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Comparison of Two Research Tools Measuring Attitudes towards Mathematics

Peter Vankúš[a*] – Ivana Ochodničanová[a]

[a] *Department of Algebra, Geometry and Didactics of Mathematics, Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Mlynská dolina, SK - 842 48 Bratislava*

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Abstract

Our paper is comparing selected results from two research tools measuring attitudes towards mathematics. Both tools are questionnaires created to measure various areas of the complex system of pupils' attitudes. In our paper we compare the results on pupils' liking of mathematics found out by the first questionnaire with the results in the same area obtained by the second questionnaire. This comparison we realize on the sample of 154 pupils in the lower secondary education (10–15 years old). The statistical analysis of the data showed that both questionnaires give coherent outputs.

Keywords: attitudes, mathematics, research tools, questionnaire, attitudes towards mathematics.

Classification: C20

Introduction

The attitudes toward mathematics are important elements those are influencing the results of mathematics education. Therefore a lot of researchers are dealing with this important topic. Proper research tools for measuring various areas of the attitudes are needed to ensure the quality of the research in this topic. In our paper we study two research tools, the questionnaires. We compare the outputs those gave these questionnaires applied on the same research sample, to extract information on the correlations between results on the pupils' liking of mathematics found out by the first and by the second questionnaire.

Used questionnaires

The importance of pupils' attitudes towards mathematics is supported by the opinion, believed to be true in scientific and teacher communities which states that pupils learn more effectively and they are more interested in the mathematics lesson and are performing better if they have positive attitudes towards mathematics (Ma & Kishor, 1997). Therefore a lot of researches are done to study closely the system of pupils' attitudes towards mathematics. Very important tools in these researches are various questionnaires those are the tools to measure the areas of this system.

In our paper we deal with two such questionnaires. The first one was created based on the surveys on pupils attitudes towards mathematics performed in Slovakia. In this study that was part of the comparative research study led by Jose Diego-Mantecon and Paul Andrews

*Corresponding author: peter.vankus@gmail.com
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from the University of Cambridge was used the modified Mathematics Related Beliefs Questionnaire (De Corte & Op't Eynde, 2002). This questionnaire was designed to find out the compatibility of its use in various European states, specifically in England, Spain and Slovakia (Andrews, Diego-Mantecón, Op 't Eynde, & Sayers, 2007; Andrews, Diego-Mantecón, Vankúš, Op 't Eynde, & Conway, 2008; Andrews, Diego-Mantecón, Vankúš, Op 't Eynde, & Sayers, 2011).

Our first questionnaire that was used in the study described in this paper was created based on our analysis of the Slovak results of mentioned survey and also on our other studies that we performed in this field of the research (Vankúš & Kubicová, 2010; Vankúš &Kubicová, 2012). The questionnaire consists of 16 items and measures 4 areas: the liking of the mathematics, beliefs on the usefulness of mathematics, pupils' mathematics self-beliefs, and self-evaluation of pupils' effort in the mathematics. The complete questionnaire was published in our work (Vankúš, 2014, p. 134–135) that is also accessible on the webpage www.comae.sk/efektivnost.pdf. In this article we will work just with the items of this questionnaire dealing with the area the liking of the mathematics. These items, as well as the rest of the questionnaire, were 6 scale Likert type items. The items are included in the table 1.

Table 1: *Items from the first questionnaire*

I am fond of mathematics.
Mathematics makes me happy.
To learn mathematics is pleasure for me.
I like mathematics.

The second questionnaire that we study in this paper was used in our previous research (Vankúš, 2006; Vankúš, 2007). The questionnaire was created based on the sample questionnaire from the work by Mager (1984). The questionnaire has 4 items with the selection of answers and one item with possibility of the free answer. All the items are focused on the area of the liking of the mathematics. The questionnaire was published in our work (Vankúš, 2014, p. 128–129).

