Mathematics Attitude of Future Teachers of Stem Subjects

Antonín Jančařík

Department of Mathematics and Mathematical Education
Faculty of Education, Charles University
M. D. Rettigové 4, 116 39, Praha 1, Czech Republic
E-mail address: antonin.jancarik@pedf.cuni.cz
ORCID: https://orcid.org/0000-0003-3331-2396

Guilherme Stecca Marcom

Department of Mathematics and Mathematical Education
Faculty of Education, Charles University
M. D. Rettigové 4, 116 39, Praha 1, Czech Republic
E-mail address: guilherme.steccamarcom@pedf.cuni.cz
ORCID: https://orcid.org/0000-0002-7297-8345

Maurício Urban Kleinke

Department of Applied Physics, Physics Institute Gleb Wataghing
University State of Campinas
Sérgio Buarque de Holanda, 777, 13083-859, Campinas - SP, Brazil
E-mail address: mauricio.u.kleinke@gmail.com
ORCID: https://orcid.org/0000-0002-7610-5269

Abstract

Aim. This paper presents research aimed at testing the mathematical self-efficacy of mathematics and computer science student teachers. The aim of the presented phase of the research was to verify the effectiveness of the chosen research instrument after translation into Czech, its applicability within the specific environment of the preparation of future teachers and the design of a shorter version of the questionnaire.

Methods. 97 students of the first and second year of Bachelor's degree studies at the Faculty of Education of Charles University, specialising in mathematics and computer science, were interviewed either in a single-subject form or in combination with a second subject. Subsequently, the data was processed and evaluated using quantitative methods.

Results. The results confirmed that the test, even when translated into Czech, fully met the claim of high reliability (Cronbach's Alpha = 0.965). Using the Principal Axis Factoring method with Varimax with Kaiser Normalisation in 11 iterations,

convergence to the four basic components, which were characterised as Motivation and Enjoyment, Anxiety, Self-confidence and Value, was achieved.

Conclusion. The research has shown that the chosen research instrument, the ATMI questionnaire, is fully functional after translation into English and use in the environment of preparation of future mathematics and science teachers. The first measurement data also confirms that attitudes towards mathematics are very different among future mathematics and science teachers. It also confirmed the assumption that the questionnaire has the potential to identify students who have problematic attitudes towards mathematics and are therefore at risk of dropping out.

Keywords: future teachers, mathematics anxiety, attitudes toward mathematics, motivation, enjoyment

Introduction

The way students perceive their subject of study and their abilities within it greatly influences their academic performance. Understanding how students perceive themselves in relation to their subject of study is an important tool for supporting them in their studies and predicting their potential academic failure and risk of drop-out.

The aim of the research presented here is to create a tool that allows measuring students' mathematics attitudes and their evolution during their studies, in order to better understand their needs and create tools that will contribute to their support. Solely the data derived from a preliminary study conducted to ascertain the validity of the instrument are expounded upon. The target group is not only mathematics teacher education and first grade teacher education students who will directly teach mathematics, but also future teachers of other disciplines that use mathematics, especially computer science and science.

The Attitudes Toward Mathematics Inventory (ATMI) questionnaire (Tapia & Marsh, 2004), which was translated into English and slightly modified for college testing purposes, was used as a baseline in the development of the evaluation instrument. The questionnaire was evaluated on a group of first- and second-year undergraduate students in mathematics and computer science, either in a single subject or in combination with another subject. The aim of the testing was not only to verify the reliability of the localised test, but also to create a short version of the test (cf. Lin & Huang, 2014).

Purpose and Objective

The original ATMI questionnaire contained 49 questions. The items were constructed using a Likert-scale format with the following anchors: 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree. The questionnaire was designed to investigate the underlying dimensions of attitudes toward mathematics (Tapia & Marsh, 2004). These included the following 6 areas:

- Confidence;
- Anxiety;
- Value;
- Enjoyment;
- Motivation;
- Parent/teacher expectations.

In our research we worked with a shortened version of the questionnaires, which contained 40 questions focusing on the first five of the original six areas, so we did not work with the area of parent/teacher expectations, which we considered not very relevant in the context of higher education.

