PUPILS' MATHEMATICAL SELF-CONCEPT IN THE BEGINNING OF THE SIXTH GRADE

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ABSRACT
The article shows the mathematical self-concept of the sixth grade pupils (n=57) in relation to their mathematical skills in school. Mathematical skills were measured with the help of a survey of the command of the decimal system and on the basis of the report grades in mathematics. The pupils' mathematical self-concept was surveyed in the beginning of the sixth grade with the interviews and a questionnaire using the Likert-scale. The mathematical self-concept seemed to be more positive the better the mathematics skills pupils had.

Key Words: Mathematical self-concept, elementary school

INTRODUCTION

The Finnish pupils' skills in mathematics have often been discussed at the level of the whole society. The excellent mathematical skills of the Finnish pupils' have also received international attention. The success in the PISA-studies has especially affected this discussion. However, in the last PISA 12-study the mathematical skills of the Finnish adolescents had weakened compared to the results of the previous PISA-studies. (Kupari, Välijärvi, Andersson, Arffman, Nissinen, Puhakka & Vettenranta 2013.) The decline in the skills in mathematics has raised concern for the state of the Finnish learning environments in mathematics.

Finnish pupils' learning results in mathematics, attitudes towards mathematics and the factors which affect the level of learning results have been studied and are examined at a national as well as international level. The Finnish National Board of Education is responsible for the evaluations at the national level. Some of the international assessments that have been carried out in Finland are, among others, PISA (Programme for International Student Assessment) and TIMMS (Trends in International Mathematics and Science Study). PISA-assessment measures skills in mathematics, natural sciences and reading comprehension. TIMMS-assessment concentrates on the evaluation of the skills in mathematics and natural sciences. It was possible to see the declining attitudes towards mathematics in all the national and international surveys and research studies carried out in the 2000s. In the assessments of mathematics three attitude factors have been examined: mathematical self-concept, performance confidence and mathematics anxiety. The self-concept of the mathematics is a matter of the pupil's belief in their own abilities in studying mathematics. In the performance confidence of the mathematics the pupil's confidence in themselves in managing the mathematical tasks is examined. The mathematics anxiety means the anxiety, helplessness and frustration the pupil experiences whilst studying mathematics. (Kupari, Välijärvi, Andersson, Arffman, Nissinen, Puhakka & Vettenranta 2013, 59.) This article focused in particular on the examination of the pupils' self-concept.

There have been national evaluations of the comprehensive school which were carried out by the Finnish National Board of Education during the years 2007 and 2008. In 2007 the mathematical skills and attitude factors of the sixth grade pupils of the comprehensive school were evaluated. In regard to mathematical self-concept, it was found out that the more positive the attitude the pupils had towards mathematics the better their learning results were in the mathematics. In particular, the boys' attitudes towards mathematics and their self-concept were better than those of the girls. (Niemi 2010.) When the results of the national 2007 evaluation were compared with the study that had been carried out at the beginning of the third grade, three years earlier, the pupils' attitudes towards mathematics and their concept of themselves as experts of mathematics had weakened distinctly. This result is parallel with earlier studies because the learners' concept from themselves as experts of mathematics weakens during the lower grades. According to (Metsämuuronen 2010) Kupari (2013) among others, the pupils' strong self-concept can be seen on the one hand as a result of education but on the other hand its significance can be seen as a predicting factor in the pupils' performance in mathematics. Self-concept has for its part a significance in what

kind of targets the pupils sets for themselves and with what kind of studying methods they intend to reach the objectives. Self-concept is also reflected in the pupil's overall well-being and personality. The Finnish pupils' success has been excellent in the PISA-surveys, even though in the last evaluations there has been a decrease in the learning results in mathematics. In the last PISA-survey the mathematical self-concept of the Finnish pupils' was near the average for OECD countries. According to the PISA 2012-results those pupils who had a strong self-concept in mathematics achieved considerably better learning results in mathematics than the ones with a poor self-concept. The boys' self-concept in mathematics was better than the girls' self-concept. When comparing these results in the light of the PISA-results for the year 2003, one can state that the self-concept of the Finnish ninth grade pupils' in mathematics has improved a little.

