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Original Paper

Impact of education on the ability to use mathematical tools to solve financial tasks. A case study of Slovakia

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ABSTRACT

Between financial literacy and mathematics has been found a high correlation according OECD study. In the Slovak Republic, relative performance in financial literacy was lower than expected at all levels of mathematics performance. The aim of the paper was to examine the impact of education focus on the ability to use mathematical tools to solve financial tasks on a sample of students from Slovakia. The examined sample consisted of 103 students from two faculties of the Slovak University of Agriculture in Nitra. We performed a questionnaire consisted of 7 multiple choice questions (financial tasks according to ISCED 2, ISCED 3A). We found statistically significant differences in the answers of respondents according to their university education focus (economic, non-economic). The most problematic area of the questionnaire was to calculate value added tax.

KEYWORDS: numerical skills, financial literacy, education focus, university students, Slovakia

JEL CLASSIFICATION: D10, D35, M34

INTRODUCTION

Finances are part of our daily life with great influence on it. Whether positive or negative way, it depends on the financial literacy of each of us. Nowadays financial literacy has become an universally necessary skill for life because dynamic and rapidly changing development on the financial markets coupled with impact of the global economic crisis makes the financial decisions and personal money management more challenging than ever before [16]. Financial literacy is knowledge and understanding of financial concept and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order

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to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life [10]. The growth of financial literacy of population through financial education can be perceived as a tool to improve living conditions through better decision-making [3]. Higher level of financial literacy can increase level of living standard [17]. Increasing consumer financial literacy is a public policy objective to improve welfare through better decision making [4, 18]. Researches have been shown that levels of financial literacy worldwide are unacceptably low [1], particularly among young people [10]. In 2008, the OECD established the organization named the International Network on Financial Education, which is directly focused on support of financial education in the OECD countries [7]. Due to the recognizing an importance of financial literacy, a growing number of countries have developed and have implemented national strategies for financial education in order to improve the financial literacy of their populations in general, often with a particular focus on younger generations [5, 10].

In 2008, Ministry of Education, Science, Research and Sport of the Slovak Republic emphasized the importance of financial literacy development by formulating the National Standard of Financial Literacy in 2008 [17]. It is the initial document for incorporating financial literacy into the school education programs in the Slovak republic [8]. This document was updated to version 1.1 in september 2014 [9]. It that time methodology was also developed for incorporation and application of financial literacy topics into The National Education Programs – Mathematics ISCED 2, ISCED 3A [14, 15].

The ability to use mathematical tools to solve numerical tasks in financial decision making (numerical literacy) goes “hand to hand” with financial literacy [7]. On average across the 13 OECD countries and economies, the correlation between financial literacy and mathematics was 0.83 [11], which indicates that financial literacy was strongly correlated with mathematics. Some basic knowledge of mathematics is necessary to develop proficiency in financial literacy [11]. Conversely, interest in financial matters and financial literacy competencies can also support the development of mathematics and reading skills as well as provide a potentially engaging, real-life context to other school subjects [10].

The aim of the paper was to examine the impact of education focus on the ability to use mathematical tools to solve financial tasks on a sample of students from Slovakia.

MATERIAL AND METHODS

The examined sample consisted of 103 students from two faculties of the Slovak University of Agriculture in Nitra (SAU). We selected the Faculty of Economics and Management (FEM, 50 students) and the Faculty of Biotechnology and Food Sciences (FBFS, 53 students). We wanted to compare numerical ability of students focused on economic studies and students focused on non-economic studies. The examined sample consisted of first-year students of the university, 42 graduated from secondary grammar schools (SGS), 26 graduated from business colleges (BC) and 35 graduated from secondary vocational colleges (SVC, technical, chemical, agricultural). The sample structure is shown in table 1.

We performed a questionnaire consisted of 7 multiple choice questions. Questions were formulated as financial tasks. We focused on The National Educational Program Mathematics ISCED 2, ISCED 3A. The tasks were focused on the ability to calculate value added tax,

to calculate gross salary, to use of exchange list, to compare the offers of insurance companies, to use simple and compound interest, to understanding the links between the interest rate and the length of the interest period. Students solved the tasks in questionnaire in 20 minutes and they were allowed to use a calculator.

Tab. 1 Numbers of students participating in research

	Faculty of Economics and Management		Faculty of Biotechnology and Food Sciences		total
	women	*men*	*women*	*men*	
secondary grammar schools	8	2	21	11	42
business colleges	23	3	0	0	26
secondary vocational colleges	8	6	18	3	35
total	39	11	39	14	103

We created index of successfulness of respondents for each question according to selected determinants. It is an average score of correct answers of respondents. The highest possible $I-SR$ value can be 1, the lowest 0. We calculated $I-SR$ by the formulas:

1) Index of selected determinants (FEM, FBFS, SGS, BC, SVC, women, men, questions):

$$I-SR=\frac{Number\ \ of\ \ correct\ \ answers\ \ of\ \ respondents}{Number\ \ of\ \ respondents\ according\ to\ determinant}$$

2) Total index:

$$I-SR=\frac{Number\ \ of\ \ correct\ \ answers\ \ of\ \ respondents}{(Number\ of\ \ questions)\cdot(Number\ \ of\ \ respondents\ according\ to\ determinant)}$$

We used SAS software to realized statistical analysis of obtained data. We created contingency tables, because they provide a basic view of the interrelation between two or more variables and can help find interactions between them. Analysis of contingency tables includes chi-square tests and measures of association.