The aim of the research was to answer following questions:

- Can the questionnaire be localised to the Czech language while maintaining the reliability of the original test?
- Can the original response scale be used or will it have to be adapted to give respondents the full range of responses?
- Which questions best describe the students' attitudes in the given areas and can serve as the basis for a shorter version of the test?
- Can the test describe differences between summarising groups of students and is the test able to identify students who are potentially at risk of academic failure?

The first two questions are more technical in nature; how crucial the third and fourth questions are for the further use of the questionnaire becomes apparent. We make the theoretically based assumption that students' self-perceptions in particular areas have a significant impact on their academic performance. We now provide evidence for this assumption for each of the individual domains.

Confidence

Confidence in one's own abilities, or confidence in one's own abilities in relation to a given subject of study - self-efficacy has been studied continuously since the concept of self-efficacy was defined (Bandura, 1977). A meta-analytic investigation the first decade of research (Multon et al., 1991) showed that there are strong effects when efficacy and basic skills are compared in a particular domain. Focusing on mathematics, Frank Pajers and David Miller (1995) reported that early research on self-efficacy focused on two basic areas. The first is the relationships among efficacy beliefs, related psychological constructs, and academic motivation and achievement (see Schunk, 1991). The second is then the link between efficacy beliefs and college major and career choices (see Lent & Hackett, 1987).

Thus, mathematics self-efficacy significantly influences both the choice of major studied and success during college. Therefore, it is important to monitor the self-efficacy of entering students (cf. Hall & Ponton, 2005; Jaafar & Ayub, 2010). At the same time, students' self-efficacy can also be

directly worked with and influenced in mathematics education (Zakariya, 2022).

Anxiety

"Fear of math" or "math anxiety" is one of the oldest concepts that have been studied in relation to math achievement. Systematic research has been conducted since the second half of the twentieth century. Initially, a unidimensional scale working primarily with anxiety and enjoyment of subject matter was used to describe subject perception (see Aiken & Dreger, 1961; Dutton, 1954; Gladstone et al., 1960). Anxiety is another factor that significantly affects student performance (Núñez-Peña et al., 2013) and across disciplines (Khasawneh et al., 2021).

At the same time, as with confidence, it is possible to work with math anxiety in mathematics education and influence it in a positive way (Perry, 2004).

Value

Perceptions of the value of mathematics were linked to perceptions of enjoyment of mathematics in early applications (Aiken, 1974). It appears that perceptions of low value of mathematics may also be one of the reasons for underachievement (Awaludin et al., 2015). Math anxiety can also be reduced by increasing the value of mathematics learning (Brezavšček, 2020). Students who see meaning in the use of mathematics achieve better results.

Enjoyment

The way students perceive learning and how much they enjoy it or, on the contrary, are bored during learning are among other factors that are monitored and influence student achievement (Schukajlow, 2015). Similar to valuation of mathematics, enjoyment also influences student anxiety (Bessant, 1995). This is again one factor that can be influenced by the teaching methods chosen and other support tools such as study group support.

Motivation

Motivation and enjoyment are two closely related factors that together influence both mathematics achievement and mathematics anxiety (Li et al., 2021). There are a number of factors that influence students' motivation to study mathematics (Teoh et al., 2010) and student motivation can be influenced by appropriate tools (Deitte & Howe, 2003, Tran & Nguyen, 2021).

Research Methodology

The subject of the research was the ATMI questionnaire, which was presented to first and second year students of Bachelor of Teacher Education with a focus on mathematics and computer science. The questionnaire contained 40 questions in Czech language. Responses were given on Likert-

-scale format with the following anchors: 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree. The questionnaires also included student data, but completion was not required and students could submit their answers anonymously. We did the analysis of data using the SPSS.

Basic Characteristics of the Sample

In total, responses were obtained from 97 students. 75 respondents were studying full-time, 22 were studying combined. 46 respondents were male, 39 respondents were female. 7 respondents did not indicate their gender. 54 respondents were studying in their first year of study, 39 in their second year, 4 students did not specify the year. 21 respondents were studying only single subject mathematics teaching, 45 were studying mathematics in combination with a second subject, 27 were studying only single subject computer science teaching and 4 respondents did not specify their field of study.

