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Original Paper

The ability to apply numerical concepts in financial tasks

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ABSTRACT

Person's capability to manage financial issues has become important in today's world. Mathematical knowledge is a part of consumer and financial literacy. According the OECD study, there is a high correlation between financial literacy and mathematics. The aim of the paper is to examine the impact of gender, level of education and age on the ability to use mathematical tools to solve financial tasks in a sample of population. The examined sample consisted of 350 inhabitants of the Galanta region in the Slovak Republic. We distributed a questionnaire which consisted of 6 multiple choice questions (financial tasks focused on ability to calculate the value added tax and gross income, to use the exchange rate list, to compare the offers of insurance companies, to calculate simple interest). We found statistically significant differences in the answers of respondents according to their gender, level of education and also age. Respondents of both genders were most successful in calculation of the value added tax and in use of simple interest.

KEYWORDS: numerical skills, financial literacy, association, Slovakia

JEL CLASSIFICATION: K40, M30

INTRODUCTION

With an increasingly complex and diverse array of financial product choices available to individual small investors, today's people need to be financially literate. In personal and professional lives, active citizens need to make a number of complex financial decisions, many of which have a lasting impact on their welfare. In 2008, the OECD established the organization named the International Network on Financial Education, which is directly focused on supporting of financial education in the OECD countries. Providing students with the opportunity to work with a variety of real-world financial examples may increase the likelihood that the decisions they make will be financially sound and savvy [10]. Thus, financial education without the ability to assess financial options in the real-world and, over one's lifetime, make sound financial decisions, does not make one financially literate [10]. A growing number of countries OECD have developed and have implemented national strategies for financial education in order to improve the financial literacy of their

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populations. Financial literacy requires familiarity with fundamental concepts from economics and finance [5], practical experience, and the ability to apply the knowledge one has gained [6, 8], and the ability to perform a range of elementary mathematical computations such as calculating simple and compound interest or depreciation [1, 5, 7]. The ability to use mathematical tools to solve numerical tasks in financial decision making (numerical literacy) goes "hand to hand" with financial literacy [4]. Educational organizations on mathematics all over the world support including real-world financial problems in the curriculum and emphasize the connection between mathematics, numeracy and financial literacy [10]. On average, across the 13 OECD countries and economies, the correlation between financial literacy and mathematics was 0.83 [9]. This fact indicates that financial literacy is strongly correlated with mathematics. In 2008 the 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, the initial document for incorporating financial literacy into The National Education Programs – Mathematics ISCED 2, ISCED 3A. The aim of the paper is to examine the impact of gender, level of education and age on the ability to use mathematical tools to solve financial tasks on a sample of population of the Galanta region in Slovakia.

MATERIAL AND METHODS

The examined sample consisted of 350 inhabitants of the Galanta region in Slovakia. We aimed to compare numerical ability of people of different education, age and gender. The sample structure is shown in Table 1.

Table 1 Numbers of respondents participating in research

Education	age 15-19		age 20-26		age 27-40		age 41-61		age over 62		Total
	women	*men*	*women*	*men*	*women*	*men*	*women*	*men*	*women*	*men*	
elementary	15	10	1	3	7	4	5	1	2	2	50
secondary	16	8	17	11	8	12	17	28	7	26	150
university	0	0	15	28	23	14	37	25	5	3	150
Total	31	18	33	42	38	30	59	54	14	31	350

We distributed a questionnaire which consisted of 6 multiple choice questions. Questions were formulated as financial tasks. The tasks were focused on the ability to calculate value added tax and gross income, to use the exchange rate list, to compare the offers of insurance companies and to calculate simple interest.

We created index of successfulness of respondents ($I - SR$) for each question according to selected determinants (age, education, gender). 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 formulas:

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

We used SAS software to process statistical analysis of obtained data and created contingency tables. Values in contingency tables present the frequency, expected frequency, table percentage, row percentage and column percentage according to selected determinants. The 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 (gender, education, age) is shown in Table 2. The overall successfulness of our sample measured by $I - SR$ was 57 %. It means that, on average, each respondent answered correctly more than 3 answers out of 6.

Table 2 Index of successfulness of respondents according to selected determinants

Determinants		*Questions*						
		1	2	3	4	5	6	*average*
gender	women	0.47	0.69	0.64	0.54	0.35	0.78	0.58
	men	0.42	0.66	0.44	0.62	0.46	0.72	0.55
education	elementary	0.56	0.76	0.58	0.36	0.48	0.68	0.57
	secondary	0.49	0.66	0.54	0.58	0.41	0.77	0.57
	university	0.36	0.66	0.53	0.65	0.37	0.76	0.55
age	15-19	0.49	0.78	0.55	0.35	0.41	0.61	0.53
	20-26	0.40	0.60	0.55	0.65	0.51	0.81	0.59
	27-40	0.46	0.63	0.56	0.53	0.41	0.85	0.57
	41-61	0.44	0.71	0.58	0.61	0.30	0.71	0.56
	over 62	0.47	0.66	0.40	0.69	0.47	0.76	0.57

As we can see in Table 2, the differences in the index of successfulness calculated for selected determinants are minimal. The obtained values show a beneficial effect of female gender on the ability to solve financial tasks (see Table 2, Table 3). Mancebón et al. [7] according to their research claim that gender is a factor which affects the level of financial literacy. In their research they observed better scores of girls than boys. However Bhushan & Medury [2], Krechovská [4], Tóth et al. [11] described higher financial literacy of men compared to women in their research.

