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THE EFFICACY OF A VIDEO LIBRARY IN ALLEVIATING MATH ANXIETY: A CROSS-COUNTRY ANALYSIS OF PROSPECTIVE AND PRIMARY SCHOOL TEACHERS' PERSPECTIVES

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ABSTRACT

This study investigates the impact of a video library containing learning scenarios for mathematics classes on the perceptions of prospective teachers and primary school teachers, with the primary objective of reducing math anxiety. Participants from five different countries provided 541 responses to a questionnaire, evaluating various aspects of the scenario and video content. The research analyzes the key factors influencing participants' perceptions and explores diverse comparisons based on status, age, work experience years, and country of origin. The questionnaire covers a range of criteria, including the relevance of content, adherence to didactic principles, integration of new technologies, alignment with mathematics curriculum requirements, incorporation of robotics, and effectiveness in reducing math anxiety. The study further delves into the promotion of purposeful teaching/learning processes, differentiation of tasks, suitability for various literacy levels, and encouragement of active participation. The findings contribute valuable insights into the global applicability of scenario-based videos, especially in leveraging educational robotics to enhance mathematics education and alleviate math anxiety among students.

Keywords: *Educational Robotics, In-service Teachers, Math Anxiety, Prospective Teachers, Scenario-Based Learning, Teachers Feedback.*

Introduction

Globally the field of education keeps pace with the development of technology, as changes in technology lead to major changes in training. Various studies show that we can no longer perceive the instructional process in schools without the involvement of technology (Chiou, 2004; Highfield et al., 2008; Hamidi et al., 2011; Ng, 2015; Mubin et al.,

2013; Atman Uslu et al., 2023). A special role is played by educational robot technology widely applied in the teaching approach for any level of education, even in primary education. Teachers are the first to look for solutions for the application of educational robots for their use as valuable teaching material accepted by children. They seek to include educational robots for any curriculum area in primary education (Highfield et al., 2008). In addition, educational robots are seen as a basic part of Science, Technology, Engineering and Mathematics (Atman Uslu et al., 2023). Mathematics is an important subject and at the same time special because of the difficulties that children encounter since primary school, difficulties in understanding fundamental notions and forming abstract concepts (Acharya, 2017). These barriers to understanding mathematics in the primary cycle lead to anxiety and fear of mathematics and certainly major failure in later academic years (Ashcraft & Faust, 1994; Chang & Beilock, 2016).

Primary school teachers have the main role in detecting symptoms of anxiety, and in forming conditions in which children do not reach states of anxiety, and fear. They can intervene with interactive tools such as educational robots and mock or even reduce even the lowest chances of being anxious in math (Hak, 2014; Highfield et al., 2008).

The basic characteristics of educational robots that can be used to teach mathematics are fun, safe, open and easy to use (Pei & Nie, 2018a). Research shows that new solutions are being sought to improve these features, namely as educational robots, complemented with other important features such as extensibility, durability, compatibility and others depending on the domain used (Pei & Nie, 2018b).

The role of educational robots in mathematics learning

Mathematics as a science is not only definitions, abstract concepts, and fundamental notions but also a series of rules, algorithms and symbolic representations. Which makes a close connection between mathematics and educational robots as a concept of bilateral application. The common part for both is the precision with which one can solve problems and determine solutions through multiple paths, but also the feeling of control over the knowledge to apply it easily in other new situations, and challenges.

The role of educational robots in teaching and learning mathematics can be highlighted by several statements reflecting the most valuable part of applying educational robots to mathematics: (1) educational robots lead to higher-order thinking skills, namely thinking with higher comprehension power, solving individual and collaborative problem situations, which makes abstract notions better understood (Atman Uslu et al., 2023), lead to the development of cognitive infrastructure, where accuracy and prediction are related to the programming process (Highfield et al., 2008); (2) development of social skills, involving students in groups to solve a common problem, leads to teamwork capabilities (Atman Uslu et al., 2023); (3) educational robotics contributes to the development of emotional characteristics, establishing positive relationships with robots which leads to a state of joy, friendship and psychological comfort (Atman Uslu et al., 2023); (4) educational robots help to increase motivation for learning mathematics, performance and greater interest in learning mathematics in other forms (Atman Uslu et al., 2023).