Of the 97 questionnaires returned, in 4 cases the data were incomplete and these questionnaires were omitted from further processing.

Research Question Number 1

Can the questionnaire be localised into the Czech language while maintaining the reliability of the original test?

To test this hypothesis, Cronbach's alpha was calculated. This value represents the internal validation of the questionnaire, it is used to confirm if the translation of the issues for Czech language maintenance the internal consistency (Stadler et al., 2021; Edwards et al., 2019). Calculating the alpha in our investigation the value came out to be 0.965.

The Cronbach's alpha of the original test was .963 (Tapia & Marsh, 2004), so localising the test did not reduce the reliability of the test. All questions contribute to the result. The only question that proved problematic was, "I would like to avoid using math in college". This question does not quite make sense in relation to mathematics teachers but is of great importance to students in other disciplines that use mathematics, such as physical education teachers and biomechanics courses. There were also translation problems with this question, where the meaning of the first version used was more like I hope I don't take math in college. The question was modified to I would like to have a smaller scope of mathematics in my studies.

Research Question 2

Can the original range of responses be used or will it need to be modified to give respondents the full range of responses? The willingness to use the extreme values strongly disagree and strongly agree depends on cultural practices (cf. Voňková et al., 2022). In some cases it is therefore better to use a Likert-scale format with the following anchors: 1 disagree, 2 rather disagree, 3 neutral, 4 rather agree, and 5 agree. To determine whether the full Likert scale was being used, all 1680 responses (regardless of the question asked) were analysed and the number of which responses were used

was recorded. Analysis of the responses revealed that even cut-off values expressing strong agreement or disagreement are used and therefore the original response scale can be maintained.

Research Question Number 3

Which questions best describe students' attitudes in the areas and can serve as the basis for a shorter version of the test?

To respond to these questions some statistical tools can be used. But in our context, we need to consider different variables can affect the development of self-efficacy. Looking simultaneously at all these aspects and identifying these characteristics and salient features can be a costly and time-consuming task. In this sense, it is necessary to use statistical tools of multivariate analysis, more specifically the Exploratory Factor Analysis (EFA) to look atful , from the answers of students to the questionnaires, the most relevant aspects that influence the development of self-efficacy.

In this sense, Daniel Matos and Erica Rodrigues (2019) point out that factor analysis is an empirical technique, i.e., it is purely based on the questionnaire responses as a criterion for grouping the variables. However, it is expected that the factors found at the end of the process make sense from the theoretical point of view. The EFA is one of the most used multivariate statistical procedures in questionnaire-related research in various domains (psychology, education sociology, public management, and health, among others). The main purpose of the EFA is to reduce the dimension of the analysis and determine the number and nature of latent variables present in a questionnaire or a test, that is, the factors that explain the covariance between a set of observed measures (questionnaire or test items). These observed measures are correlated because they share a common cause, the same construct. The factor analysis, therefore, seeks to assess the dimensionality of a set of indicators, obtaining the smallest number of interpretable factors smaller than the total number of measures required so that it is possible to interpret the possible to interpret correlations between them (Brown, 2006).

To confirm if the EFA could be useful we apply the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity were used to verify that the selected data were appropriate for factor analysis. The results confirmed that this type of analysis can be used (see Table 1).

Table 1

KMO and Barlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.904
Bartlett's Test of Sphericity	Approx. Ci-Square	2795
	df	780
	Sig.	.000

Source. Own research.

Table 2

Exploratory Factor Analysis of the Attitudes Toward Mathematics Inventory: A Four-Factor Solution and Final Communality

