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Primary School Teachers' Self-efficacy and Difficulties in Implementing STEAM Education

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Abstract

Recently, many countries around the world have paid more attention to the quality of natural and exact sciences, technology and engineering education – STEM disciplines have become extremely important in order to develop economic innovations. Educational research shows that successful integration of STEM requires content and pedagogical knowledge of these subjects, but teachers admit that they feel unprepared to apply STEM methodology. The subject and methodical, reflection and self-improvement competences of the primary school teacher are extremely important when the integration of STEAM subjects appears in the general education programs of many countries. The goal of the pilot study presented in this article is to validate in the Lithuanian sample the questionnaire designed to assess the difficulties of primary school teachers in teaching STEAM and to highlight their self-efficacy features. Statistical data analysis using SPSS 27 revealed the lack of self-efficacy of primary school teachers in teaching subjects related to the fields of chemistry and physics, which is one of the main reasons why teachers have difficulties in implementing STEAM activities. It is expected that the questionnaire will allow assess the professional development needs of primary school teachers and will help higher education institutions to improve teacher training programs.

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Introduction

In recent decades, the world has rapidly develope innovations in technology to meet the needs of sustainable energy and transportation, as well as environmental protection and effective healthcare. With the growing economic ambitions of world states, more attention has been paid to the quality of education in the fields of natural and exact sciences, technology and engineering. Understanding the nature of these sciences and the foundations of knowledge, i.e. STEM literacy, should become an educational priority for all students in the near future. On the other hand, educational researchers note that students lack some of these competencies: "The latest programme for international student assessment results, however, indicate that even in economically mature countries such as those in Europe, and the USA and Australia, approximately 20% of students lack sufficient skills in mathematics or science." (Maass, et al., 2019, p. 869).

Educators recognize that teacher competence determines the education quality and teacher understanding of the integration of STEM / STEAM subjects is an essential factor for its successful implementation (Widya, et al., 2019; Valtonen, et al., 2021). Teachers face a variety of challenges when integrate STEAM subjects. Lack of knowledge of STEAM subjects content and insufficient preparation for teaching these subjects are mentioned among the obstacles to the implementation of STEAM integration in practice (Belbase, et al., 2022; Cibulskaitė & Kurienė, 2015; Dignam, 2023; Hebebci, 2023; Saralar-Aras & Hebebci, 2023; Ling, et al., 2020; Spyropoulou & Kameas, 2020).

All the states that participate in the Bologna process join the unified European education space by creating study programs with the main focus on the education of teacher competencies: „Competence-based frameworks should be generalised to outline educators' development and career paths.“ (Learning and teaching. Final report. EHEA, 2024, p. 13). Therefore, when preparing pedagogical study programs, Lithuanian universities and colleges envisage the general and subject competencies of the pedagogic profession to be developed, the content of which is constructed taking into account the professional roles of the pedagogue, performed in the educational environment, i.e. pedagogical, organizational, interpersonal, etc. In the Lithuanian Description of competences of teachers and student support specialists (Mokytojų ir pagalbos mokiniui specialistų kompetencijų aprašas, 2023) pedagogue‘s competences are grouped into four competence areas: professional behaviour, cognitive, working together and emotional-motivational. The field of professional behavior includes the competencies of professional development, professional autonomy and reflection; the cognitive domain includes subject and interdisciplinary competence as well as the development and implementation of educational content. In this study, we name these competencies as reflection and self-improvement, subject and methodological.

Theoretical Background

The mentioned roles of teachers are based on the diffusion of various competences, of which a few can be singled out when provisions for the integration of STEAM subjects appear in the general education programs of many countries. These are subject and methodical competencies that guarantee transfer of the basics of the subject and understanding of the application of this subject in real life; as well as reflection and self-improvement competencies, guiding the teacher to take care of his personal and professional development. In the context of the modern continuous learning paradigm, the competencies of personal reflection are especially emphasized. Reflection is a process during which a person gets to know his states: through reflection, we get to know ourselves and our relationships with others; we look at the problem from different perspectives; we reflect on experiences, forms of activity and ways that lead to change and new knowledge. Reflection is one of the effective methods of continuous professional development - in the process of reflection, newly acquired professional experience is transformed into professional and personal development (Cibulskaitė, 2014).