We wanted to find associations between gender and correct answers, therefore we created contingency tables with the SAS software. Values in Table 3 present the expected frequency, table percentage, row percentage and column percentage according to gender by questions. We can see differences in answers in Table 3. Respondents of both genders were the most successful in questions 2 and 6 (calculate value added tax, use simple interest). The first and the second questions were related to value added tax. Respondents did not know that VAT is an indirect tax (index of successfulness for the first question was only 45 %, Table 2) but they knew its value, because the index of successfulness for the second question was 67 %. Men in our research were not able to calculate correctly the gross income (question 3). On the other hand, men were more successful in solving tasks 4 (use of the exchange rate list) and 5 (comparing the offers of insurance companies). We tested an association between gender and answers (correct, wrong). Using the chi-square test we verified the differences between real and expected frequencies. The chi-square statistic is 23.73 with 11 degrees of freedom. The associated p-value is 0.014, which means that there is a significant association between gender and answers to questions. Measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value of 0.11, it is a weak association.

Table 3 Contingency table for gender and questions

Gender	*Questions*												Total
	1c	*2w*	*2c*	*2w*	*3c*	*3w*	*4c*	*4w*	*5c*	*5w*	*6c*	*6w*	
Men	74	101	115	60	77	98	108	67	80	95	126	49	1050
	78	97	118	57	94.5	80.5	101	74	70.5	104.5	131.5	43.5	
	3.56	4.81	5.48	2.86	3.67	4.67	5.14	3.19	3.81	4.52	6.00	2.33	50.00
	7.05	9.62	10.95	5.71	7.33	9.33	10.29	6.38	7.62	9.05	12.00	4.67	
	47.44	52.06	48.73	52.63	40.74	60.87	53.47	45.27	56.74	45.45	47.91	56.32	
Women	82	93	121	54	112	63	94	81	61	114	137	38	1050
	78	97	118	57	94.5	80.5	101	74	70.5	104.5	131.5	43.5	
	3.90	4.43	5.76	2.57	5.33	3.00	4.48	3.86	2.90	5.43	6.52	1.81	50.00
	7.81	8.86	11.52	5.14	10.67	6.00	8.95	7.71	5.81	10.86	13.05	3.62	
	52.56	47.94	51.27	47.37	59.26	39.13	46.53	54.73	43.26	54.55	52.09	43.68	
Total	156	194	236	114	189	161	202	148	141	209	263	87	2100
	7.43	9.24	11.24	5.43	9.00	7.67	9.62	7.05	6.71	9.95	12.52	4.14	100.00

c - correct answers, w - wrong answers

In the next part of the paper we present contingency tables with statistically significant associations between the observed determinants. The differences in answers of primary school, secondary school and university graduates can be seen in Table 2 and Table 4.

Table 4 Contingency table for education and questions for women

Education	*Questions*												Total
	1c	*2w*	*2c*	*2w*	*3c*	*3w*	*4c*	*4w*	*5c*	*5w*	*6c*	*6w*	
elementary	22	8	23	7	22	8	6	24	17	13	20	10	180
	14.06	15.94	20.74	9.26	19.2	10.8	16.11	13.89	10.46	19.54	23.49	6.51	
	2.10	0.76	2.19	0.67	2.10	0.76	0.57	2.29	1.62	1.24	1.90	0.95	17.14
	12.22	4.44	12.78	3.89	12.22	4.44	3.33	13.33	9.44	7.22	11.11	5.56	
	26.83	8.60	19.01	12.96	19.64	12.70	6.38	29.63	27.87	11.40	14.60	26.32	
secondary	32	33	40	25	41	24	29	36	19	46	50	15	390
	30.46	34.54	44.94	20.06	41.6	23.4	34.91	30.09	22.66	42.34	50.89	14.11	
	3.05	3.14	3.81	2.38	3.90	2.29	2.76	3.43	1.81	4.38	4.76	1.43	37.14
	8.21	8.46	10.26	6.41	10.51	6.15	7.44	9.23	4.87	11.79	12.82	3.85	
	39.02	35.48	33.06	46.30	36.61	38.10	30.85	44.44	31.15	40.35	36.50	39.47	
university	28	52	58	22	49	31	59	21	25	55	67	13	480
	37.49	42.51	55.31	24.69	51.2	28.8	42.97	37.03	27.89	52.11	62.63	17.37	
	2.67	4.95	5.52	2.10	4.67	2.95	5.62	2.00	2.38	5.24	6.38	1.24	45.71
	5.83	10.83	12.08	4.58	10.21	6.46	12.29	4.38	5.21	11.46	13.96	2.71	
	34.15	55.91	47.93	40.74	43.75	49.21	62.77	25.93	40.98	48.25	48.91	34.21	
Total	82	93	121	54	112	63	94	81	61	114	137	38	1050
	7.81	8.86	11.52	5.14	10.67	6.00	8.95	7.71	5.81	10.86	13.05	3.62	100.00