Questions	Factor				Final Communality
	1	2	3	4	
Q26	.736	.172	.227	.292	.708
Q29	.705	.362	.290	.237	.768
Q32	.688	.197	.312	.330	.718
Q28	.678	.300	.224	.279	.678
Q2	.677	.168	.204	.352	.651
Q3	.672	.134	.116	.005	.484
Q34	.623	.388	.264	.190	.643
Q33	.603	.229	.380	.131	.577
Q31	.593	.351	.010	.322	.578
Q30	.559	.351	.358	.165	.590
Q14	.554	.472	.217	.331	.687
Q24	.514	.374	.133	.311	.518
Q35	.500	.100	.139	.287	.362
Q25	.471	.396	.051	.432	.567
Q27	.393	.323	.137	.296	.365
Q13	.303	.760	.150	.244	.751
Q11	.261	.668	.242	-.006	.573
Q10	.168	.655	.367	.212	.637
Q12	.369	.619	.159	.277	.622
Q16	.185	.600	.330	.048	.506
Q20	.291	.562	.090	.376	.550
Q9	.345	.520	.453	.121	.609
Q40	.121	.519	.363	.312	.513
Q15	.299	.440	.399	.308	.537
Q38	.132	.351	.255	.103	.216
Q37	.283	.339	.168	.094	.232
Q17	.089	.311	.787	.111	.737
Q19	.296	.323	.643	.210	.649
Q18	.349	.452	.619	.125	.725
Q23	.428	.248	.607	.202	.654
Q21	.292	.479	.548	.257	.682
Q22	.468	.288	.475	.188	.563
Q6	.155	.196	.045	.744	.617
Q5	.147	-.123	.312	.662	.572
Q1	.249	.129	.285	.547	.459
Q39	.358	.272	-.084	.526	.485
Q8	.213	.032	.346	.488	.404
Q7	.105	.228	.057	.461	.279
Q4	.356	.289	.101	.376	.361
Q36	.198	.178	.093	.357	.207

Source. Own research.

Subsequently, the communality of each question was checked and the number of factors was analysed using the four original factors (Tapia & Marsh, 2004). The values of this EFA and communality are described in Table 2.

Extraction method Principal Axis Factoring and the rotation method Varimax with Kaiser Normalisation were used to determine each factor and after 11 convergences, four factors were identified to characterise students' attitudes. Once the four factors had been identified, resulting from the factor analysis, we once again calculated Cronbach's alpha to analyse the internal consistency of each factor. Thus, for the first factor, we identified 15 questions that carried characteristics of this factor, calculating the alpha on these items, the value was 0.946. The same procedure applied to the other three factors revealed the following alpha values described in the table.

Table 3
Internal alpha for each factor

Factor	*Nº of questions*	*Alpha Cronbach*
I	15	.946
II	11	.908
III	6	.908
IV	8	.809

Source. Own research.

The values indicated a high internal consistency in each factor, which collaborate with the validation of the translation of the questionnaire to the Czech language. To collaborate with this idea, we calculate the Pearson Correlation (Benesty et al, 2009) for the factors. The result can be seen in Table 4.

Table 4
Pearson Correlation for each factor

		Factor 1	*Factor 2*	*Factor 3*	*Factor 4*
Factor 1	Pearson Correlation	1	.019	.035	.077
	Sig. (2-tailed)		.856	.742	.462
Factor 2	Pearson Correlation		1	.111	.022
	Sig. (2-tailed)			.290	.832
Factor 3	Pearson Correlation			1	.016
	Sig. (2-tailed)				.880
Factor 4	Pearson Correlation				1
	Sig. (2-tailed)				

Source. Own research.

To better describe the factors, we present some examples of questions with the highest values calculated from the EFA for each of the four factors. The individual factors were characterised as follows:

Factor I - Motivation and Enjoyment
The questions that contribute most significantly to the saturation of this factor are:

- I like to solve new problems in mathematics;
- I really like mathematics;
- I am willing to take more than the required amount of mathematics.

Factor II - Anxiety
The questions that contribute most significantly to the saturation of this factor are:

- I am always under a terrible strain in a math class;
- Studying mathematics makes me feel nervous;
- My mind goes blank and I am unable to think clearly when working with mathematics.

Factor III - Self-confidence
The questions that contribute most significantly to the saturation of this factor are:

- I have a lot of self-confidence when it comes to mathematics;
- I expect to do fairly well in any math class I take;
- I am able to solve mathematics problems without too much difficulty.

Factor IV - Value
The questions that contribute most significantly to the saturation of this factor are:

- Mathematics is one of the most important subjects for people to study;
- Mathematics is important in everyday life;
- Mathematics is a very worthwhile and necessary subject.

Based on the factor analysis, 12 questions were extracted which saturate the factors the most and can form a shortened version of the questionnaire and be used to describe some characteristics of the students.