In the TIMMS-survey of 2011, the fourth grade pupils' self-concept and how much the pupils like mathematics and how they commit themselves to studying mathematics were examined. The fourth grade pupils liked mathematics less than others when compared internationally but their confidence in their own skills was internationally at an average level. However, the commitment to studying mathematics was extremely poor when measured internationally. From the point of view of the learning results in mathematics, the pupil's self-concept had the strongest effect of the three. (Kupari, Sulkunen, Vettenranta & Nissinen 2012a, 41 –55.) TIMMS 2011-study also surveyed the skills of the eight grade pupils of the comprehensive school, and the same matters were examined as with the fourth grade pupils. Furthermore, the appreciation of the eight grade pupils towards mathematical skills was measured. It is worrying that Finland was placed with four other countries in a group where those pupils who liked mathematics the least were found. When assessed internationally, the Finnish eight grade pupils appreciated mathematics very little, the commitment to studying mathematics was extremely poor and the self-concept was average internationally. (Kupari, Vettenranta & Nissinen 2012b, 31 –38, 71.)

Even though the pupils' self-concept as experts in mathematics gets nationally poorer during the lower grades, the pupils' self-concept is internationally at an average level in the light of surveys that have been described above and according to the PISA-surveys the self-concept of the pupils at the end of the comprehensive school has become more positive during the years. The results tell rather about the pupils' low commitment and attitude towards studying mathematics. According to Linnanmäki (2004), learning in mathematics is generally regarded as important. National and international measurements that have been presented above also demonstrate the importance of learning mathematics. The abstract nature of mathematics and yet on the other hand its importance in managing in the everyday life make it a unique subject. One must be able to apply the skills in practice. In learning mathematics the pupil's self-concept has a strong role. The study by Linnanmäki (2004) shows the correlation of the self-concept with the achievements in mathematics. The teachers indeed should work systematically to develop the pupils' self-concept in a positive direction and they should share information about the methods they use with their colleagues. The experiences of success that the weaker pupils gain are paramount in reaching the objective.

The Finnish teaching tradition of mathematics has followed the international trends of teaching and learning with a small delay. In the 1960s the so-called "new mathematics" (New Math) was trendy, the objective of which was to make school mathematics resemble higher scientific mathematics. However, the learning results remained quite superficial and in the 1970s as a reaction in many countries so-called Back to Basics –movement was created, where the aim was to get back to the basics, not wanting to emphasize the scientific nature of mathematics any more. The emphasis on problem-solving skills arrived in Finland in the 1980s. After this the constructivist learning theory has prevailed in teaching mathematics. In Finland, with the 1994 national curriculum reform, the understanding of learning as an active operation and the mathematical skills which can be adapted to different everyday life problem solving situations became the most central focus of teaching mathematics. The objective was that the pupils would have a chance to adapt mathematics in situations that are meaningful to them. The core curriculum 2004 for basic education still leans on the constructivist learning theory. The point of view of mathematics teaching has not really changed from the previous reform. The central focus areas are still problem solving and the development of thinking skills. (Patrikainen 2012.) In the core curriculum of 2014 for mathematics the constructivist point of view is still emphasized in the teaching of mathematics and now supporting of pupils' positive attitudes towards mathematics and their positive self-concept as learners of mathematics is sought after (the Core Curriculum for Basic Education 2014). One aim of the Gamification-project carried out in the school year 2014-2015 for the three sixth grade classes of comprehensive school is to support the positive development of the pupils' mathematical self-concept. For this reason it is important to find out the connection between the mathematical skills of the pupils (n=57) who participate in the project and their mathematical self-concept.

