

Thematic Approach and Mathematics Textbooks in Primary School

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Abstract: In the process of teaching mathematics, it is possible to involve various everyday actions and objects which would help pupils' link mathematics with lifetime actions. The aim of the article is to select the aspects of thematic choice and analyze the application of these aspects in mathematics textbooks in primary school. The use of the thematic approach in mathematics textbooks has been researched analyzing alternative mathematics textbooks in primary school Forms 1-3. Teaching mathematics thematically emphasises the use of application of mathematics around a central theme whereas teaching in topics predominantly emphasises mathematical content. In the thematic approach mathematics content involves objects, information, topics and themes. The topicality should be linked with happenings in their personal lives as well as the latest developments in community life, socio-economic processes or a scientific context as well. The levels of implementation of the thematic approach are closely linked with the content of the selected thematic aspect. In mathematics textbooks predominate thematic aspects: pupils' personal experience and situations, socio-economic processes.

Keywords: thematic approach, mathematics, textbooks, primary school.

Introduction

We use mathematics and the content related to it in various everyday situations: different commercial fields beginning with food trade and finishing with global financial issues, in measurements, construction as well as in cooking. Thus, in mathematics content, it is possible to involve such actions and objects which would help pupils' link mathematics with lifetime actions. Students' ability to apply mathematics in various contexts in daily life is seen as a core goal of mathematics education (Boaler, 1993; De Lange, 2003; Graumann, 2011; Muller, Burkhardt, 2007; Niss, Blum, Galbraith, 2007; Wijaya, Van den Heuvel-Panhuizen, Doorman, 2015). The European Commission report "Mathematics education in Europe: common challenges and state policy" admits that teachers do not provide pupils with sufficiently clear explanations how they can associate mathematics with everyday life and lifetime actions (Mathematics in Europe ..., 2011). In the process of teaching mathematics, it is necessary to change the attitude and opinion that mathematics is complicated, boring and not related to real life. One of the options, how to implement it, is to organize teaching/learning mathematics around "the great idea" and cross-curricular themes which will help show the link with everyday life and other school subjects (Helmane, 2012; Van den Heuvel-Panhuizen, 2001).

Therefore, it is necessary to create such mathematics content during the acquisition of which pupils would perceive, see and link the skills and knowledge obtained in mathematics with the real lifetime situation as well as such mathematics content during the acquisition of which pupils' development trends, needs and interests would be provided and met; also, holistic approach to pupils' development would be implemented. One of the existing options, how to implement such progress of mathematics content, is the thematic approach.

The aim of the article is to select the aspects of thematic choice based on the quantitative and qualitative analysis of theoretical literature and analyze the application of these aspects in mathematics textbooks for the acquisition of mathematics content within the thematic approach in primary school.

Methodology

Essence of thematic approach

The thematic approach involves the integration of various content fields exploring an exciting idea which is closely linked with the content of different subject areas. This approach arranges the study content in such a way that learners comprehend the link among different subject areas as well as interconnection with real life (Helmane, 2014; Volša, Konflina, 1998). Mathematics content in the framework of the thematic approach is associated with the development of skills in practical activities the so called 'hands on' as well as the inter-correlation of the acquired knowledge based on the theme

or a concept; also, skills that can be applied in lifetime actions as well as the development of a personal sound attitude, values and goals (Figure1).

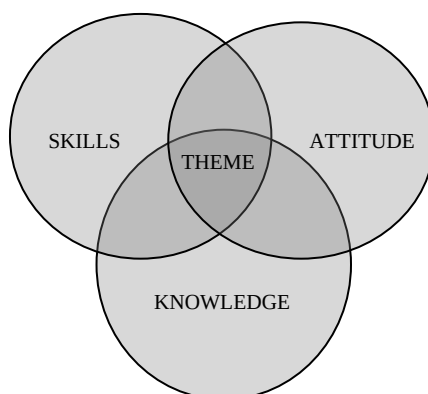


Figure 1. Mathematics content in the framework of the thematic approach (Helmane, 2011).