Research Question Number 4

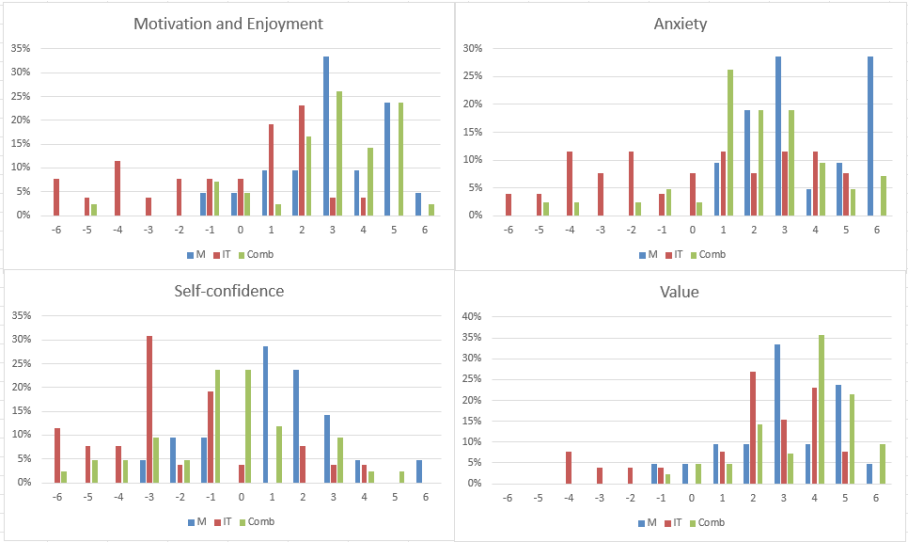
Can the test describe differences between groups of students and is the test able to identify students who are potentially at risk of academic failure?

In order to answer this question, a shortened version of the questionnaire was designed to assess only the responses from the three questions that most saturate that factor for each factor. The values are then summed. The following graphs then show the relative occurrences of the values for the basic three groups of students - single subject mathematics teacher

education students (M), single subject computer science students (IT) and students studying mathematics in combination with a second subject (comb).

The finding that there is a high level of student prospective computer science teachers who have high mathematics anxiety seems to be crucial. What is surprising is that students with significant mathematics anxiety are also found among mathematics teacher education students combined with a second major, on the other hand mathematics anxiety is minimal among single major teacher education students. The situation is similar for self-confidence and motivation and enjoyment, here too the attitudes of computer science teachers can be characterised as rather negative. In the area of Value, the majority of students perceive mathematics as valuable, although there are a few exceptions, but not from the order of future mathematics teachers.

