heavily influenced by the chosen mathematics textbook system. We conclude that the lack of formal organization is problematic from an educational point of view and deliberate future perspectives.

Keywords: Preschool grade 0 mathematics, policy and curriculum, Bishop's activities for mathematical enculturation, educational resources.

Introduction

During the last three decades, national level preschool curricula have become more commonplace in early year mathematics education in OECD countries (Henriksen, 2021a; Samuelsson et al., 2006). Members of the CERME Early Years Mathematics thematic working group have previously noted that there are similarities and differences between countries in terms of the curriculum and organization of preschool and express that there is a “need to know more about the organization of preschool in each country” (Bartolini Bussi et al., 2015, p. 1887). For example, in Italy, the preschool curriculum was developed based on Bishop's (1988) six universal activities for mathematical enculturation: counting, locating, measuring, designing, playing and explaining (Bartolini Bussi et al., 2015), whereas Levenson and Barkai (2013) report that Israeli curriculum documents describe quite extensively the competencies and concepts that children should grasp in preschool by listing “explicitly and separately which of those concepts may be promoted and which skills should be enhanced for children ages 3-4, 4-5 and 5-6 years old.” (Levenson & Barkai, 2013, p. 2158).

In Nordic countries such as Denmark, Sweden, Finland, a one-year participation at grade 0 for children at the age of 5-7 (usually called “preschool”) is now prevalent with the purpose of supporting the transition from kindergarten (age 0-5) to compulsory primary school (grade 1). Since the introduction of the grade 0 in Denmark in 1912, attendance has been voluntary, meaning that some children rather remained at kindergarten one more year, before entering primary school grade 1. However, in 2009, attending grade 0 became mandatory, and new foci on playful learning and cognitive development were introduced (Henriksen, 2021b, Vejleskov, 2017). The shift was soon followed by the implementation of national curricula for grade 0 (Børne- og

Undervisningsministeriet, 2014), which came during a time when results from PISA showed that a higher percentage among weak readers did not attend preschool for one or more years compared to all students (Fredrikson, 2012).

In the Faroe Islands¹, the grade 0 tradition is less established historically. Beginning in 1963, a single primary school introduced grade 0 (students aged 5-7), which was physically located at the school, and it remained the only school with this structure until 2010 (Matras et al., 2014). Since then, several of the larger public primary schools of the Faroe Islands have introduced this system, and as of September 2020, a third of Faroese public school students attend grade 0, even though attendance is still voluntary.

In this paper, we attempt to address the call of Bartolini Bussi et al. (2015) of the need to investigate the organization of preschool mathematics in different countries, in our case focusing on the context of preschool in the Faroe Islands. In particular, we center our attention on grade 0 (students aged 5-7), in which attendance has grown extensively in recent years, and on which no previous research has been conducted.

Our study includes, perhaps obviously, the elaboration of formal curricular documents, however, since the unfolding of curriculum in praxis is not necessarily a one-to-one correspondence, we also seek to collect perspectives anchored in praxis. In this paper, we therefore put forward the following research question:

What is the content and organization of preschool mathematics for grade 0 in the Faroe Islands from a formal and praxis point of view, respectively?

To shed light on our question, we investigate the historical motives and intentions behind the genesis of grade 0 in the Faroe Islands and unveil formal documents that describe the organization and content in preschool mathematics. To gain qualitative insights from a praxis point of view, we interview two mathematics teachers working in grade 0 and investigate which resources they use.

In the next section, we present Bishop's (1986, 1988) six fundamental activities for mathematical enculturation, which is the conceptual background that is used in our analysis. Afterwards, we present the methodological choices underlying our study, which is followed by an elaboration of pertinent policy documents as well as an historical account of Faroese grade 0. We then present interview data and ensuing analysis. Finally, we conclude on our study by referring back to our research question and deliberating future perspectives.

Conceptual background

As mentioned previously, in Italy, the preschool curriculum was developed following Bishop's (1986, 1988) six fundamental activities for mathematical enculturation (Bartolini Bussi et al., 2015). The activities are:

¹ The Faroe Islands is a self-governing country within the Kingdom of Denmark with a population of approximately 53.000.

“Counting. The use of a systematic way to compare and order discrete phenomena. It may involve tallying, or using objects or string to record, or special number words or names. [...]

Locating. Exploring one’s spatial environment and conceptualising and symbolising that environment, with models, diagrams, drawings, words or other means. [...]

Measuring. Quantifying qualities for the purposes of comparison and ordering, using objects or tokens as measuring devices with associated units or ‘measure-words’. [...]

Designing. Creating a shape or design for an object or for any part of one’s spatial environment. It may involve making the object, as a ‘mental template’, or symbolising it in some conventionalized way. [...]

Playing. Devising, and engaging in, games and pastimes, with more or less formalised rules that all players must abide by. [...]