Teachers take these statements into account when using educational robots in the classroom, which goes a long way in reducing math anxiety. For teachers looking for interactive solutions for teaching, they also need new approaches to learning and training.

Scenario-based learning is a relatively modern method of learning for teachers as well. Through scenario-based learning, they connect theory and practice, where scenarios as a learning tool become a good guide for understanding and applying what has been learned (Hursen & Fasli, 2017). Scenario-based learning is a new didactic approach that leads to reflective learning in teacher training.

Methodology

The aim of this study is to examine the opinions of teachers and prospective teachers about the "Video Library of Mathematics Activities with Robots" (https://blwithrobotics.eu/videos/), which was prepared to reduce anxiety about mathematics within the scope of BlwithRobotics project and implemented with primary school students in five different countries.

There are three sub-problems within the framework of the purpose determined in the research:

1. What are the opinions of teachers and pre-service teachers about "Video Library of Mathematics Activities with Robots" and does it vary according to various variables (country of residence, gender, age groups and status)
2. What are the opinions of teachers about "Video Library of Mathematics Activities with Robots" and do they vary according to various variables (country of residence, gender, age groups and years of training experience)?
3. What are the opinions of pre-service teachers about "Video Library of Mathematics Activities with Robots" and do they vary according to various variables (country of residence, gender, age groups and the year of study he/she is currently in the PIPP programme)?
4. The research was designed in a descriptive survey model, which is one of the quantitative research models. The study group of the research consists of a total of 541 participants, 205 teachers and 336 student/pre-service teachers, selected by non-random convenience sampling method. Demographic characteristics of the study group are presented in Table 1.

When Table 1 is analyzed, 541 participants were from five different countries, 148 (27.4%) from Turkey, 81 (15%) from Poland, 103 (19%) from Lithuania, 105 (19.4%) from Romania and 104 (19.2%) from Latvia. 86% of the study group were female and 46.6% were between the ages of 18–22. Table 1 shows that when 205 participants whose status is teacher are analyzed in terms of years of training experience, the majority (43.9%) are between 1–5 years; 336 participants are Student/Pre-service teacher, the majority (58.3%) are first and second year (first year 28.3%, second year 30.1%).

Table 1 Demographic Characteristics of the Study Group

Variables	Groups	Frequency (f)	Percent (%)	Cumulative Percent
Country	Turkey	148	27.4	27.4
	Poland	81	15.0	42.3
	Lithuania	103	19.0	61.4
	Romania	105	19.4	80.8
	Latvia	104	19.2	100.0
	Total	541	100.0	–
Gender	Female	465	86.0	86.0
	Male	76	14.0	100.0
	Total	541	100.0	–
Age	18–22	252	46.6	46.6
	23–27	91	16.8	63.4
	28–32	57	10.5	73.9
	33–37	59	10.9	84.8
	38–42	35	6.5	91.3
	43–47	24	4.4	95.7
	48 and over	23	4.3	100.0
	Total	541	100.0	–
Status	Teacher	205	37.9	37.9
	Student/Pre-service teacher	336	62.1	100.0
	Total	541	100.0	–
Years of training experience (for teachers)	Less than a year	23	11.2	11.2
	1–5 years	90	43.9	55.1
	6–10 years	35	17.1	72.2
	11–15 years	14	6.8	79.0
	16–20 years	19	9.3	88.3
	21 and over years	24	11.7	100.0
	Total	205	100.0	–
The year of study (for Student/ Pre-service teacher)	First year	95	28.3	28.3
	Second year	101	30.1	58.3
	Third year	85	25.3	83.6
	Fourth and over year	55	16.4	100.0
	Total	366	100.0	–

In this study, the scale of "Prospective Teachers' and Teachers' Opinions on "Video Library of Mathematics Activities with Robots" developed by researchers from five different countries was used. The scale is a five-point Likert-type scale (1 strongly disagree, 2 disagree, 3 somewhat agree, 4 agree, 5 strongly agree). It consists of 22 items and one dimension. Each item in the scale is related to the activities in the video library on

the BlwithRobotics project website (https://blwithrobotics.eu/videos/). The participants examined these activities before answering the scale and then answered the scale voluntarily by taking these activities into consideration. "The Cronbach Alpha (α) value calculated for the reliability analysis of the "Prospective Teachers' and Teachers' Opinions on "Video Library of Mathematics Activities with Robots" Scale is 0.96.