MATHEMATICAL SELF-CONCEPT

Mathematical self-concept is essentially connected to the skills in mathematics. According to the studies (among others, Chen, Yeh, Hwang & Lin 2013; Möller, Retelsdorf, Köller & Marsh 2011; Linnanmäki 2004) the relationship between the skills in mathematics and the mathematical self-concept is reciprocal. The mathematical

self-concept affects the adoption of the skills in mathematics and correspondingly the skills in mathematics affects the building of the mathematical self-concept significantly. Building the mathematical self-concept is a complex process and its construction is connected also to the other factors in addition to the skills in mathematics (Skaalvik & Skaalvik 2002). Shavelson, Hubner and Stanton (1976) define self-concept as the views of the human on the ego. Self-concept is built from the interpretations of the environment and from the experiences received there. Shavelson etc. (1976) has divided a general self-concept into academic and non-academic self-concept. The non-academic self-concept is built from the social (the relations with peers, significant people), emotional (feelings) and from physical (physical capability and appearance) self-concept. The academic self-concept can be examined through subject-specific (mother tongue, history, mathematics and natural sciences) self-concepts. Marsh and Shavelson (1985) have condensed an academic self-concept further. According to them, the academic self-concept can be divided into a mathematical and a linguistic academic self-concept. Marsh (1990) has further focused the model of the academic self-concept. According to him, the mathematical academic self-concept is built from the self-concepts of the subjects of mathematics and natural sciences. Whereas the linguistic academic self-concept is based on the self-concepts of the native language and foreign languages. The general school self-concept as well as those in biology, economics, geography, history are connected to both mathematical and linguistic self-concepts. In this article the academic self-concept is examined with particular regard for mathematics.

Skaalvik and Skaalvik (2002 240) write that the areas of self-concept are built through internal and external comparison. In the internal comparison an individual evaluates their own skills in mathematics with respect to their other skills. Thus, the skills in mathematics can be either a strength or a weakness for the individual. In the external comparison an individual compares their skills with the information from the environment. The pupils receive information for both internal and external comparison from following their own performance, from the teacher's comments and assessments, the comments and performances by the peer group and from the grades they have received.

According to earlier studies (see Metsämuuronen 2010) the pupils' own experience of themselves as being good in mathematics declines between the third and the sixth grade. In particular, the girls' confidence in their own skills gets weaker than that of the boys. Generally, those pupils who have a strong mathematical self-concept are distinctly better in their skills in mathematics than the ones with a poor mathematical self-concept. Similar results from the connection between the self-concept and the performance in mathematics especially in the higher grades of the comprehensive school have been also obtained in other studies (among others, Linnanmäki 2004; Valentine, DuBois & Cooper 2004; Guay, Marsh, Boivin 2003).

RESEARCH METHODS AND DATA COLLECTION

At the initial stage of the project the focus in the research was on surveying especially the pupils' mathematical self-concept. Based on surveying the mathematical self-concept, the objectives of the project are drawn up for developing game-like learning environments and supporting the positive mathematical self-concept. The pupils of three sixth grade classes (n = 57) of the comprehensive school participated in the study. The research material has been collected with the Ten Base-survey 2 (Ikäheimo 2011) for the pupils, through the pupils' interview and with an inquiry which surveys mathematical self-concept. The pupils' report grades were used as an indicator of their skills in mathematics in addition to the Ten Base-survey in mathematics. The pupils' report grades varied in the range of 6-10. In the study group there were more than 40% of pupils who had got a poor (6-7) report grade in mathematics, a third had received an excellent and the rest (25%) of the pupils had received a good report grade.

Ten Base-survey 2 was carried out at the beginning of the project as an initial measurement of the skills in mathematics at the end of the fifth grade in the spring of 2014 as well as at end of the project as a final measurement in spring of 2015 of the sixth grade. Ten Base-survey 2 is meant to be carried out at the end of the fifth grade. The survey contains the tasks which are related to the concepts of both natural numbers and decimals, basic calculations and the conversions with the units of measure which are central from the point of view of the command of the decimal system during grades 1-6. The starting point for the survey is that at the end of the fifth grade the pupils have command of the contents of the survey to receive the mark 10. The First Ten Base-survey 2 was carried out with all the pupils in May 2014, and the pupils were divided into three groups on the basis of the results: those whose performance in the survey was poor (30%), average (44%) and good (26%). The group of pupils who had performed poorly had received 0-40 points, the average group received 41-57 points and the group which succeeded well had 58-70 points. The maximum number of points in the survey is 70 which none of the pupils reached. From all of these three groups 18 pupils were chosen for the interview which was carried out in October 2014. The interview was a group interview which was carried out six times. In each interview three pupils (one pupil from every sixth grade class) who were at the same level from the point of view of the skills in mathematics participated. A Likert-scale questionnaire concerning mathematical self-concept that was drawn up based on the interview, was carried out in December 2014 and a second time in May 2015. The questionnaire was divided into three main points: the pupils' self-concept as learners of mathematics, the pupils' ideas of learning and teaching

in mathematics and the pupils' ideas of the nature of mathematics in relation to the solution processes of the tasks in school mathematics. The research material was examined from the connections between the Tens Base –survey 2, the report grades and the questionnaire regarding the self-concept. In the examination attention was also paid to the differences between the genders.