The *goal of this research* is twofold: 1) to validate in the Lithuanian sample the questionnaire designed to assess the difficulties of primary school teachers in teaching STEAM related to subject and methodological competencies, and 2) to highlight the features of primary school teacher's self-efficacy, which is related to the competencies of reflection and self-improvement.

Method

Research method. The quantitative research carried out using the Teacher's efficacy scale questionnaire (TES), which developed by a group of researchers from several countries implementing the international Erasmus+ project ProSTEAM. The survey includes a scale to assess teachers' difficulties in teaching STEAM and a teacher self-efficacy scale. During the validation and pilot study of the questionnaire, primary school teachers answered the questions of the online survey and marked the answers on a 7-point Likert scale: from 1 - completely unsure to 7 - completely sure. Statistical analysis of the collected data performed using SPSS 27 (Garson, 2013a; 2013b).

Instrument. In cooperation with the ProSTEAM team, the first version of TES in English was prepared. It presented to four Lithuania primary school teachers who know English good enough. Teachers were asked to answer each question by ticking the appropriate scale score and to explain why they chose one or another score. When answering questions, teachers translated them into Lithuanian, and this made it possible to make sure that they understood all questions adequately. In order to improve the questionnaire, teachers' comments and summaries of their interviews are provided. Then a group of three experts used a back-to-back translation procedure, all experts translated the original version of TES into Lithuanian, these translations were compared with each other and the final Lithuanian version of TES was constructed. Some questions were a little bit adjusted to match the context of Lithuanian education and the national thesaurus of pedagogy: more precise words were chosen for the wording; it was achieved that similar questions about different teaching subjects use the same terms; names of rating scale scores have been clarified.

Model. The expert team estimated the factor structure and tested several competing models in order to find which one had the more acceptable fit. The team identified three models that might be reliable and suggested that project participants test the reliability of the ten-factor system using national data. After factor analysis and internal validity testing, the TES questionnaire consisted of 52 items. The results showed that Lithuanian data (Table 1) are similar to other three project participants collected data and correspond to the general average.

Table 1. Overview of Fit Indices for Three Factor Solutions (Lithuania data, N = 118)

Models	**$\chi 2$**	**df**	**CFI**	**TLI**	**RMSEA**	**RMSEA 95% CI**
MODEL 1: 8 factors	1764.1***	1246	0.971	0.969	0.059	].053; .066[
MODEL 2: 9 factors	1741.3***	1238	0.972	0.970	0.059	].052; .065[
MODEL 3: 10 factors	1678.8***	1229	0.975	0.973	0.056	].049; .062[

***p < .001

The characteristics of the variables that make up all the factors are quite close: for both mean values and standard deviations. Differences established between symmetry or asymmetry of distributions of variables and their kurtosis. As an example of calculations, the results of statistical analysis for Factor1 are presented in Table 2 and Table 3.

Table 2. Calculation of Variables Statistics for Factor1 (N = 118)

Variables	**TIG1**	**TIG2**	**TIG3**	**TIG4**
Valid	118	118	118	118
Missing	0	0	0	0
Mean	5.35	5.62	5.71	5.55
Std. Deviation	1.355	1.085	1.047	.992
Skewness	-1.139	-1.229	-1.261	-,971
Std. Error of Skewness	.223	.223	.223	.223
Kurtosis	1.687	2.810	3.497	2.961
Std. Error of Kurtosis	.442	.442	.442	.442

Table 3. Calculation of Variables Correlation for Factor1 (N = 118)

Variables		TIG1	TIG2	TIG3	TIG4
TIG1	Pearson Correlation	1	.742**	.577**	.677**
	Sig. (2-tailed)		.000	.000	.000
	N	118	118	118	118
TIG2	Pearson Correlation	.742**	1	.760**	.776**
	Sig. (2-tailed)	.000		.000	.000
	N	118	118	118	118
TIG3	Pearson Correlation	.577**	.760**	1	.788**
	Sig. (2-tailed)	.000	.000		.000
	N	118	118	118	118
TIG4	Pearson Correlation	.677**	.776**	.788**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	118	118	118	118

** Correlation is significant at the 0.01 level (2-tailed)

The third 10-factor model selected for use in the research, because the results of statistical analysis of all factors variables showed:

(a) the means of the variables within all the factors except F5 and F10 are more than 5.0 and less than 5.8; the means of the factors of F5 and F10 are more than 4.0 and less than 4.7;

(b) distributions of the variables within factors F1 and F4 are more asymmetrical than symmetrical, within factors F2, F3, F6, F7, F8, and F9 - more symmetrical than asymmetrical; factors F5 and F10 have all symmetrical distributions of the variables; these results indicate the similarity of all distributions to the normal distribution;

(c) the all distributions of variables of F1, F4, F6, F9 have sharp peaks, F3 have 5 peaks and F8 - 6 peaks – this indicates that these data are not scattered; the distribution of all variables of F5 and F10 are flat, F2 and F7 are almost flat, but have 1 or 2 peaks – this indicates that these data are more or less scattered;

(d) the correlations between all the variables are strong or moderate within all the factors except F2, there a weak positive correlation of three variables is observed - this indicate that there is a correlation, but not as strong as for the other factors variables; the all correlations are statistically significant;

(e) the shapes of the variable distributions of factors F5 and F10 are similar to each other, the mean values and standard deviations are close, which means that these factors are very similar in their characteristics; the similarity of the characteristics of the remaining factors cannot be stated unequivocally.

Participants. The sample of respondents consists of 118 elementary school teachers of 61 "STEAM school label" schools coordinated by the National Education Agency of the Republic of Lithuania. The school can get this label if integrated STEM education ideas implemented in the educational process and teachers with students actively participated in STEAM projects, concourses and actions across the country and abroad. The research sample represents all counties of the country. Two teachers from each school filled out the questionnaire; no answers received from two schools, so the level of non-response is only 3.3%. The number and percentages of teachers in each demographic characteristic presented in Tables 4 and 5.

Table 4. Demographic Characteristics of Respondents for Gender, Education, and Training (Frequency in %)

Demographic characteristics		**N**	**%**
Gender	Female	118	100
Level of formal education completed	Bachelor’s or equivalent level	86	72.9
	Degree or equivalent level	1	0.9
	Master’s or equivalent level	28	23.7
	Doctor or equivalent level	3	2.5
Training in STEAM	Yes	58	49.2
Training in integrated teaching	Yes	56	47.5

All respondents were female, the average age of the participants is 50 years, and average teaching experience is 25 years, the teaching experience at the same school - 16 years. 73.8 % of the study participants have a bachelor or equivalent degree; 23.7% had a master degree, and a few had a doctorate (2.5%).

A half of the informants (49.2%) claim to have participated in various STEAM competence development events (for example, STEAM education for leadership, Technological STEAM solutions, Small technology developers, STEAM lesson for little ones, Technology and engineering in primary grades), carried out projects, visited laboratories of STEAM centers, learned to use ICT platforms related to STEAM. Slightly less than half of the informants (47.5 %) noted that they constantly improve their qualifications in integrated teaching at conferences and seminars (for example, Education in non-traditional environments, Blended learning, Thinking school methods, Creative programming), participated in Erasmus+ projects, etc.

Table 5. Descriptive Statistics of Demographic Characteristics for Age and Teaching Experience

Demographic characteristics	**M**	**SD**	**Min**	**Max**
Age (years)	49.7	8.9	23	65
Teaching Experience	24.8	11.5	1	43
Teaching experience in current school	15.9	12.9	0	43

Results

Statistical Analysis for the Factors

The means, standard deviations, skewness and kurtosis, and normality test were calculated for all the factors (Table 6, Table 7).

Table 6. Descriptive Statistics, Mean, SD, Skewness and Kurtosis and Reliability Scores of the Dimensions

Dimensions	N	Mean	Std. Dev.	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
Teaching in General - I	118	5.557	.993	-1.108	.223	3,210	,442
Teaching in General - BM	118	5.524	.782	-.414	.223	.677	.442
Math & Math Motivation	118	5.467	.861	-.537	.223	.452	.442
Biology Teaching	118	5.271	1.217	-1.177	.223	2.023	.442
Chemistry Teaching	118	4.377	1.333	-.367	.223	.034	.442
Science Motivation	118	5.155	.990	-.889	.223	2.828	.442
Arts & Arts Motivation	118	5.260	.994	-.758	.223	1.806	.442
ICT Use	118	5.421	1.051	-.817	.225	1.599	.446
Physics Teaching	118	5.261	1.088	-.878	.225	1.449	.446
Integrated Teaching	118	4.468	1.326	-.537	.223	.254	.442
Valid N (listwise)	118						

Note: Teaching in General - I = Teaching in General - Instruction; Teaching in General - BM = Teaching in General - Behavior Management; Math & Math Motivation = Math Teaching and Math Motivation; Arts & Arts Motivation = Arts Teaching and Arts Motivation; ICT Use = Information and Communications Technology Use.