RESULTS AND DISCUSSION

The index of successfulness of respondents in each question according to selected determinants (education focus, graduated school, gender, question) is shown in table 2.

Tab. 2 Index of successfulness of respondents according to selected determinants

Determinants	*Questions*							
	1	2	3	4	5	6	7	Total
FEM	0.400	0.760	0.400	0.820	0.720	0.720	0.740	0.651
FBFS	0.019	0.377	0.623	0.868	0.434	0.321	0.547	0.456
SGS	0.119	0.429	0.619	0.952	0.429	0.405	0.619	0.510
BC	0.500	0.846	0.346	0.654	0.731	0.615	0.692	0.626
SVC	0.086	0.514	0.514	0.857	0.629	0.571	0.629	0.543
women	0.218	0.564	0.487	0.821	0.551	0.474	0.654	0.538
men	0.160	0.560	0.600	0.920	0.640	0.640	0.600	0.589
question	0.204	0.563	0.515	0.845	0.573	0.515	0.641	0.551

The overall successfulness of our sample measured by total $I-SR$ was 55.1 %. It means that is average each respondent answered correctly more than 3 answers out of 7.

As can be seen in table 2 the main differences in $I-SR$ calculated for selected determinants are in education focus. The $I-SR$ of the students of the Faculty of Economics and Management (FEM) was 65.1 %. It was the best result. The $I-SR$ of the students of the Faculty of Biotechnology and Food Sciences (FBFS) was 45.6 %. Twenty percentage point difference was probably due to the time proceedings research. The research took place in the summer semester, when the students of FEM already passed the first tests of the winter semester. The obtained values show a beneficial effect of economic education on the ability of students to solve financial tasks. The $I-SR$ of the respondents from secondary grammar school (SGS) was 51 %. The second best result of the success was measured at graduated of business colleges (62.6 %). It should be noted that all graduated of business colleges (BC) were students of FEM (see table 1). The $I-SR$ of the respondents from secondary vocational colleges (SVC) was 54.3 %. We noticed only minimal differences in correct answers of women and men similar as the Slovak Banking Association when examined the financial literacy of the population of Slovakia [13]. However Bhushan & Medury [1], Ivančová [6], Krechovská [7], Poliaková [12], Tóth et al. [16,17] described in their research higher financial literacy of men as women.

Tab. 3 Contingency table of faculties and questions

Frequency Expected Percent Row Pct Col Pct	Table of faculty by question														
	question														
faculty	1c	1w	2c	2w	3c	3w	4c	4w	5c	5w	6c	6w	7c	7w	Total
FEM	20	30	38	12	20	30	41	9	36	14	36	14	37	13	350
	10.194	39.806	28.155	21.845	25.728	24.272	42.233	7.767	28.641	21.359	25.728	24.272	32.039	17.961	
	2.77	4.16	5.27	1.66	2.77	4.16	5.69	1.25	4.99	1.94	4.99	1.94	5.13	1.80	48.54
	5.71	8.57	10.86	3.43	5.71	8.57	11.71	2.57	10.29	4.00	10.29	4.00	10.57	3.71	
	95.24	36.59	65.52	26.67	37.74	60.00	47.13	56.25	61.02	31.82	67.92	28.00	56.06	35.14	
FBFS	1	52	20	33	33	20	46	7	23	30	17	36	29	24	371
	10.806	42.194	29.845	23.155	27.272	25.728	44.767	8.233	30.359	22.641	27.272	25.728	33.961	19.039	
	0.14	7.21	2.77	4.58	4.58	2.77	6.38	0.97	3.19	4.16	2.36	4.99	4.02	3.33	51.46
	0.27	14.02	5.39	8.89	8.89	5.39	12.40	1.89	6.20	8.09	4.58	9.70	7.82	6.47	
	4.76	63.41	34.48	73.33	62.26	40.00	52.87	43.75	38.98	68.18	32.08	72.00	43.94	64.86	
Total	21	82	58	45	53	50	87	16	59	44	53	50	66	37	721
	2.91	11.37	8.04	6.24	7.35	6.93	12.07	2.22	8.18	6.10	7.35	6.93	9.15	5.13	100.00

c - correct answers, w - wrong answers

We wanted to find interactions between education focus and correct answers, therefore we created contingency tables by software SAS. Values in table 3 present expected frequency, the table percentage, row percentage, and column percentage according of faculties by questions. The differences in answers of students of FEM and FBFS we can see in table 2 and table 3. The students of FBFS were the most successful at question 3 and 4 (use of exchange list, compare the offers of insurance companies). These students could not calculate value added tax, there is only one correct answer to first task. The students of FEM could not calculate value added tax (question 1) neither correct use of exchange list (question 3). The students of FEM solved all other tasks with a success rate more than 72 % (table 2). According to our research in 2014 [2], researched students were also not very successful in calculating value

added tax. Maximum score of solved tasks was obtained by only 7 % students in grade 10, by 47 % students in grade 12 of Piarist High School in Nitra and by 4 % first-year students of FEM in Nitra.