Research

The comparison of the questionnaires was done on the sample of 154 pupils in the lower secondary education (10–15 years old). The pupils were from two classes in the grades 5–8 and from one class in the grade 9. The research was done in the state school in Bratislava. The scoring of the used questionnaires was done based on the method described in already mentioned work (Vankúš, 2014, p. 130 and p. 138). The results are presented in the table 2. The results are done separately for each grade. The reason for this is the fact, found out by the previous researches that the attitudes towards mathematics are changing with the age of pupils (Ma & Kishor, 1997; Vankúš &Kubicová, 2012).

***Table 2**: Research results*

5th grade (10–11 years old) ***n = 43***	**First questionnaire**	**Second questionnaire**
Mean	17,21	15,77
Standard deviation	4,72	4,30
Normality test (Shapiro-Wilk, *W*)	0,94 (not normal)	0,97 (normal)
6th grade (11–12 years old) ***n = 25***	**First questionnaire**	**Second questionnaire**
Mean	15,44	14,76
Standard deviation	3,37	3,98
Normality test (Shapiro-Wilk, *W*)	0,94 (normal)	0,95 (normal)
7th grade (12–13 years old) ***n = 26***	**First questionnaire**	**Second questionnaire**
Mean	12,08	10,85
Standard deviation	5,87	5,79
Normality test (Shapiro-Wilk, *W*)	0,91 (not normal)	0,92 (not normal)
8th grade (13–14 years old) ***n = 37***	**First questionnaire**	**Second questionnaire**
Mean	13,00	13,03
Standard deviation	5,02	4,35
Normality test (Shapiro-Wilk, *W*)	0,97 (normal)	0,96 (normal)
9th grade (14–15 years old) ***n = 23***	**First questionnaire**	**Second questionnaire**
Mean	11,87	10,91
Standard deviation	4,18	4,81
Normality test (Shapiro-Wilk, *W*)	0,97 (normal)	0,93 (not normal)

Based on the normality Shapiro-Wilk test stated in the table 2 the results from the questionnaires are not all normally distributed ($p < 0{,}10$), so we will use both parametric and nonparametric tests. We will now compare the results of the questionnaires by the parametric Student's t-test (for normally distributed data) and nonparametric Mann-Whitney U-Test (for all data). The results from these tests are in the table 3.

***Table 3**: Statistical comparison*

5th grade		
Mann-Whitney U-Test	$U = 748,0$	$p = 0,13$
6th grade		
Student's t-test	$t = 0,65$	$p = 0,52$
Mann-Whitney U-Test	$U = 267,5$	$p = 0,39$
7th grade		
Mann-Whitney U-Test	$U = 293,0$	$p = 0,42$
8th grade		
Student's t-test	$t = 0,02$	$p = 0,98$
Mann-Whitney U-Test	$U = 682,0$	$p = 0,98$
9th grade		
Mann-Whitney U-Test	$U = 221,5$	$p = 0,35$

From the data in the table 3 we can see that results from both questionnaires are not statistically significantly different ($p < 0,10$). So we can say that our questionnaires give statistically coherent outputs. We can also compute the Pearson coefficients of the correlation, which are in table 4. They show moderate positive correlations, which means there is a tendency for high scores in the first questionnaire go with high scores in the second one (the same for the low ones).

***Table 4**: Pearson coefficients*

Grade	5th	6th	7th	8th	9th
Pearson coefficient	$R = 0,74$	$R = 0,80$	$R = 0,91$	$R = 0,84$	$R = 0,75$

Conclusion

In our paper we compared the results from our two questionnaires used to study pupils' attitudes towards mathematics. In both questionnaires we focused on the area of the liking of mathematics. We have done statistical comparison of the results obtained from 154 pupils. The statistical data show that our questionnaires give coherent outputs those are in correlation. This implies that the questionnaires are properly built. Further studies on the bigger samples are still needed to verify the validity and reliability of these research tools. That will be beneficial for the next studies in the field of attitudes towards mathematics.

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