Statistical analysis for the factors let us to state:

(a) the mean values of almost all factors are quite close, two factors F5 and F10 stand out quite clearly – the means of F5 and F10 are more than 4.3 and less than 4.5; the average values of other factors are more than 5.1 and less than 5.6; meanwhile, the standard deviations are not very different and their values are close to 1;

(b) the distributions of the factors are not characterized by pronounced asymmetry - skewness is < -1 only for a couple of factors F1 and F4;

(c) as for a kurtosis, we can see that most of the factor (F1, F4, F6, F7, F8, F9) distributions have sharper - more pointed peaks (index >1), others four (F2, F3, F5, F10) are more flat, this means that these data are more scattered;

(d) the Kolmogorov-Smirnov test shows that the distributions of all factor variables cannot be considered normal, however, for the factors we form from those variables, normality is present (only F4 is questionable, Sig. 0.006), it allows the application of parametric criteria.

Table 7. One - Sample Kolmogorov-Smirnov Test

Variables	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
N	118	118	118	118	118	118	118	118	118	118
Normal Parameters a, b Mean	5.557	5.524	5.467	5.271	4.377	5.155	5.260	5.421	5.261	4.468
Std. Deviation	.993	.782	.861	1.217	1.333	.991	.994	1.051	1.088	1.326
Most Extr. Differ. Absolute	.121	.073	.098	.158	.102	.124	.075	.103	.112	.113
Positive	.090	.063	.065	.078	.061	.087	.041	.067	.076	.065
Negative	-.121	-.073	-.098	-.158	-.102	-.124	-.075	-.103	-.112	-.113
Kolmogorov-Smirnov Z	1.315	.798	1.066	1.712	1.104	1.351	.815	1.108	1.208	1.232
Asymp. Sig. (2-tailed)	.063	.547	.205	.006	.174	.052	.520	.171	.108	.096

a. Test distribution is Normal b. Calculated from data.

Correlation among the Factors

Data shows, all ten factors significantly and positively correlated with each other (Table 8). The correlation is strong (> 0.7) among: F1- F2, F3, F6; F2- F3, F6; F3 - F4, F6; F4 - F5, F6, F9, F10; F5 - F6, F10; F6 - F10. The correlation is medium (0.5 - 0.7) among other factors, except F5 - F7, F8, and F7 - F10, which correlation is weak (0.3 - 0.5) (Garson, 2013).

Table 8. Correlations among the Factors

	F1	F2	F3	F4	F5	F6	F7	F8	F9
F2	0.857								
F3	0.880	0.819							
F4	0.676	0.674	0.713						
F5	0.514	0.505	0.598	0.764					
F6	0.745	0.791	0.836	0.802	0.703				
F7	0.662	0.630	0.620	0.607	0.435	0.675			
F8	0.621	0.658	0.511	0.608	0.396	0.642	0.599		
F9	0.551	0.650	0.583	0.724	0.637	0.691	0.539	0.640	
F10	0.589	0.543	0.647	0.759	0.848	0.767	0.481	0.540	0.689

Note: F1= Teaching in General - Instruction; F2 = Teaching in General - Behavior Management; F3 = Math Teaching; F4 = Biology Teaching; F5 = Chemistry Teaching; F6 = Science Motivation; F7 = Arts Teaching; F8 = ICT Use; F9 = Integrated Teaching; F10 = Physics Teaching. All correlations were significant at $p < 0.01$.