Explaining. Finding ways to account for the existence of phenomena, be they religious, animistic or scientific.” (Bishop, 1988, pp. 182-183)

According to Bishop (1988), these fundamental activities are, on the one hand, universal, because “they appear to be carried out by every cultural group ever studied” (p. 182) and, on the other hand, they are “necessary and sufficient for the development of mathematical knowledge.” (p. 182).

Method

To investigate our research question from a formal point of view, we searched for and studied regulative frameworks, executive orders, ministerial reports (including PISA reports), and curricular documents published by the Ministry of Education as well as the Faroese primary and lower secondary school council.

In addition to our studying of policy and curricular documents, we visited two teachers in order to interview them and to see their facilities. This could provide us with some qualitative insights of the content and organization of grade 0 from a praxis point of view, although only as reported by the teachers. Our method comprised a mixture of closed and open questions in a semi-structured interview approach, which is characterized by the interviewer preparing a guide that can serve as a starting point for a conversation, but where the interviewer can improvise if there is a need to ask for examples or elaborations (Arksey & Knight, 1999; Tanggaard & Brinkmann, 2015). The interview guide contained our research questions, followed by interview questions that were formulated in everyday language (Hansen & Andersen, 2009), which we used in the interview situation. Besides asking broadly about what the mathematics practice in grade 0 comprised of, we asked directly if the teaching practice involved each of Bishop’s (1988) six fundamental activities, and also which types of resources were used.

The collected data was transcribed and analyzed in order to unveil the constituents of the grade 0 mathematics practice in our cases, investigating from a praxis point of view to what degree Bishop’s (1988) six fundamental activities were part of this practice, and which resources are used.

Our findings are presented in the next two sections, beginning with an elaboration of pertinent policy documents followed by interview data analysis.

From PISA to grade 0 – policy and curricular documents analysis

When the Faroe Islands participated in the PISA survey for the first time in 2005/2006, the academic results sent shockwaves through the Faroese education system and society in general. The students' results in mathematics, reading and science were by far worse than every other Nordic country, in fact, also below Mexico, which was the worst performing country in the OECD at the time (Egelund, 2006). In the aftermath, comparative analysis highlighted differences between the Faroese education system and education systems in other Nordic countries, and one detail that gained traction was that almost all Faroese students at the end of 9th grade had received only 9 years of education since there was only one school that included grade 0 in the Faroe Islands, whereas >99% of Danish 9th grade students had spent 10 years at school (Egelund, 2006). In the subsequent years, politicians and other stakeholders voiced their opinions on the matter (Nielsen & Joensen, 2013) including the Faroese primary and lower secondary school council, which recommended that children enter grade 0 (Matras et al., 2011).

As an increasing number of schools began to offer grade 0, a regulative framework, “Executive order on organization and learning in prechool” (Uttanríkis- og mentamálaráðið, 2013) was developed by the Ministry of Education, which outlined the aim, content and organization of grade 0. The two-page document mentions mathematics once: “The content of the education should at least include the foundations of [...] mathematics and nature” (Uttanríkis- og mentamálaráðið, 2013). In the already existing regulative framework for grades 1-10, a paragraph was added concerning grade 0, which also mentions mathematics once “The children should learn the foundations for reading, writing and mathematics...” (Uttanríkis- og mentamálaráðið, 2019). Curiously, no curriculum has yet been developed for grade 0 in the Faroe Islands.

Interview data and ensuing analysis

In table 1, below, we have collected some of the interview excerpts that pertain to each of Bishop’s fundamental activities.

Bishop’s activities	Classroom practice
Counting	Teacher 1: “We use many activities of counting [...] count how many days they have been to school. We use straws [...] when we get to 10, then we bundle the straws with an elastic and call it ‘one tens’ [...] centicubes [...] jars with different colors to put the straws in ones, tens and hundreds [...] We have the abacus, which is old and actually brilliant, but actually it is not easy for them to understand...”
Locating	Teacher 1: “exactly that is in the book [...] They see a tall building where there are different characters [...] then I ask ‘what is to the side of the man?’ [...]” Teacher 2: “the teacher guidance book is very good in that aspect (it says) ‘use the students to explain prepositions, e.g. can you, Linda, stand in front of Magnus’”

Measuring	<p>Teacher 1: “it’s one chapter [in the book]. how long is the table... how many pencils is the table... and if we have clips, then ask, how many clips long is the book. Or they throw a paper ball on the wall and measure how many clips the ball fell from the wall – then it becomes a tournament, then they cheat and the clips become shorter, but that is also fun, it is a process.</p> <p>Teacher 2: “and we measure heads, hands, noses etc. using strings with clamps”</p> <p>Teacher 1: “yes, there is a page about that”</p>
Designing	<p>Teacher 1: “yes that is a really good chapter. There is a lot concerning patterns. It is further ahead in the book. You see a picture from an Asian city, where there are towers with different beautiful shapes [...] The shapes are typically triangles, quadrilaterals, both rectangles and squares, and then we have circles. Circles we call ‘0-edges’ in grade 0 [...] a student said it this year, and I like it so much I will use it going forward”</p>
Playing	<p>Teacher 1: “There is a lot playing, we have something called ‘free play’ where they can play what ever they want [...] And they play many games such as dice games”</p> <p>Teacher 2: “Cards and dice games [...] board games, memory and some of them can play beginners chess”</p>
Explaining	<p>Teacher 1: “explanations is mostly... so we try to explain extremely well when we are explaining, but to make them explain... we do try to ask them questions to make them explain, some of them explain in great details [...] in each chapter there is a page that is about describing”</p> <p>Teacher 2 (with the book in his hands): “now I took a random page – they have to explain how many apples there are [...] I am not sure if this is what you are asking”</p>