We tested an association between faculties and answers (correct, wrong). Using the chi-square test we verified the differences between actual and expected frequencies. The chi-square statistic is 73.0694 with 13 degree of freedom. The associated p-value is < 0.0001, which means that there is significant association between faculties and answers to questions. The measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value 0.3183, it is a mediate association. The focus of university education (whether it is economic or not) has statistically significant influence on the correctness of the respondents' answers. Authors Ivančová [6], Krechovská [7], Tóth et al. [16, 17] studied the effect of economic education focus on financial literacy of university students. They found as we do, that economic focus of education has an impact on financial literacy. But differences between economic and non-economic samples of students were not as great as ours.

Tab. 4 Contingency table of secondary schools and questions

Frequency Expected Percent Row Pct Col Pct	Table of sschool by question														
	question														
sschool	1c	1w	2c	2w	3c	3w	4c	4w	5c	5w	6c	6w	7c	7w	Total
SGS	5 8.5631 0.69 1.70 23.81	37 33.437 5.13 12.59 45.12	18 23.65 2.50 6.12 31.03	24 18.35 3.33 8.16 53.33	26 21.612 3.61 8.84 49.06	16 20.388 2.22 5.44 32.00	40 35.476 5.55 13.61 45.98	2 6.5243 0.28 0.68 12.50	18 24.058 2.50 6.12 30.51	24 17.942 3.33 8.16 54.55	17 21.612 2.36 5.78 32.08	25 20.388 3.47 8.50 50.00	26 26.913 3.61 8.84 39.39	16 15.087 2.22 5.44 43.24	294 40.78
BC	13 5.301 1.80 7.14 61.90	13 20.699 1.80 7.14 15.85	22 14.641 3.05 12.09 37.93	4 11.359 0.55 2.20 8.89	9 13.379 1.25 4.95 16.98	17 12.621 2.36 9.34 34.00	17 21.961 2.36 9.34 19.54	9 4.0388 1.25 4.95 56.25	19 14.893 2.64 10.44 32.20	7 11.107 0.97 3.85 15.91	16 13.379 2.22 8.79 30.19	10 12.621 1.39 5.49 20.00	18 16.66 2.50 9.89 27.27	8 9.3398 1.11 4.40 21.62	182 25.24
SVC	3 7.1359 0.42 1.22 14.29	32 27.864 4.44 13.06 39.02	18 19.709 2.50 7.35 31.03	17 15.291 2.36 6.94 37.78	18 18.01 2.50 7.35 33.96	17 16.99 2.36 6.94 34.00	30 29.563 4.16 12.24 34.48	5 5.4369 0.69 2.04 31.25	22 20.049 3.05 8.98 37.29	13 14.951 1.80 5.31 29.55	20 18.01 2.77 8.16 37.74	15 16.99 2.08 6.12 30.00	22 22.427 3.05 8.98 33.33	13 12.573 1.80 5.31 35.14	245 33.98
Total	21 2.91	82 11.37	58 8.04	45 6.24	53 7.35	50 6.93	87 12.07	16 2.22	59 8.18	44 6.10	53 7.35	50 6.93	66 9.15	37 5.13	721 100.00

c - correct answers, w - wrong answers

Table 4 presents the contingency table of graduated secondary schools by answers (correct, wrong). The differences in answers of graduated of secondary grammar schools, graduated of business colleges and graduated of secondary vocational colleges we can see in table 2 and table 4. We tested an association between secondary schools and answers to questions. The chi-square statistic (a value of 57.1874 with 26 DF) provides evidence of an association between secondary school and students answers (p = 0.0004). The measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value between 0.1855 - 0.2623, it is weak association.

CONCLUSIONS

The most problematic area of the test was to calculate value added tax. This fact is troubling, because everybody applies the VAT every day during shopping in stores. The obtained values of successfulness show a beneficial effect of economic focus of university studies on the ability of students to solve financial tasks. There were statistically significant differences in the answers of respondents according to their education focus. The overall performance of FEM students was 65.1%, in average each respondent answered correctly more than 4.5 answers out of 7. We verified the relationship between type of secondary school and answers to questions, but did not found statistically significant influence secondary schools on the correctness of the respondents' answers.

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