To assess internal consistency, Cronbach's alpha coefficient calculated, the reliability analyzed for the variables that make up each factor (Table 9). Both unstandardized and standardized Cronbach's alpha values for all factors are greater than 0.9, except the Factor2, which value is less than 0.9, however, that shows very good compatibility of all factors variables. Sufficiently strong multi-factor correlation and good internal validity of the scale let us state: the all variables within all factors are aligned or homogeneous in terms of measurement scale; the variances of the responses to individual questions are quite similar; the scale is valid, it measures the intended variables very well.

Table 9. Cronbach's Coefficient Alpha for the Scale Dimensions

Dimensions	**Number of items**	**Cronbach's Alpha**	**Cronbach's Alpha Based on Standardized Items**
Teaching in General - Instruction	4	.903	.911
Teaching in General - Behavior Management	5	. 865	.865
Math Teaching and Math Motivation	8	.933	.934
Biology Teaching	4	.954	.954
Chemistry Teaching	4	.918	.919
Science Motivation	4	.919	.919
Arts & Arts Motivation	8	.951	.951
ICT Use	7	.937	.938
Physics Teaching	4	.912	.912
Integrated Teaching	4	.936	.936

The Groups of the Factors

The picture of the all factors means and their 95% confidence intervals shows a clear separation of the factors F5 and F10 and the possibilities of two more interrelated groups of factors (Figure 1).

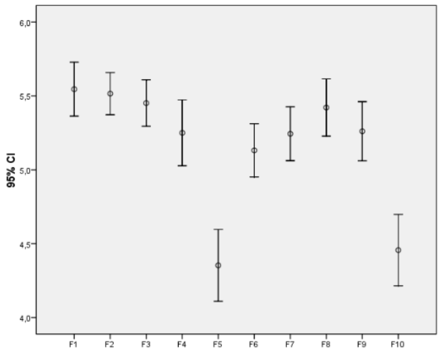

Figure 1. The Factors Mean and Their Confidence Intervals (95%)

The results of statistical analysis made it possible to distinguish groups of interrelated factors: first group consist of factors F1, F2, F3 and F8; second group – of factors F4, F6, F7 and F9; and third group – of F5 and F10. ANOVA analysis made for the first and second groups, and t-test for the third group (Table 10 - Table 15).

Table 10. ANOVA Analysis for the Group of Factors F1, F2, F3, F8

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	1.275	3	.425	.494	.686
Within Groups	400.499	466	.859		
Total	401.773	469			

$p > 0.05$

Table 11. Multiple Comparisons (Bonferroni) for the Group of Factors F1, F2, F3, F8

(I) facto r	**(J) factor**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
1.00	2.00	.03347	.12069	1.000	-.2863	.3533
	3.00	.09004	.12069	1.000	-.2297	.4098
	8.00	.13602	.12121	1.000	-.1851	.4572
2.00	1.00	.03347	.12069	1.000	-.3533	.2863
	3.00	.05657	.12069	1.000	-.2632	.3764
	8.00	.10255	.12121	1,000	-.2186	.4237
3.00	1.00	-.09004	.12069	1.000	-.4098	.2297
	2.00	-.05657	.12069	1.000	-.3764	.2632
	8.00	.04598	.12121	1.000	-.2752	.3671
8.00	1.00	-.13602	.12121	1.000	-.4572	.1851
	2.00	-.10255	.12121	1,000	-.4237	.2186
	3.00	-.04598	.12121	1.000	-.3671	.2752

Table 12. ANOVA Analysis for the Group of Factors F4, F6, F7, F9

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	1.063	3	.354	.306	.821
Within Groups	539.772	466	1.158		
Total	540.835	469			

$p > 0.05$

Table 13. Multiple Comparisons (Bonferroni) for the Group of Factors F4, F6, F7, F9

(I) factor	(J) factor	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
4.00	6.00	.11653	.14012	1.000	-.2547	.4878
	7.00	.01165	.14012	1.000	-.3596	.3829
	9.00	.01041	.14072	1.000	-.3624	.3833
6.00	4.00	-.11653	.14012	1.000	-.4878	.2547
	7.00	-.10487	.14012	1.000	-.4761	.2664
	9.00	-.10611	.14012	1.000	-.4790	.2667
7.00	4.00	-.01165	.14012	1.000	-.3829	.3596
	6.00	.10487	.14012	1.000	-.2664	.4761
	9.00	-.00124	.14012	1.000	-.3741	.3716
9.00	4.00	-.01041	.14012	1.000	-.3833	.3624
	6.00	.10611	.14012	1.000	-.2667	.4790
	7.00	.00124	.14012	1.000	-.3716	.3741