FINDINGS

Tens Base –survey and report grades

The skills of the fifth grade pupils participating in the study were lower than the anticipated results of the Tens Base –survey 2. In other words, none of the pupils reached a perfect standard (a grade 10). The pupils' skills were inadequate. Next we will examine the pupils' success in more detail. Based the results on the first Tens Base –survey 2, the boys succeeded better than the girls (cf. PISA results). 45% of the boys belonged to the group that had succeeded well (got 58-70 points) while for the girls the figure was 29%. Otherwise the pupils' division into three levels in the survey on the basis of the skills (poor, average, good performance) was even, in other words, every level represented about a third of the pupils. An interesting observation can be made in connection to the boys' report grades because, the report grade was poor (6 or 7) for half of the boys. Figure 1 presents the connection between the Tens Base –survey 2 and the pupils' report grades which was statistically extremely significant (p=001).

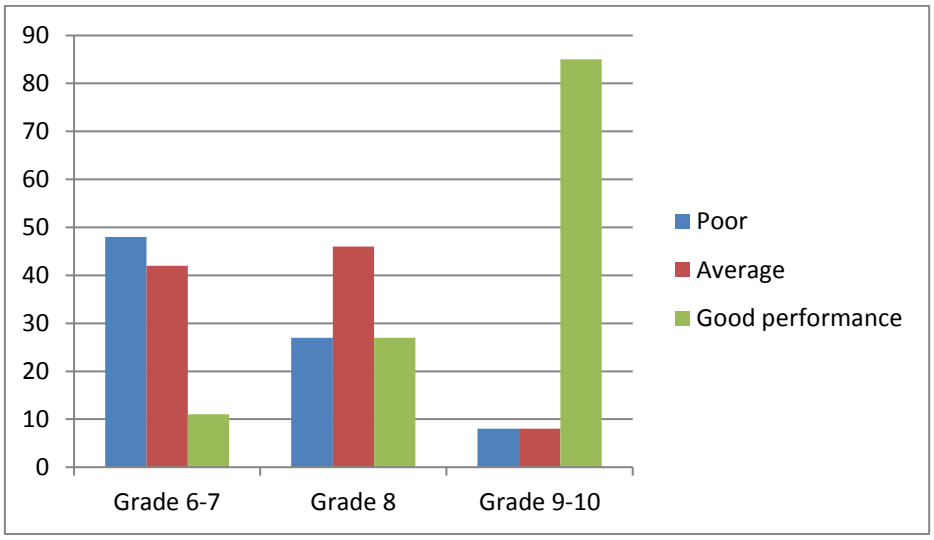

Figure 1 The connection between the Tens Base –survey 2 results and the pupils' report grades

It appears from Figure 1 one that half of the pupils who have got a poor report grade (6 or 7) performed in Tens Base –survey poorly however, 10% of the same group succeeded well. It was possible to see a parallel phenomenon also with the pupils who had got a good report grade and of whom more than 80% succeeded well in Tens Base –survey. The result that figure 1 presents is expected in regard to the fact that the pupils who had succeeded well in the survey had received excellent report grades and correspondingly those who performed poorly had received poor report grades in mathematics. The good success of the pupils who had received a poor report grade in mathematics Tens Base –survey 2 can be explained partly by the fact that the contents of the survey are basics which the pupils are expected to know and, in turn, the report grade consists of a wider content at each grade. Other elements as assessment of working are also included in the report grade given by the teacher. The validity of the report grade can be thought about from many points of view. The studies which are related to the pupil assessment show that often the report grade received by the pupil is influenced also by the pupil's temperament, the teacher's understanding of the pupil's teachability and goal orientation (Mullola 2012.).