Figure 1
Students rating by individual factors

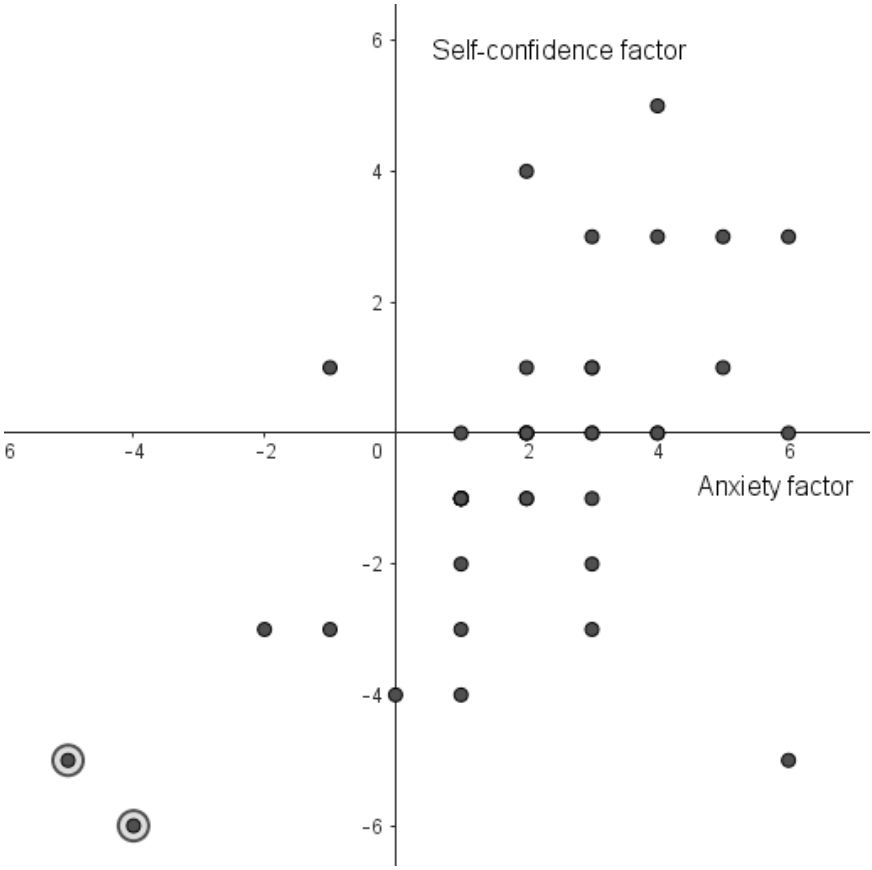


Source. Own research.

The following graph shows the self-assessment of all mathematics students in combination with a second subject, with the ratings on the x-axis plotted in the Anxiety factor and the y-axis plotted in the Self-confidence factor. Students who are on the edge of the third quadrant have significant mathematics-anxiety and simultaneously low self-confidence. Based on these facts, they can be characterised as potentially at risk for drop-out and given specialised support.

Figure 2

Two-dimensional evaluation of students by individual factors



Source. Own research.

Conclusion

The pilot validation of the Czech version of the ATMI for student teachers demonstrated the effectiveness of the instrument and provided data for a shortened version of the questionnaire. The values of Cronbach alpha demonstrated that the validity of the questionnaire, adapted for the context of teacher training and for the Czech language, was preserved.

In assessing student attitudes towards mathematics, four main factors were identified - Motivation and Enjoyment, Anxiety, Self-confidence and Value. The first results confirm that there is a big difference between student teachers focused on teaching mathematics only, teaching mathematics in combination with another subject and teaching a subject that uses math-

ematics only. Students who do not study a subject with mathematics very often have a negative attitude towards mathematics, mathematics anxiety and low self-confidence/self-efficacy, which negatively affects their academic performance. On the other hand, all student teachers perceive a high value of mathematics.

Another aim of the presented research is to use a shortened version of the questionnaire to test and compare teacher education students of different subjects at teacher education faculties in the Czech and Slovak Republics, to suggest appropriate tools to support students at risk of drop-out and to monitor the development of attitudes during their studies.

References

[1] Aiken, L. R. (1974). Two scale of attitude toward mathematics. *Journal for Research in Mathematics Education*, *5*(2), 67-71.

[2] Aiken, L. R., & Dreger, R. M. (1961). The effect of attitudes on performance in learning mathematics. *Journal of Educational Psychology*, *52*(1), 19-24.

[3] Awaludin, I. S., Ab Razak, R., Azliana Aridi, N., & Selamat, Z. (2015) Causes of Low Mathematics Achievements in a Private University. *Journal of Computer Science & Computational Mathematics*, *5*(2), 21–26.

[4] Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215.

[5] Benesty, J., Chen, J., Huang, Y., Cohen, I. (2009). Pearson Correlation Coefficient. In Yiteng Huang, Y., Cohen, I., Chen, J., & Benesty, J. (Eds.), *Noise Reduction in Speech Processing* (pp. 1-4). Springer. https://doi.org/10.1007/978-3-642-00296-0_5

[6] Bessant, K. C. (1995). Factors associated with types of mathematics anxiety in college students. *Journal for research in mathematics education*, *26*(4), 327-345.

[7] Brown, T. A. (2006). *Confirmatory Fator analysis for applied research*. The Guilford Press.

[8] Brezavšček, A., Jerebic, J., Rus, G., & Žnidaršič, A. (2020). Factors influencing mathematics achievement of university students of social sciences. *Mathematics*, *8*(12), 2134.

[9] Deitte, J. M., & Howe, R. M. (2003). Motivating students to study mathematics. *The Mathematics Teacher*, *96*(4), 278.