Table 14. T-test Group Statistics for the Group Pair of Factors F5, F10

Factor	N	Mean	Std. Deviation	Std. Error Mean
5.00	118	4.3771	1.33323	.12273
10.00	118	4.4682	1.32632	.12210

Table 15. Independent Sample Test for the Pair of Factors F5, F10

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
Equal variances:	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
assumed	.018	.895	-.526	234	.599	-.09110	.17312	-.43218	.24998
not assumed			-.526	233.994	.599	-.09110	.17312	-.43218	.24998

$p > 0.05$

The ANOVA analysis and t-test confirmed the hypotheses about the statistically significant equality of the means of factor groups: (a) checked equality of means with parametric criteria shows that the means of factors F1, F2, F3 and F8 are not statistically significantly different (Sig. 0.686, p > 0,05); (b) analogously, the means of factors F4, F6, F7 and F9 do not differ statistically significantly (Sig. 0.821, p > 0,05); (c) factors F5 and

F10 – the t-test for two independent samples shows that the means of this factors can be considered equal (Sig. 0.599, p > 0,05). The results allow us to assert that when answering the questions of the identified groups of factors, teachers choose similar answer options (scores).

The Characterization of Lithuania Primary School Teachers in Relation to Their Self-efficacy in Teaching STEAM

The characteristics of questioned Lithuanian primary school teachers in terms of their self-efficacy were carried out based on their level of education, learning STEAM and PBL, teaching experience in general and in the school where they currently work. In determining whether the level of self-efficacy of teachers differs depending on the acquired education (Figure 2), it was found that teachers with bachelor's and licentiate degree education are much less self-efficacy than teachers with a higher master's or doctoral degree in all teaching areas.

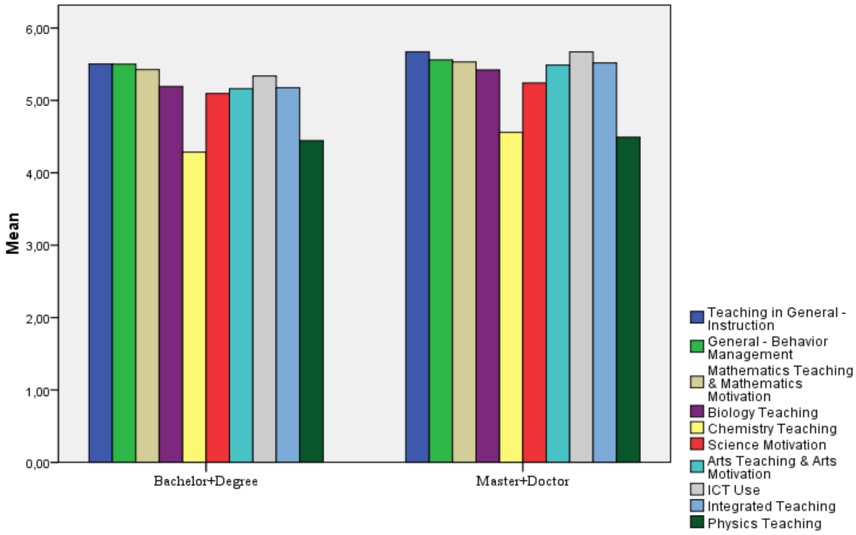

Figure 2. Means of the Dimensions in Relation to the Variable "Level of Education"

Examining the self-efficacy of teachers depending on whether they had STEAM training or not (Figure 3), it can be state that:

(a) the teachers of both acquired education groups have similar and least self-efficacy in the subject area of chemistry;

(b) the level of self-confidence of untrained teachers in chemistry and physics is almost the same and the lowest, in this case trained teachers in the field of physics feel more confident than in chemistry;

(c) the trained teachers are more self-confident than untrained teachers in all tested areas.

Examining the results of the analysis according to the variable "Training in integrated approaches to teaching", it was observed that these results are almost the same as those discussed above according to the variable "Training in STEAM" (Figure 4), except that the level of self-confidence of untrained teachers in the field of physics is slightly higher than in the field of chemistry.