Results

Descriptive statistics were used in the analysis of the research data. The data were analyzed using SPSS software. In determining the statistical techniques to be used in the analysis of the data; kurtosis and skewness values of the distributions were examined to determine whether the distributions showed normal distribution (see Table 2).

Table 2 The Kurtosis and Skewness Values of the Scale

Kurtosis	Std. Error	Skewness	Std. Error
2.908	.210	–1.263	.105

Table 3 shows that Kolmogrov-Smirnov and Shapiro-Wilk test values are significant at $p < .05$ level. Based on the analyses made to determine whether the distribution is parametric or not, it was deemed appropriate to use the "Mann Whitney U" test for the sub-problems with two independent variables and the "Kruskal Wallis H" test for the sub-problems with more than two independent variables among the nonparametric statistical techniques in solving the research problem (Tabachnick & Fidell, 2013).

Table 3 Kolmogrov-Smirnov and Shapiro-Wilk Test Significance Values

Kolmogrov-Smirnov			Shapiro-Wilk		
Statistic	***df***	***p***	**Statistic**	***df***	***p***
.133	541	.000*	.892	541	.000*

Findings Related to the Opinions of Teachers and Pre-service Teachers about "Video Library of Mathematics Activities with Robots"

Within the scope of the first sub-problem of the research; arithmetic averages and standard deviations of teachers' and pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" are presented in Table 4. When Table 4 is examined, the arithmetic means of the items vary between 4.30 and 4.54 and the arithmetic mean of the total scale is 4.40. The teachers and pre-service teachers who constitute the study group have positive opinions about "Video Library of Mathematics Activities with Robots" at the level of "strongly agree".

Table 4 Analysis Results of Teachers' and Pre-service Teachers' Opinions on "Video Library of Mathematics Activities with Robots"

Item	$\bar{x}$	Ss
1. Content of scripts and videos is relevant to its purpose (including target group)	4.45	.691
2. Scenarios and videos align with the principles of education in general	4.40	.725
3. Contents of scripts and videos are based on new technologies	4.50	.671
4. The tasks in the scenarios and videos are directly related to the field of mathematics education for primary school	4.37	.710
5. Scenarios and videos include tasks to learn or improve math knowledge and skills using robotics	4.54	.639
6. Scenario and video tasks can be used to reduce students' math anxiety	4.41	.739
7. Scenarios and videos raise potential teachers' awareness of opportunities to reduce students' math anxiety	4.30	.801
8. Scenarios and videos promote learning processes with clearly defined purpose	4.45	.691
9. The tasks and exercises in the scenarios and videos are strategic in terms of lesson planning	4.31	.775
10. Video scenarios and exercises are suitable for different proficiency levels in the mathematics subject for primary education	4.38	.718
11. Scenarios and videos provide different ways to reduce math anxiety by encouraging active participation	4.41	.695
12. Scenarios and videos provide ways to make learning more fun for all children by using new technologies	4.53	.687
13. Video library offers easy-to-learn robotics applications for teaching math	4.36	.763
14. Contents of scripts and videos are presented in a clear way	4.36	.787
15. The video library offers scripts and videos adapted to the national context	4.33	.785
16. Visual design of scripts and videos is aesthetic and encourages learning	4.42	.772
17. The content of scripts and videos is appropriate, avoiding unnecessary or irrelevant information.	4.42	.707
18. Scenarios and videos are suitable for incorporation into blended learning environments.	4.41	.719
19. Scenarios and videos are suitable for incorporation into flipped classroom strategies.	4.33	.747
20. Scenarios and videos motivate teachers or prospective teachers to explore responses to children's math anxiety by seeking additional information from various sources.	4.33	.727
21. Videos available on the online learning platform can be used as teaching materials	4.44	.712
22. The results of the online projects available on the site inspire the search for new software programs and robotics to improve children's mathematical skills	4.44	.701
TOTAL	4.40	.535

Within the scope of the first sub-problem of the research; the results of the analyses related to the examination of the opinions about "Mathematics Activities with Robots Video Library" in terms of various variables (country of residence, gender, age groups and status) are presented in Table 5, Table 6, Table 7 and Table 8.