Table 1 – Bishops’ fundamental activities in the classroom practice

From the teachers’ utterances, we can identify that each of the fundamental activities are present to some extent. However, the frequency of the activities, and the reasons that they are present, differ across the categories. On the one hand, **counting** and **playing** are frequent activities that the teachers consciously and in a goal-oriented manner activate in many different contexts. On the other hand, the activities of **locating**, **measuring**, and **designing** are present, yet to a lesser degree, and seemingly only because there are certain pages of the chosen mathematics textbook that encourage this type of activity. **Explaining** is the lone activity that the teachers are hesitant about, which indicates that it is not a particular focal point, however, they explain that it is partly included in the classroom discussions, in which the teachers ask the students questions that stem from the textbook, hence requiring explanations from the students.

When asked directly and indirectly about the type of resources that the teachers used in relation to each of the fundamental activities, the following resources were described: Counting (Straws, jars, centicubes and Abacus); Locating (Textbook, teacher guidance book, and chairs); Measuring (Textbook, pencils, clips, amd strings with clamps); Designing (Textbook, and the outdoors); Playing (Cards, dice games, board games, memory, and chess); Explaining (Textbook).

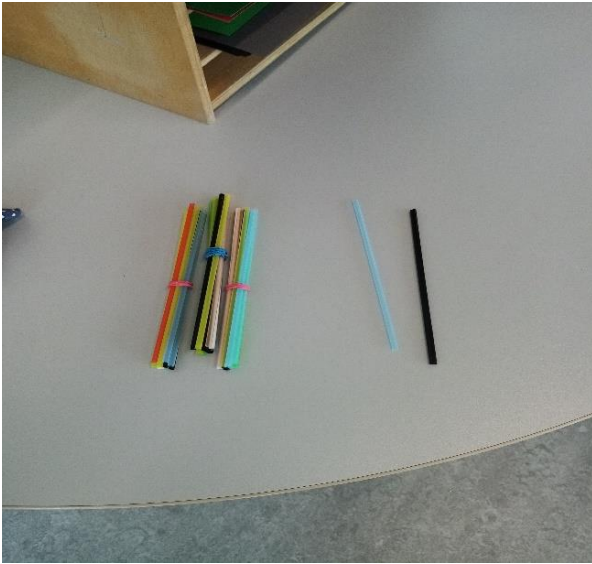


Figure 1 – Straws as ones and bundles of ten



Figure 2 – Cards, dices and other games

Most of the resources are oriented towards **counting** and **playing**, and a few that are used in relation to **measuring**, while the other fundamental activities are based on pages from the mathematics textbook.

In figure 1 we see some of the straws that are used in different teaching activities related to counting, while figure 2 shows a few of the educational resources that are used in playing activities.

Concluding discussion

Referring back to our research question, we can conclude from a formal point of view, firstly, that the content and organization of preschool mathematics for grade 0 in the Faroe Islands is scarcely developed, with only vague peripheral policy documents available. Secondly, from a praxis point of view, our cases indicates that Bishop's six fundamental activities are to a varying degree a part of the classroom practice, with **counting** and **playing** being the main activities that the teachers in our cases emphasize. That is supported by the fact that many of the educational resources that they employ are oriented towards counting and playing. Conversely, the mathematics textbook seems to be the main reason that **locating**, **measuring**, and **designing** are employed. We should stress that our insights into praxis are limited in this case study that consists of interviews with only two teachers. In addition, our data is teacher reported and not observed from the classroom. Therefore, the data may not depict the actual praxis for various reasons.

As mentioned previously, there are many possible approaches to organizing preschool, e.g., the Danish focus on playful learning; the Italian focus on Bishop's (1988) six universal activities for mathematical enculturation; or the extensive Israeli description of learning goals in terms of competencies and concepts that children should grasp. Deciding which approach is suitable is not a trivial task from an educational point of view, however, we would argue that **some** organization is needed.

Hence, we find it problematic that there is no curriculum for grade 0 in the Faroe Islands. The consequence being that the content and organization is altogether in the hands of the individual

teacher, and possibly quite different between schools. A conceivable consequence, which is somewhat evident in our cases, is that the content will be heavily based on the chosen mathematics textbook system.

Looking forward, we argue that the important goal of supporting Faroese students' mathematical development demands a coherent goal-oriented organization, which includes at least a curriculum that describes goals for these critical years in children's development.

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