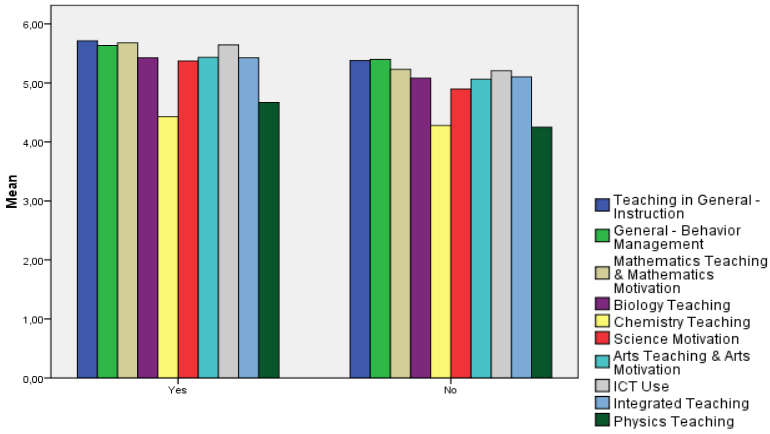

Figure 3. Means of the Dimensions in Relation to the Variable "Training in STEAM"

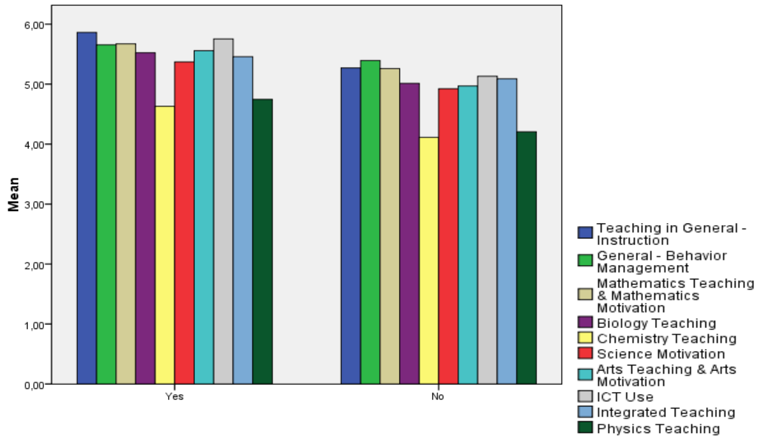

Figure 4. Means of the Dimensions in Relation to the Variable "Training in Integrated Approaches to Teaching"

Teachers of different groups of teaching experience demonstrate the highest and higher level of self-confidence as follows (Figure 5):

(a) the first group ($n \leq 10$) – Communications Technology Use, Teaching in General - Instruction and Behavior Management, Arts & Arts Motivation;

(b) the second group ($10 < n \leq 20$) – Communications Technology Use, Teaching in General - Instruction, Math Teaching and Math Motivation, Arts & Arts Motivation;

(c) the third group (20 <n ≤30) – Teaching in General - Instruction and Behavior Management, Math Teaching and Math Motivation, Integrated teaching;

(d) the fourth group (n > 30) – Teaching in General - Instruction and Behavior Management, Math Teaching and Math Motivation, Biology Teaching.

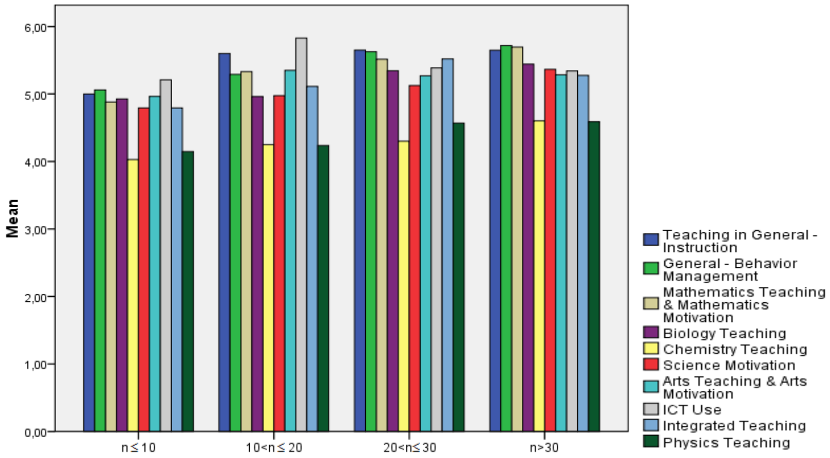

Figure 5. Means of the Dimensions in Relation to the Variable "Teaching Experience"