Table 5 Analysis of Teachers' and Pre-service Teachers' Opinions According to the Variable of the Country of Residence

Country	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*	Significant Difference
Turkey (1)	148	4.26	219.79	4	54.745	.000*	1–2 (.001) 1–3 (.000) 2–3 (.006) 2–5 (.017) 3–4 (.002) 3–5 (.000)
Poland (2)	81	4.50	294.99				
Lithuania (3)	103	4.73	359.15				
Romania (4)	105	4.34	268.51				
Latvia (5)	104	4.28	240.40				

*$p < .05$

When Table 5 is examined, it is seen that the opinions of teachers and pre-service teachers about "Video Library of Mathematics Activities with Robots" differed at $p < .05$ level according to the country variable (X2(4) = 54.745, p=.000). When it was analyzed which countries there was a significant difference between Turkey and Poland ($p = .001$) and Lithuania ($p = .000$) against those living in Turkey; Poland and Lithuania ($p = .006$) against those living in Poland; Poland and Latvia ($p = .017$) against those living in Latvia; Lithuania and Romania ($p = .002$) and Latvia ($p = .000$) in favor of those living in Lithuania.

Table 6 Analysis of Teachers' and Pre-service Teachers' Opinions According to Gender Variable

Gender	*N*		Mean Rank	Sum of Ranks	*U*	*p*
Female	465	4.41	273.08	126984.00	16701.000	.442
Male	76	4.39	258.25	19627.00		

According to Table 6, the opinions of teachers and pre-service teachers about "Video Library of Mathematics Activities with Robots" do not show significant differences according to gender variables.

Table 7 Analysis of Teachers' and Pre-service Teachers' Opinions According to Age Group Variables

Ages	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*	Significant Difference
18–22 (1)	252	4.34	246.12	6	17.439	.008*	1–3 (.010) 1–4 (.006) 1–7 (.006)
23–27 (2)	91	4.37	267.01				
28–32 (3)	57	4.53	303.03				
33–37 (4)	59	4.51	306.79				
38–42 (5)	35	4.42	289.97				
43–47 (6)	24	4.46	288.48				
48 and over (7)	23	4.58	341.15				

When Table 7 is examined, it is seen that the opinions of teachers and pre-service teachers about "Video Library of Mathematics Activities with Robots" differed at $p < .05$ level according to the age groups variable (X2(6) = 17.439, $p = .008$). When it was analyzed between which age groups there was a significant difference, it was found that there was a significant difference between 18–22 age groups and 28–32 ($p = .010$), 33–37 ($p = .006$) and 48 and over ($p = .006$) age groups against 18–22 age groups.

Table 8 Analysis of Teachers' and Pre-service Teachers' Opinions According to Status Variable

Status	*N*		Mean Rank	Sum of Ranks	*U*	*p*
Teacher	205	4.49	298.48	61187.50	28807.500	.001*
Student/Pre-service teacher	336	4.35	254.24	85423.50		

According to Table 8, the opinions of teachers and pre-service teachers about "Video Library of Mathematics Activities with Robots" show a significant difference in favor of teachers at $p = .001$ level according to the status variable. As a matter of fact, there was a significant difference against the participants between the ages of 18–22 in Table 7. Considering that the participants with student/pre-service teacher status are generally between the ages of 18–22; these two findings support each other.

Findings Related to Teachers' Opinions on "Video Library of Mathematics Activities with Robots"

Within the scope of the second sub-problem of the research; arithmetic averages and standard deviations related to teachers' opinions about "Video Library of Mathematics Activities with Robots" are presented in Table 9.