The pupils' interview

The interview which mapped out the basic information of the Likert-scale questionnaire was examined from the point of view of the three groups that were divided according to the results of Tens Base –survey 2. The pupils' opinions and experiences of studying mathematics, their own level of skills and their attitudes were expressed in the interview. For the pupils who had succeeded well, it had been easy to learn mathematics from the beginning of the school and correspondingly the ones which had performed poorly had experienced learning mathematics as a challenge at times. All the interviewed pupils shared the opinion that the teacher must teach mathematics in

learning sessions, in other words, they must explain, in particular, the contents of new matters. In the pupils' opinion, mathematics cannot be independently learned without instruction.

Five out of six poorly performing pupils in Tens Base –survey 2 gave themselves a better grade by one than the teacher. The grades given to themselves by the pupils varied in the range of 7-8. Exactly same result appeared for the pupils who had succeeded averagely. The grades of the pupils who had succeeded averagely varied between 7 and 9. The pupils who succeeded well evaluated their own skills with the same number in line with the report grade given by the teacher. The pupils did not know how to justify the grade given by themselves or did not know how to analyze matters which they should still have a better command of. In the pupils' own evaluation the grades of the mathematics tests seemed to be significant, which leads to the conclusion that the pupils did not know the assessment criteria to reflect their skills more widely. The pupil assessment also becomes more grade based all the time for the older pupils, in which case the pupil can be left feeling unclear regarding the contents of the grade. It came forth in the interview that the pupils who had performed poorly and averagely hoped for diverse methods of work, working together, the teacher's support, diverse mathematics equipment and a peaceful working environment for the teaching of mathematics. The wishes of the pupils who had succeeded well were directed mainly at the structure of the lesson. They hoped for structured teaching where the contents are first taught and after that independent work is carried out in a peaceful environment. The pupils had a neutral attitude to studying mathematics, only one pupil who had succeeded well was particularly interested in mathematics.

The connection between mathematical self-concept and school report grade

Three main points were included in Likert-scale questionnaire about mathematical self-concept: the pupils' self-concept as learners of mathematics, the pupils' ideas of learning and teaching in mathematics and the pupils' understanding of the nature of mathematics in relation to the solution processes of the tasks in school mathematics. In light of the results of the questionnaire the pupils' self-concept as learners of mathematics was in line with the earlier research results (cf. Kupari et al. 2013; Metsämuuronen 2010). More than half of the pupils who received a poor report grade (6-7) had a low self-concept of themselves as learners of mathematics and in turn, more than 60% of the pupils who had received excellent report grade had a positive self-concept. However, 10% of the pupils with a poor report grade and about third (p=005) of the pupils with a good (8) report grade had a good self-concept. When differences in mathematical self-concept between the girls and the boys are compared, the differences are non-existent. A positive attitude was found a little bit more with the boys than the girls. This result parallels the result by Niemi (2010) and it can be partly explained by the general way of thinking, according to which the boys are better than girls in mathematics and thus the idea which is conveyed to the boys has a positive effect on their self-concept.

When asked about the matters which are related to the learning and teaching of mathematics, for half of the pupils who had received an excellent report grade and to more than 60% of the pupils who had a good report grade, teaching or learning of mathematics did not present a great significance. Instead, nearly 40% of the pupils who had a poor report grade saw the matters connected to teaching and learning of mathematics in a positive light. This result points to the fact that the teaching of mathematics is significant to the pupils with poorer skills. It showed in the interview that the weak pupils had more wishes in regard to the teaching of mathematics and the teaching they received was versatile which can partly explain their more positive attitude towards the teaching and learning of mathematics. When asked about the nature of mathematics in relation to the solution processes of the tasks in school mathematics, 30% of the pupils who had received a poor report grade had positive attitude. Only one pupil who had an excellent report grade had a positive view of the above mentioned general nature of mathematics. Half of all the pupils had a generally neutral attitude towards mathematics.