Teaching mathematics thematically envisages linking mathematics with the central theme which emphasizes and comprises mathematical content. For instance, if the central theme is „Sports”, then the thematic units could be organized in various content areas: percentage, measurements, statistics or algebra, thus strengthening mathematics content (Handal, Bobis, 2001). Therefore, the themes should be included in mathematics curriculum and content in such a way that skills and knowledge would be taught and mastered in accordance with the central theme, thus attaching significance and direction to the educational process (Freeman, Sokoloff, 1995). The thematic learning links mathematics with real, existing life situations (Handal, 2000) and the mathematics content is acquired in a meaningful and practically oriented context.

Taking into account that a pupil at the early school age has a difficulty concentrating if the content is not interesting, if it is abstract and does not stimulate thinking (Cooper, 1998), also, when a pupil does not see the sense in doing what he has to do, then the anticipated does not give satisfaction. In such a state the pupil feels disappointed, stressed, internally alarmed which is frequently accompanied by isolation, protest and unwillingness to learn. It is especially dangerous in those educational stages when learning as a meaningful process has just started (Sousa, 2001; Абрамова, 2003). Then, within the framework of thematic approach it is possible to show the practical importance of mathematics content by explaining to pupils where mathematical skills and knowledge are encountered in life and how significant it is to obtain and apply correctly each new mathematical skill and knowledge. When facing such practical study content linked with real lifetime activities, pupils develop a positive attitude towards mathematics and the content to be mastered as well as interest and motivation to acquire mathematical skills and knowledge.

Aspects of thematic choice in the acquisition of mathematics content

In the thematic approach to mathematics content it is essential to use such topicality that a learner may encounter in his/her real lifetime activities; moreover, the topicality should be linked with happenings in their personal lives as well as the latest developments in community life, socio-economic processes or a scientific context as well: learners' personal experience in accordance with learners' daily activities; social processes and learners' roles in them, behavioural norms, ways of socially important activities, generally accepted symbols as well as the economic aspect; calendar year with seasonal changes, anniversaries and traditional holidays, specific features of the period as well as objects; science including the technological process, a theoretical explanation or a precisely defined maths problem as well as widening the outlook; themes in accordance with the National Standard of Basic Education with the content integration of other subject areas, i.e., cross- curricula acquisition of the mathematics content (Helmane, 2011).

Taking into account the specific character of mathematics content in primary school and the aspects of thematic choice when mastering the mathematics content, the thematic approach should be implemented in levels (Table 1).

Table 1

Levels of thematic approach in mathematics (Helmane, 2012)

Level	Component	Essence of level
Level 1	Objects	Any object, article, phenomenon, living being according to the calendar time from pupils' private and social life, socio-economic processes or with a scientific context.
Level 2	Information and event	Any real event, its procedure, real life phenomenon about private and social life events, socio-economic or scientific processes, calendar passage of time.
Level 3	Topic	A short definition of content viewing, discussing and investigating private and social life events, socio-economic processes or also with a scientific context, calendar passage of time.
Level 4	Theme	General narration as the whole of phenomena, ideas, vital issues according to the calendar time about pupils' private and social life events, socio-economic or scientific processes.

The levels of thematic approach in mathematics manifest themselves successively envisaging a gradual transition from objects to information and then to the topic and theme (Figure 2).