Table 9 Analysis Results of Teachers' Opinions on "Video Library of Mathematics Activities with Robots"

Item	$\bar{X}$	Ss
1. Content of scripts and videos is relevant to its purpose (including target group)	4.49	.704
2. Scenarios and videos align with the principles of education in general	4.46	.750
3. Contents of scripts and videos are based on new technologies	4.52	.654
4. The tasks in the scenarios and videos are directly related to the field of mathematics education for primary school	4.46	.696
5. Scenarios and videos include tasks to learn or improve math knowledge and skills using robotics	4.61	.596
6. Scenario and video tasks can be used to reduce students' math anxiety	4.49	.683
7. Scenarios and videos raise potential teachers' awareness of opportunities to reduce students' math anxiety	4.39	.723
8. Scenarios and videos promote learning processes with clearly defined purpose	4.54	.660
9. The tasks and exercises in the scenarios and videos are strategic in terms of lesson planning	4.37	.753

Item	$\bar{X}$	Ss
10. Video scenarios and exercises are suitable for different proficiency levels in the mathematics subject for primary education	4.45	.645
11. Scenarios and videos provide different ways to reduce math anxiety by encouraging active participation	4.48	.646
12. Scenarios and videos provide ways to make learning more fun for all children by using new technologies	4.59	.633
13. Video library offers easy-to-learn robotics applications for teaching math	4.46	.744
14. Contents of scripts and videos are presented in a clear way	4.45	.800
15. The video library offers scripts and videos adapted to the national context	4.47	.731
16. Visual design of scripts and videos is aesthetic and encourages learning	4.49	.745
17. The content of scripts and videos is appropriate, avoiding unnecessary or irrelevant information.	4.53	.653
18. Scenarios and videos are suitable for incorporation into blended learning environments.	4.50	.690
19. Scenarios and videos are suitable for incorporation into flipped classroom strategies.	4.44	.688
20. Scenarios and videos motivate teachers or prospective teachers to explore responses to children's math anxiety by seeking additional information from various sources.	4.43	.687
21. Videos available on the online learning platform can be used as teaching materials	4.56	.659
22. The results of the online projects available on the site inspire the search for new software programs and robotics to improve children's mathematical skills	4.55	.652
TOTAL	4.49	.510

When Table 9 is examined, it is seen that the arithmetic means of the items vary between 4.37 and 4.61 and the arithmetic mean of the total scale is 4.49. The teachers in the study group had very positive opinions at the level of "strongly agree" about "Video Library of Mathematics Activities with Robots".

Within the scope of the second sub-problem of the research; the results of the analyses of the teachers' opinions about "Video Library of Mathematics Activities with Robots" in terms of various variables (country of residence, gender, age groups and years of training experience) are presented in Table 10, Table 11, Table 12 and Table 13.

Table 10 Analysis of Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to the Variable of Country of Residence

Country	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*	Significant Difference
Turkey (1)	50	4.33	84.13				
Poland (2)	16	4.49	100.00				
Lithuania (3)	53	4.72	118.91	4	11.355	.023*	1–3 (.000)
Romania (4)	52	4.46	112.57				
Latvia (5)	34	4.40	92.74				

When Table 10 is analyzed, it is seen that teachers' opinions about "Video Library of Mathematics Activities with Robots" differ at $p < .05$ level according to the country they live in (X2(4) = 11.355, $p = .023$). When the significant difference between which countries was analyzed, a significant difference emerged between Turkey and Lithuania ($p = .000$) against the teachers living in Turkey. When the arithmetic averages are analyzed, it can be said that teachers living in Lithuania have the most positive views, while teachers living in Turkey have the most negative views compared to other countries.

Table 11 Analysis of Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to Gender Variable

Gender	*N*		Mean Rank	Sum of Ranks	*U*	*p*
Female	175	4.51	105.92	18536.50	2113.500	.087
Male	30	4.36	85.95	2578.50		

According to Table 11, teachers' opinions about "Video Library of Mathematics Activities with Robots" do not differ significantly according to gender variable. When the arithmetic averages are analyzed, it can be said that female teachers have more positive opinions.