Consequently, teachers with up to 20 years of practice feel they have better mastered Communications Technology Use and Arts & Arts Motivation, as well as being knowledgeable about Teaching in General. It can be assumed that less experienced and probably younger teachers are more proficient ICT users and have acquired modern theoretical knowledge of pedagogy. Those who have been working in a school for more than 20 years are more confident in applying Teaching in General strategies, as well as in teaching mathematics and biology. It can be assumed that more practice leads to greater self-confidence in the application of knowledge of pedagogy and methodology and in the teaching of mathematics and biology subjects.

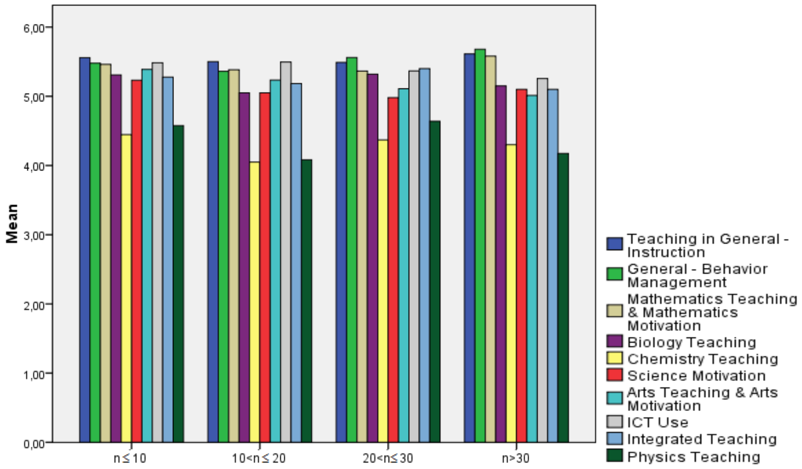

Figure 6. Means of the Dimensions in Relation to the Variable "Teaching Experience in the Same School"

The teachers of all groups have the least self-confidence in the fields of teaching chemistry and physics. It was found that self-efficacy for Teaching in General (Instruction and Behavior Management), Math Teaching and Math Motivation, Biology Teaching and Science Motivation increased with increasing years of experience; this tendency is observed in Chemistry and Physics Teaching as well. Self-motivation in Integrated teaching arises until teachers accumulate 30 years of experience, in teaching Arts – until 20 years of experience.

The same four groups created to study the variable "Teaching Experience in the same School" (Figure 6). It was found that all teachers are similar more confident in Teaching in General – Instruction and Behavior Management, Math Teaching and Math Motivation; less experienced teachers demonstrated stronger self-efficacy in ICT use and Arts & Arts Motivation area than more experienced teachers.

Conclusion

The integration of STEM subjects requires teachers' knowledge of these subjects content and pedagogical content knowledge on how to convey this content to students, however according to educational researches, primary school teachers admit that they feel unprepared to apply a specific STEM methodology.

The Teacher's efficacy scale questionnaire allows assessing the teacher's self-efficacy in STEAM education: its application in the Lithuanian sample showed appropriate psychometric properties; strong multifactor correlation and good internal validity indicated the reliability of the scale.

It was found that less experienced younger teachers are more proficient ICT users and have acquired modern theoretical knowledge of pedagogy, but more practice leads to greater self-efficacy in the use of methodology knowledge and in the teaching of math and biology. This may testify to the importance of university second-cycle primary teacher training in order to prepare qualified educators in STEAM education.

In STEAM education trained teachers are more self-efficacy than untrained and more experienced teachers. This substantiates the importance of STEAM education qualification training, which means that greater attention is required to pay for the continuous training of in-service teachers, especially in the field of integrated education.

The study highlighted the lack of self-efficacy in the subject area of chemistry and physics teaching among primary school teachers who have a higher level of education, who seek to improve their qualifications, and who have more teaching experience. Primary school teacher training institutions aiming to prepare teachers who meet the needs of STEAM education should improve their study programs by including content study modules in these subjects.

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