[10] Dutton, W. H. (1954). Measuring attitudes toward arithmetic. *Elementary School Journal*, *55*(1), 24-31.

[11] Edwards, A., Joyner, K., & Schatschneider, C. (2019). A simulation study on the performance of different reliability estimation methods. *Educational and Psychological Measurement*, *81*(6), 1089-1117.

[12] Gladstone, R., Deal, R., & Drevdahl, J. E (1960). Attitudes toward mathematics. In M. E. Shaw & J. M. Wright (Eds., 1967). *Scales for the measurement of attitudes* (pp. 237-242). McGraw Hill.

[13] Hall, J. M., & Ponton, M. K. (2005). Mathematics self-efficacy of college freshman. *Journal of developmental education*, *28*(3), 26.

[14] Jaafar, W. M. W., & Ayub, A. F. M. (2010). Mathematics self-efficacy and meta-cognition among university students. *Procedia-Social and Behavioral Sciences*, *8*, 519-524.

[15] Khasawneh, E., Gosling, C., & Williams, B. (2021). What impact does maths anxiety have on university students? *BMC psychology*, *9*(1), 1-9.

[16] Lent, R. W., & Hackett, G. (1987). Career self-efficacy: Empirical status and future directions. *Journal of Vocational Behavior*, *30*(3), 347-382.

[17] Li, Q., Cho, H., Cosso, J., & Maeda, Y. (2021). Relations between students' mathematics anxiety and motivation to learn mathematics: A meta-analysis. *Educational Psychology Review*, *33*, 1017-1049.

[18] Lin, S., & Huang, Y. (2014). Development And Application Of A Chinese Version Of The Short Attitudes Toward Mathematics Inventory. *International Journal of Science and Mathematics Education*, *14*(1), 193-216. https://doi.org/10.1007/s10763-014-9563-8
[19] Matos, D. A. S., & Rodrigues, E. C. (2019). *Análise Fatorial*. Escola Nacional de Administração Pública (ENAP).
[20] Multon, K. D., Brown, S. D. & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of counseling psychology*, *38*(1), 30-38.
[21] Núñez-Peña, M. I., Suárez-Pellicioni, M. & Bono, R. (2013). Effects of math anxiety on student success in higher education. *International Journal of Educational Research*, *58*, 36-43.
[22] Pajares, F., & Miller, M. D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology*, *42*(2), 190–198.
[23] Perry, A. B. (2004). Decreasing math anxiety in college students. *College Student Journal*, *38*(2), 321-325.
[24] Schukajlow, S. (2015). Effects of enjoyment and boredom on students' interest in mathematics and vice versa. In K. Beswick, T. Muir & J. Wells (Eds.), *Proceedings of 39th Psychology of Mathematics Education conference* (pp. 137–144). Psychology of Mathematics Education. Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist*, *26*(3-4), 207-231.
[25] Stadler, M., Sailer, M., & Fischer, F. (2021). Knowledge as a formative construct: A good alpha is not always better. *New Ideas in Psychology*, *60*, 100832.
[26] Tapia, M., & Marsh, G. E. (2004). An Instrument to Measure Mathematics Attitudes. *Academic Exchange Quarterly*, *8*(2), 16-21.
[27] Teoh, S. H., Koo, A. C., & Singh, P. (2010). Extracting factors for students' motivation in studying mathematics. *International Journal of Mathematical Education in Science and Technology*, *41*(6), 711-724.
[28] Tran, L. T., & Nguyen, T. S. (2021). Motivation and Mathematics Achievement: A Vietnamese Case Study. *Journal on Mathematics Education*, *12*(3), 449-468.
[29] Voňková, H., Papajoanu, O., & Boško, M. (2022). Heterogenita ve způsobu odpovídání na dotazníkové položky u českých žáků v PISA 2012: analýza dle kraje, typu a velikosti školy [Heterogeneity in the way Czech pupils answer questionnaire items in PISA 2012: analysis by region, type and size of school.] *Studia Paedagogica*, *27*(3), 127-159. https://doi.org/10.5817/SP2022-3-5
[30] Zakariya, Y. F. (2022). Improving students' mathematics self-efficacy: A systematic review of intervention studies. *Frontiers in Psychology*, *13*, 986622.