Table 12 Analysis of Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to Age Group Variables

Ages	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*
18–22	17	4.34	91.59			
23–27	37	4.38	87.93			
28–32	45	4.54	99.67			
33–37	38	4.53	107.55	6	7.026	.318
38–42	26	4.47	110.87			
43–47	20	4.50	104.60			
48 and over	22	4.62	125.36			

According to Table 12, teachers' opinions about "Video Library of Mathematics Activities with Robots" do not show a significant difference at $p < .05$ level according to age groups. (X2(6) = 7.026, $p = .318$). When the arithmetic averages are analyzed, it can be said that teachers in the age range of 48 and over have the most positive opinions, while teachers in the age range of 18–22 have the most negative opinions compared to teachers in the other age range.

Table 13 Analysis of Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to Years of Training Experience Variable

Years of Training Experience	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*
Less than one year (0)	23	4.30	81.91	5	7.747	.171
1–5 years (1)	90	4.46	99.79			
6–10 years (2)	35	4.56	105.70			
11–15 years (3)	14	4.67	119.93			
16–20 years (4)	19	4.43	98.84			
21 and over years (5)	24	4.61	124.73			

According to Table 13, teachers' opinions about "Video Library of Mathematics Activities with Robots" do not show significant difference at $p < .05$ level according to years of training experience variable (X2(5) = 7.747, $p = .171$). When the arithmetic averages are analysed, it can be said that teachers with years of training experience in the range of 11–15 years have the most positive views, while teachers with less than one year have the most negative views compared to other teachers. As a matter of fact, in Table 12, it was found that teachers in the 18–22 age range had more negative views than teachers in other age ranges. Considering that teachers with less than one year of training experience are generally between the ages of 18–22; these two results support each other.

Findings Related to Prospective Teachers' Opinions on "Video Library of Mathematics Activities with Robots"

Within the scope of the third sub-problem of the research; arithmetic averages and standard deviations of pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" are presented in Table 14.

Table 14 Results of the Analyses of the Pre-service Teachers' Opinions on "Video Library of Mathematics Activities with Robots"

Item		$\bar{X}$	Ss
1.	Content of scripts and videos is relevant to its purpose (including target group)	4.42	.682
2.	Scenarios and videos align with the principles of education in general	4.36	.708
3.	Contents of scripts and videos are based on new technologies	4.49	.682
4.	The tasks in the scenarios and videos are directly related to the field of mathematics education for primary school	4.32	.714
5.	Scenarios and videos include tasks to learn or improve math knowledge and skills using robotics	4.49	.660
6.	Scenario and video tasks can be used to reduce students' math anxiety	4.35	.767
7.	Scenarios and videos raise potential teachers' awareness of opportunities to reduce students' math anxiety	4.24	.842
8.	Scenarios and videos promote learning processes with clearly defined purpose	4.40	.706
9.	The tasks and exercises in the scenarios and videos are strategic in terms of lesson planning	4.28	.788

Item	$\bar{X}$	Ss
10. Video scenarios and exercises are suitable for different proficiency levels in the mathematics subject for primary education	4.34	.756
11. Scenarios and videos provide different ways to reduce math anxiety by encouraging active participation	4.37	.721
12. Scenarios and videos provide ways to make learning more fun for all children by using new technologies	4.50	.717
13. Video library offers easy-to-learn robotics applications for teaching math	4.29	.768
14. Contents of scripts and videos are presented in a clear way	4.31	.776
15. The video library offers scripts and videos adapted to the national context	4.24	.804
16. Visual design of scripts and videos is aesthetic and encourages learning	4.38	.786
17. The content of scripts and videos is appropriate, avoiding unnecessary or irrelevant information.	4.35	.730
18. Scenarios and videos are suitable for incorporation into blended learning environments.	4.36	.732
19. Scenarios and videos are suitable for incorporation into flipped classroom strategies.	4.26	.774
20. Scenarios and videos motivate teachers or prospective teachers to explore responses to children's math anxiety by seeking additional information from various sources.	4.26	.744
21. Videos available on the online learning platform can be used as teaching materials	4.37	.734
22. The results of the online projects available on the site inspire the search for new software programs and robotics to improve children's mathematical skills	4.38	.723
TOTAL	4.35	.545

When Table 14 is examined, the arithmetic means of the items vary between 4.24 and 4.50 and the arithmetic mean of the total scale is 4.35. The pre-service teachers in the study group had positive opinions at the level of "strongly agree" about "Video Library of Mathematics Activities with Robots".