c - correct answers, w - wrong answers

We tested an association between the level of education and answers to questions. The chi-square statistic (a value of 26.90 with 22 DF) does not provide evidence for association between answers of respondents of both sexes and the level of education ($p = 0.2151$). When we focused only on answers of women, we found significant associations between answers and level of education. Table 4 presents the contingency table for the level of education by answers (correct, wrong) for women. The chi-square statistic (a value of 57.81 with 22 DF) provides evidence for association between answers of women and level of education ($p < 0.0001$). Measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value between 0.17 - 0.23, it is a weak association.

The differences in answers of respondents of different ages can be seen in Table 2 and Table 5. We tested an association between age and answers to questions. The *chi*-square statistic (a value of 47.13 with 44 DF) does not provide evidence for association between age

and answers (p = 0.3459). But we found significant associations between gender and answers of respondents of age between 41 - 61 with university education. The chi-square statistic (a value of 40.55 with 11 DF) provides evidence for an association between gender and answers of above mentioned respondents (p < 0.0001). Measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value of 0.33, it is an intermediate association. When we focused only on answers of women, we found one significant associations between age and answers. Table 5 presents the contingency table for age between 41- 61 by answers (correct, wrong) for women. The chi-square statistic (a value of 32.31 with 11 DF) provides evidence for an association between answers of women and level of education (p = 0.0007). Measures of association (Phi Coefficient, Contingency Coefficient, and Cramer's V) have a value 0.22, it is a weak association.

Table 5 Contingency table for gender and questions for age 41-61

Gender	*Questions*												Total
	1c	*2w*	*2c*	*2w*	*3c*	*3w*	*4c*	*4w*	*5c*	*5w*	*6c*	*6w*	
Men	29	25	34	20	25	29	31	23	25	29	32	22	324
	23.89	30.11	38.23	15.77	31.06	22.94	32.97	21.03	16.25	37.75	38.23	15.77	
	4.28	3.69	5.01	2.95	3.69	4.28	4.57	3.39	3.69	4.28	4.72	3.24	47.79
	8.95	7.72	10.49	6.17	7.72	8.95	9.57	7.10	7.72	8.95	9.88	6.79	
	58.00	39.68	42.50	60.61	38.46	60.42	44.93	52.27	73.53	36.71	40.00	66.67	
Women	21	38	46	13	40	19	38	21	9	50	48	11	354
	26.11	32.89	41.77	17.23	33.94	25.06	36.03	22.98	17.75	41.25	41.77	17.23	
	3.10	5.60	6.78	1.92	5.90	2.80	5.60	3.10	1.33	7.37	7.08	1.62	52.21
	5.93	10.73	12.99	3.67	11.30	5.37	10.73	5.93	2.54	14.12	13.56	3.11	
	42.00	60.32	57.50	39.39	61.54	39.58	55.07	47.73	26.47	63.29	60.00	33.33	
Total	50	63	80	33	65	48	69	44	34	79	80	33	678
	7.37	9.29	11.80	4.87	9.59	7.08	10.18	6.49	5.01	11.65	11.80	4.87	100.00

c - correct answers, w - wrong answers

Financial literacy is being examined by a number of scientists who focus on various factors that affect it. For example the research by Bhushan & Medury [2] has shown that financial literacy level gets affected by gender, education, income, nature of employment and place of work whereas it does not get affected by age. Fraczek and Klimontowicz [3] concluded that gender has an effect on financial decisions. They found that women approach financial decisions in a more conservative manner compared to males and also conclude that males invest more frequently in the financial market than women. Krechovská [4], Tóth et al. [11] studied the effect of economic education focused on financial literacy of university students. They found that economic education focused on education has an impact on financial literacy. Lusardi, Mitchell and Curto [6] observed that financial literacy was strongly related to sociodemographic characteristics and financial sophistication of the family.

CONCLUSIONS

Nowadays financial literacy has become a universally necessary skill for life because financial decisions and personal money management is more challenging than ever before. A lot of scientists suppose that we must not only have a degree of familiarity with economic terms, but also a high level of reading comprehension and strong mathematical skills when we want to read financial documents. Our research has examined the impact of gender, level of education and age on the ability to use mathematical tools to solve financial tasks on a sample of population of the Galanta region in Slovakia. The obtained indices of successfulness show

a beneficial effect of female gender, university education and age between 41 - 61 on the ability of investigated respondents to solve financial tasks.

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