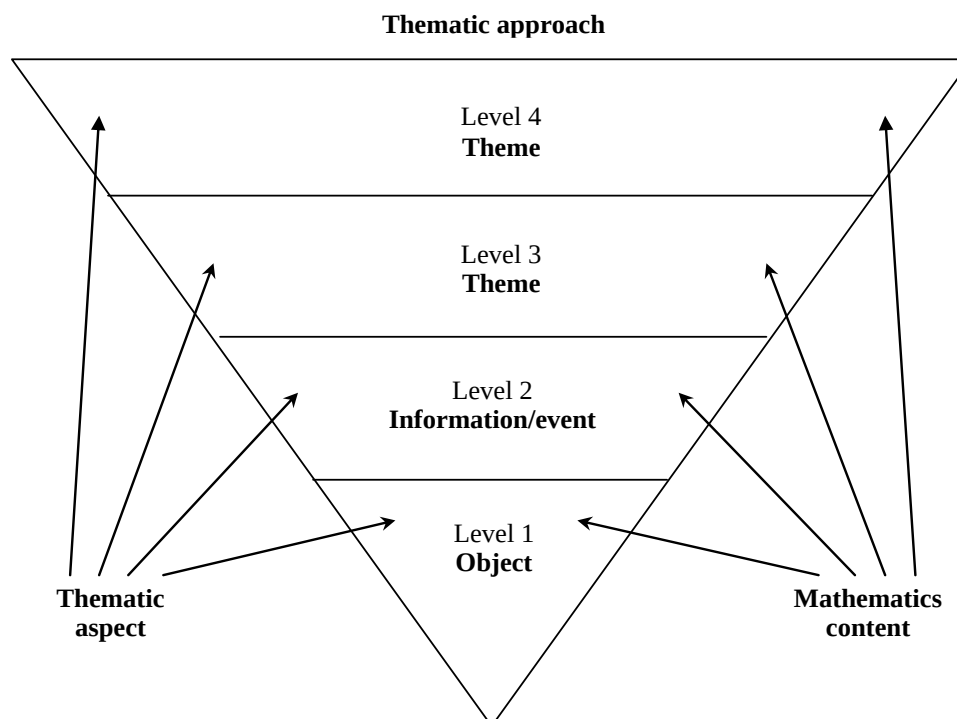


Figure 2. Thematic approach levels in mathematics (Helmane, 2012).

The levels of implementation of the thematic approach are closely linked with the content of the selected thematic aspect. By selecting a higher level of implementation of the thematic approach, the content included in the thematic aspect is expanding and enriching. Thus, in the acquisition of mathematics content, the number of tasks, exercises and operations related to the selected thematic aspect increases and also, the time envisaged for their solution enhances where most of tasks, exercises and mathematical operations in a certain period of time are connected with the chosen thematic aspect.

It is characteristic that by choosing a thematic aspect and the 1st level of implementation of the thematic approach, the acquisition of maths skills and knowledge is associated with the objects appropriate to the thematic aspect, not envisaging a wider investigation of them. In turn, when choosing a thematic aspect and, for example, the 3rd level of implementation of the thematic approach, the acquisition of maths skills and knowledge has to be implemented within a thematic framework envisaging a short outline

about pupils' private and social life events, socio-economic or scientific processes and also gives a possibility to use objects and information in accordance with the chosen thematic aspect.

Thematic approach in mathematics textbooks in primary school

The use of the thematic approach in mathematics textbooks has been researched analyzing alternative mathematics textbooks in primary school Forms 1-3, allocating each textbook a number (Table 2). The research uses such mathematics textbooks the compliance of which to the National General Education Standard has been confirmed by the National Centre for Education of the Ministry of Education and Science and which have been included into "The list of Approved and Published Textbooks" by the National Centre for Education (Mācību literatūra..., 2016).

Table 2

Forms 1, 2, 3 mathematics textbooks used in the research

Mathematics textbooks	
Form 1	1. Mencis J. (sen.), Krastiņa E., Mencis J. (jun.), Cine I., Oliņa D. (1997). <i>Mathematics for Form 1</i>. Rīga: Zvaigzne ABC. (in Latvian) 2. Valtasa I. (2005). <i>Mathematics for Form 1</i>. Rīga: Petergailis. (in Latvian) 3. Helmane I., Dāvīda A. (2013). <i>Mathematics for Form 1</i>. Lielvarde: Lielvards. (in Latvian)
Form 2	4. Mencis J. (sen.), Krastiņa E., Mencis J. (jun.), Oliņa D. (1998). <i>Mathematics for Form 2</i>. Rīga: Zvaigzne ABC. (in Latvian) 5. Valtasa I. (2008). <i>Mathematics for Form 2</i>. Rīga: Petergailis (in Latvian) 6. Helmane I., Dāvīda A. (2014). <i>Mathematics for Form 2</i>. Lielvarde: Lielvards (in Latvian)
Form 3	7. Mencis J. (sen.), Krastiņa E., Mencis J. (jun.), Oliņa D. (1999). <i>Mathematics for Form 3</i>. Rīga: Zvaigzne ABC (in Latvian) 8. Valtasa I. (2009). <i>Mathematics for Form 3</i>. Rīga: Petergailis (in Latvian) 9. Helmane I., Dāvīda A. (2015). <i>Mathematics for Form 3</i>. Lielvarde: Lielvards (in Latvian)