Within the scope of the third sub-problem of the research; the results of the analyses related to the examination of pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" in terms of various variables (country of residence, gender, age groups and the year of study he/she is currently in the PIPP programme) are presented in Table 15, Table 16, Table 17 and Table 18.

Table 15 Analysis of Prospective Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to the Country of Residence Variable

Country	*N*		Mean Rank	*df*	X^2 (Chi-Squar)	*p*	Significant Difference
Turkey (1)	98	4.23	138.24	4	47.677	.000*	1–2 (.000), 1–3 (.000) 2–3 (.024), 2–4 (.013) 2–5 (.012), 3–4 (.000) 3–5 (.000)
Poland (2)	65	4.50	194.33				
Lithuania (3)	50	4.75	241.84				
Romania (4)	53	4.22	146.50				
Latvia (5)	70	4.22	151.14				

*$p < .05$

When Table 15 is examined, it is seen that pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" differed at $p < .05$ level according to the country variable (X2(4) = 47.677, $p = .000$). When the significant differences between which countries are analyzed, it is seen that there is a significant difference between Turkey and Poland (p=.000) and Lithuania ($p = .000$) against the pre-service teachers living in Turkey, between Poland and Lithuania ($p = .024$) against the pre-service teachers living in Poland, between Poland and Romania ($p = .013$) and Latvia ($p = .012$) in favor of pre-service teachers living in Poland; between Lithuania and Romania ($p = .000$) and Latvia ($p = .000$) in favor of pre-service teachers living in Lithuania. When the arithmetic averages are analyzed, it can be said that pre-service teachers living in Lithuania have the most positive views, while pre-service teachers living in Romania and Latvia have negative views compared to other countries.

Table 16 Analysis of Pre-service Teachers' Opinions on "Video Library of Mathematics Activities with Robots" According to Gender Variable

Gender	*N*		Mean Rank	Sum of Ranks	*U*	*p*
Female	290	4.34	167.59	48601.50	6406.500	.666
Male	46	4.41	174.23	8014.50		

According to Table 16, pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" do not differ significantly according to gender variable. When the arithmetic averages are analyzed, it can be said that male pre-service teachers have more positive opinions.

Table 17 Analysis of Prospective Teachers' Opinions about "Video Library of Mathematics Activities with Robots" According to Age Group Variables

Ages	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*
18–22	235	4.34	163.10			
23–27	54	4.37	179.41			
28–32	12	4.51	212.54			
33–37	21	4.47	194.40	6	7.611	.268
38–42	9	4.27	150.72			
43–47	4	4.28	141.00			
48 and over	1	3.77	45.50			

According to Table 17, pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" do not differ significantly at $p < .05$ level according to their age groups (X2(6) = 7.611, $p = .268$). When the arithmetic averages are analyzed, it can be said that pre-service teachers between the ages of 28–32 have the most positive opinions.

Table 18 Analysis of Prospective Teachers' Opinions about "Mathematics Activities with Robots Video Library" According to The Year of Study He/She is Currently in the PIPP Program Variable

The Year of Study He/She is Currently In The PIPP Program	*N*		Mean Rank	*df*	X^2 (Chi-Square)	*p*	Significant Difference
First year (1)	95	4.22	142.92				1–2 (.009)
Second year (2)	101	4.40	179.93		9.245	.026*	1–3 (.017)
Third year (3)	85	4.40	177.18				1–4 (.027)
Fourth and over year (4)	55	4.42	178.29				

According to Table 18, pre-service teachers' opinions about "Video Library of Mathematics Activities with Robots" differ significantly at $p < .05$ level according to the year of study he/she is currently in the PIPP program variable (X2(3) = 9.245, $p = .026$). When the significant difference between the pre-service teachers in the first year and the second year ($p = .009$), the third year ($p = .017$) and the fourth year ($p = .027$) was analyzed, a significant difference emerged against the pre-service teachers in the first year.