Connection between mathematical self-concept and Tens Base –survey

Mathematical self-concept was also examined in relation to the pupils' success in Tens Base –survey. As described above, the majority of the pupils receiving good marks in the survey were boys. Otherwise the pupils' success was divided evenly into three different levels: those who had performed poorly, averagely and well. The connection between the mathematical self-concept seems to be parallel both with the success in Tens Base –survey and with the good mathematics report grade. Of the pupils who had succeeded well in the Tens Base –survey as well as received a good report grade of the mathematics, nearly 70% has a positive mathematical self-concept, whereas 10% of the pupils with poor performance are positive (p=001). There are deviations in the connection between the report grades in mathematics and mathematical self-concept as well as the success in Tens Base –survey for the pupils who have performed poorly. The pupils who had performed poorly in the Tens Base –survey appeared to have less of the negative mathematical self-concept (30%) than the pupils who had received a poor report grade (50%).

30% of the pupils who had performed poorly in Tens Base –survey had a positive attitude towards teaching and learning mathematics. This result is parallel with the views of the pupils who had received a poor report grade in mathematics because 40% of the pupils who had a poor report grade had a positive attitude towards teaching and learning of mathematics. Nearly 40% of the pupils who succeeded well had a negative attitude towards learning and teaching of mathematics which is a little more than the attitude of the pupils who have received a good report grade. The negative attitude to learning and teaching of mathematics was extremely low with the pupils who had performed poorly in Tens Base –survey (10%). It is interesting to notice that the poorly performing pupils have a more positive attitude towards learning and teaching of mathematics than the pupils who have performed well. A parallel result can be perceived in the general attitude towards mathematics of the pupils who have also performed poorly in Tens Base –survey. Nearly 40% of the pupils who had performed poorly in Tens Base –survey had a positive attitude towards mathematics whereas 14% of the ones who had performed averagely in Tens Base –survey and 20% of the ones who had succeeded well had a positive attitude towards mathematics. A quarter of the pupils who succeeded well in Tens Base –survey had negative attitude towards mathematics when asked about the pupils' ideas of the nature of mathematics, and in particular about the versatility of the solution processes of the tasks in school mathematics. There was not a great deal of difference in the attitudes of the pupils who had performed poorly and those who had succeeded well towards the solution processes of the tasks in school mathematics. 30% of the pupils who had performed poorly had a negative attitude towards the nature of mathematics especially from the point of view of the solution processes of the school mathematics tasks.

One can state as a summary that the pupils with a poor report grade and who performed poorly in Tens Base –survey have more positive attitude towards mathematics than the good pupils. The good pupils have a more positive mathematical self-concept than the weak pupils, of course, however, their attitude towards mathematics is more negative.

DISCUSSION

In this article the mathematical self-concept of the pupils of three sixth grade classes (n=57) was examined in relation to the pupils' skills in mathematics in Tens Base –survey 2 and to the report grades they had received. At the same time, the connection between the report grades in relation to the success in Tens Base –survey was also examined. The obtained results correlate rather well with the general image of the relationship between a mathematical self-concept and success in mathematics. The self-concept of the pupils who had performed poorly in mathematics was lower than that of those who seemed to be succeeding in mathematics on the basis of the results from Tens Base –survey and report grades. According to studies (see Metsämuuronen 2010, 2013; Kupari et al. 2013; Wilkins 2004) the mathematical self-concept is connected to the success in mathematics. There were differences between the pupils' report grades and the grades they had given themselves, in particular, with the pupils who had performed poorly and averagely. These pupils gave themselves a better grade than the teacher. The evaluation has to be based on both the pupil's self-assessment and the teacher's assessment. The pupils also need to know the criteria for assessment. The assessment of mathematics indeed needs to contain versatile evaluation such as verbal-, peer-, and self-assessment and has to be directed to the learning process and to working.