The textbooks written by different authors and used in the research, provide a systematic and successive acquisition of mathematics skills and knowledge from Forms 1-3. The textbooks for Forms 1-3 chosen for the analysis are like characteristics for one educational stage – for its beginning and end since the National Standard of Basic Education indicates the skills and knowledge to be acquired upon finishing Forms 3, 6, 9 (Valsts Pamatizglītības standarts..., 2006).

The research analyzes and determines the levels of implementation of the thematic approach in mathematics textbooks: the levels of objects, information and event, topic and theme. The following aspects of thematic selection have been chosen as criteria: pupils' personal experience and situations, socio-economic processes, calendar time, scientific technological processes and topics in accordance with the other textbook content in the National Standard of Basic Education.

Results and discussion

The analysis of the aspects of the thematic choice shows that the following thematic aspects predominate in primary school textbooks: pupils' personal experience and situations, socio-economic processes, however, the thematic aspect of scientific and technological processes has been used the least. Also, the aspect of coordination the topics with the content of other school subjects in the National Standard of Basic Education has been used insufficiently (Table 3).

As a result of the analysis of mathematics textbooks, exploring the levels of the thematic approach (objects, information, topics and themes), intensity, it has been found out that in mathematics textbooks in primary school, object and information level predominates and also, a common thematic aspect in topics and themes are not used or used rarely (Table 3). For instance, in Form 1 textbooks by J. Mencis (sen.) (Mencis, Krastiņa, 1997; 1998; 1999) the object level predominates, whereas in Forms 2 and 3 textbooks, information and events predominate as the 2nd level of the thematic approach. The object

level and information level can be found in such thematic aspects as Socio-economic processes and Pupils' personal experience and situations.

Table 3

Levels and aspects of the thematic approach in mathematics textbooks

Form	Aspects	Textbook (Table 1)	Levels of Thematic Approach			
			Objects	Information	Topic	Theme
Form 1	Pupils' personal experience and situations	1. J. Mencis (sen)				
		2. I. Valtasa				
		3. I. Helmane				
	Socio-economic processes	1. J. Mencis (sen)				
		2. I. Valtasa				
		3. I. Helmane				
	Calendar time	1. J. Mencis (sen)				
		2. I. Valtasa				
		3. I. Helmane				
	Scientific and technological processes	1. J. Mencis (sen)				
		2. I. Valtasa				
		3. I. Helmane				
	Topics related to the content of other school subjects	1. J. Mencis (sen)				
		2. I. Valtasa				
		3. I. Helmane				
Form 2	Pupils' personal experience and situations	4. J. Mencis (sen)				
		5. I. Valtasa				
		6. I. Helmane				
	Socio-economic processes	4. J. Mencis (sen)				
		5. I. Valtasa				
		6. I. Helmane				
	Calendar time	4. J. Mencis (sen)				
		5. I. Valtasa				
		6. I. Helmane				
	Scientific and technological processes	4. J. Mencis (sen)				
		5. I. Valtasa				
		6. I. Helmane				
	Topics related to the content of other school subjects	4. J. Mencis (sen)				
		5. I. Valtasa				
		6. I. Helmane				
Form 3	Pupils' personal experience and situations	7. J. Mencis (sen)				
		8. I. Valtasa				
		9. I. Helmane				
	Socio-economic processes	7. J. Mencis (sen)				
		8. I. Valtasa				
		9. I. Helmane				
	Calendar time	7. J. Mencis (sen)				
		8. I. Valtasa				
		9. I. Helmane				
	Scientific and technological processes	7. J. Mencis (sen)				
		8. I. Valtasa				
		9. I. Helmane				
	Topics related to the content of other school subjects	7. J. Mencis (sen)				
		8. I. Valtasa				
		9. I. Helmane				