It is interesting that according to the results of this study the pupils who succeed well in mathematics and who have a positive self-concept in mathematics didn't necessarily have a positive interest in mathematics. In international evaluation studies, the Finnish pupils' negative attitude towards the interesting nature of mathematics even in the lower grades has also come forth (see Kupari et al. 2012a; Kupari et al. 2012b). The fact that the pupils who had performed poorly in mathematics had a more positive attitude towards mathematics than those who had succeeded well is particularly interesting. Because about half of the pupils who had performed poorly were boys, a positive mathematical self-concept with the pupils who have performed poorly can partly be explained by the boys' more positive attitude and self-concept towards mathematics that has generally been observed in the studies. Another explanation may be found in the fact that the pupils who don't perform well experience getting more support, encouragement and positive feedback during the mathematics lessons than the pupils who are successful in mathematics. Contrary to this, the progress made by the pupils who are gifted and succeed well in mathematics is trusted and, for example, also directing the special needs education to the needs of the gifted pupils is lesser. It would be important to offer every pupil tasks that are at their own level and suitably challenging, in which case the positive attitude towards mathematics could be preserved through the experiences of the success. Tikkanen (2008) emphasizes the significance of the teacher to the pupils' mathematical self-concept. The significant factors are the feedback that has been received from the teacher, the expectations set by the teacher and the general atmosphere. The scope of the factors which are related to learning in mathematics adds to the challenging role of the teacher. For example, motivation, expanding the basic knowledge and understanding the mathematical phenomena have a positive affect on mathematical self-concept, and in the teaching attention should indeed be paid to realizing them as factors which affect the development of the self-concept.

When examining the differences between the genders in the success in Ten Base- survey, the boys succeeded better in the report grades and the mathematical self-concept than the girls in Ten Base- survey and the boys' mathematical self-concept was a little more positive than the girls' self-concept. However, the boys' report grades were poorer as over half of the boys had a report grade of either 6 or 7. According to Metsämuuronen (2013) the change in the mathematics skills of the girls' and boys' between the grades 3-9 is a little to the boys' advantage. This is partly explained by the fact that proportion of girls among the best succeeding pupils in mathematics falls distinctly from the sixth grade onwards. It is likely that the girls' confidence in their mathematics skills is lower than the boys' and that it gets lower year by year is connected to this.

In the study, the information of the pupils' skills in mathematics was obtained on the basis of Ten Base-survey and the report grades. The report grade and Ten Base-survey tell about the skills differently. The report grade measures the command of the mathematical contents of the grade in question whereas Ten Base- survey concentrates on the command of the decimal system. Ten Base- survey 2 has been designed for surveying the pupils' skills in the decimal system and it contains tasks, calculations and measure conversions which are related to the concepts of the natural numbers and decimals. The aim of the survey is to find those pupils whose skills in the command of the decimal system had weaknesses. These weaknesses were seen in this study also in the report grades. The types of surveys such as the Ten Base- survey are one way of finding out the level of pupils' skills, and the level of the pupil's skills cannot be explained solely with the help of Ten Base- survey. Information was obtained with the help of the pupils' interviews regarding the ideas of the different level pupils in connection with mathematical self-concept as well as their skills. Likert-scale questionnaire based on the interviews brought the opinions of the wider pupil material as the subject for the examination. When a wider general view about the nature of mathematical self-concept of the sixth grade pupils of the comprehensive school is searched for, a bigger target group would increase the reliability of the study. Likert-scale questionnaire gives the pupils the opportunity to choose and also the possibility to not answer the questions to which they do not have an opinion of. The contents of the questionnaire which are related to the mathematical self-concept can have been in some part challenging for the pupils to understand and this may have affected the results obtained. However, the results of the study are mainly parallel with the results of national and international evaluation studies.

According to the longitudinal study into the learning results in mathematics of the basic education during the years 2005−2012 edited by Metsämuuronen (2013), the Finnish pupils' interest in mathematics decreases considerably during the school years. With the decrease in interest the learning results can also become lower. Adding games and playing games in the mathematics learning environments has been raised by the Ministry of Education as one of the means to increase the interest towards mathematics. Learning of mathematics is in connection to the mathematical self-concept which has been studied extensively. Gamification can be used to make learning in mathematics more motivating, to offer a lower threshold for coping with failure, to bring a more creative and more communal way for studying mathematics, when the exchange of ideas and doing together influence the pupils' mathematical self-concept. It has been noticed that gamification is activating for the pupils, inclusive and inspiring operation. What ever the means, it would be essential to pay attention more consciously to the significance of the pupils' mathematical self-concept in the learning process and in this way have a positive effect on the learning and attitudes towards mathematics. The results of this article will be used as the information basis for the implementation of the Gamification-scheme in the spring term 2015.

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