yes



partly



no



Mainly in word problems, we can find a short outline, for example, about a class event, a project week, tests, cafeteria, money and its history, electrical installation, measurements of time, while in I. Helmane's textbook, the 2nd and 3rd levels of thematic approach predominate. The information level and the topic level can be found in such thematic aspects as Pupils' personal experience and situations. Socio-economic processes and Calendar time. In I. Helmane's (Helmane, Dāvida, 2013; 2014; 2015)

textbooks, we can sometimes find the implementation of the thematic approach in the 4th or theme level in such thematic aspects as Pupils' personal experience and situations, Socio-economic processes and Calendar time. It is characteristic that in all mathematics textbooks used in the research, the thematic aspect Pupils' personal experience and situations shows a pupil in different situations carrying out diverse lifetime activities, taking part in learning process, school supplies, out of class activities, hobbies. The thematic aspect Socio-economic processes is used in textbooks involving buying-selling processes, professions and their activities, labour market processes as well as traffic, distances between cities, population in different cities.

In mathematics textbooks by J. Mencis (sen.) (Mencis, Krastiņa, 1997; 1998; 1999) one thematic aspect comprises 2-3 tasks, exercises. It is characteristic that every task often has a different topic, the tasks without a topic predominate. The topic is revealed mainly in word problems with the help of the text without using or rarely using illustrations, pictures. In maths textbooks, separate objects predominate and do not have a common line of thematic aspects in one lesson or class. These textbooks focus on specific content, the skills and knowledge are only partly linked in a common thematic aspect line. A similar situation can be found in the textbooks by I. Valtasa (2005; 2008; 2009) where partly related thematic tasks predominate, thus, there are few thematically mutually related tasks, exercises and operations. However, in the maths textbooks by I. Helmane (Helmane, Dāvīda, 2013; 2014; 2015) 5 and more tasks, exercises are united in one thematic aspect. It is characteristic that all these tasks often comprise one thematic aspect. Thus, the levels of thematic approach are implemented according to the thematic aspect. The topic is revealed in both illustrations and various content areas: word problems, arithmetic, statistic elements. Consequently, the maths textbooks by I. Helmane comprise tasks of various content areas with a wide range of content, for example, about Pupils' Song and Dance Festival, excursions, famous inventors, composers as well as Christmas and its celebration. These textbooks use such aspect of the thematic approach as Topics related to the content of other school subjects. For instance, in order to implement the 3rd or topic level I. Helmane uses the topics the acquisition of which is topical in natural sciences: energy sources, scale, birds, fish.

It is characteristic that in all textbooks which were analyzed in the research, the level of implementation of the thematic approach is lower if pupils master new skills and knowledge in mathematics. The mathematics content to be acquired is dominant in the process of obtaining new skills. However, in the process of developing and strengthening the mastered mathematics content, the level of implementation of the thematic approach is higher.

Conclusions

The thematic approach involves integration of various content areas, investigating one interesting idea close to the content from diverse fields of school subjects. It arranges the study content in such a way that pupils see the link among different fields of school subjects and their link with real life. The mathematics content within thematic approach includes the skills to be developed in practical work, the knowledge to be mastered about the relationships included in the organizing theme or concept, the skills for applying this knowledge in lifetime activities, attitudes as personally significant values and the aim.

The thematic approach has to be implemented in the following successive levels: the 1st or object level, the 2nd or information and event level, the 3rd or topic level, the 4th or thematic level. The levels of the implementation of thematic approach are closely connected with the content saturation of the chosen thematic aspect. In the thematic approach in mathematics content, we must use such thematic aspects which pupils could encounter in real life associating them with happenings in private, community life, socio-economic processes or also, with scientific context, for example: pupils' personal experience and situations, socio-economic processes, calendar time, scientific and technological processes, topics related to the content of other school subjects.

The following thematic aspects predominate in mathematics textbooks in primary school: pupils' personal experience and situations, socio-economic processes, however, such thematic aspect as scientific and technological processes has been used the least, also, the aspect of adjusting topics to the content of other school subjects in the National Standard of Basic Education and also, in mathematics textbooks in primary school, object and information level predominates, a common thematic aspect in themes and topics is not used or used rarely.

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