Discussion

The results of the study provide valuable insights into the efficacy of the "Video Library of Mathematics Activities with Robots" in alleviating math anxiety among teachers and pre-service teachers across different countries. The results suggest a high level of agreement among participants, reflecting a favorable view of the intervention. Overall, teachers and pre-service teachers from Turkey, Poland, Lithuania, Latvia, and Romania showed divergent views. Notably, Poland, Lithuania, and Latvia demonstrated more positive perceptions compared to Turkey, with statistically significant variations. Participants in the 18–22 age group differ significantly from those in the 28–32, 33–37, and 48 and over age groups. This implies that age plays a role in shaping perceptions, with younger individuals holding distinct views on the video library.

Teachers perception. Regarding country-specific perspectives of teachers, a significant difference is noted between Turkey and Lithuania, with Lithuanian teachers expressing more positive views. This emphasizes the need for a nuanced understanding of cultural and contextual factors influencing perceptions. Despite the absence of significant differences, the arithmetic averages reveal a notable trend. Teachers aged 48 and over exhibit the most positive opinions, while those in the 18–22 age range express more negative views compared to their counterparts. This finding aligns with the notion that experience and maturity may contribute to a more favorable perception of innovative teaching tools. The absence of a significant difference based on years of training experience is noteworthy. However, the analysis of arithmetic averages unveils an interesting pattern. Teachers with 11–15 years of training experience hold the most positive views, while those with less than one year of experience express more negative opinions. Corroborating this, the study reveals that teachers in the 18–22 age range, often corresponding

to less experienced educators, share less positive sentiments. This interplay suggests that both age and experience may contribute to shaping teachers' perceptions.

Pre-service teachers perception. Notably, pre-service teachers in Lithuania exhibit the most positive views, whereas those in Romania and Latvia express comparatively negative opinions. This variation underscores the importance of considering cultural and educational context when implementing educational interventions. It also aligns with the findings which indicate that age groups among pre-service teachers do not significantly impact their opinions, emphasizing that other factors such as cultural context may play a more influential role.

A significant difference emerges, suggesting that pre-service teachers in their first year have distinct opinions, less positive, compared to those in subsequent years. This emphasizes the dynamic nature of perceptions, potentially influenced by evolving pedagogical knowledge and exposure to educational practices throughout the program.

Recommendations

In light of the cross-country analysis on the efficacy of the "Video Library of Mathematics Activities with Robots" and the nuanced perspectives revealed among teachers and pre-service teachers, several recommendations can be proposed. Firstly, educational practitioners and policymakers should consider tailoring the implementation of video libraries to address the distinct needs and preferences of teachers in different countries. Understanding the cultural and contextual factors influencing perceptions, as evidenced by the significant variations in Table 5 and Table 15, is crucial for designing effective interventions. Additionally, efforts should be directed towards providing targeted professional development programs for younger teachers and pre-service teachers, as indicated by the less positive views in Tables 12 and 17. These programs should focus on enhancing their familiarity and comfort with innovative teaching tools, thereby fostering a more positive outlook.

Furthermore, given the interconnected findings regarding age, years of training experience, and program progression, institutions offering teacher education programs, such as the initial teacher training program, should consider integrating technology-enhanced teaching methods throughout the entire curriculum. This can ensure that pre-service teachers, regardless of their program year, are adequately prepared and receptive to incorporating video libraries into their future classrooms. Lastly, continuous research efforts should be undertaken to explore the evolving landscape of educational technology and its impact on mathematics anxiety. Longitudinal studies tracking the changing perspectives of teachers and pre-service teachers over time can provide valuable insights into the sustained efficacy of video libraries and inform ongoing improvements in their design and implementation.

Conclusion

In conclusion, the cross-country analysis of teachers' and pre-service teachers' opinions on the "Video Library of Mathematics Activities with Robots" provides a multifaceted understanding of the factors influencing their perceptions. The overall positive views indicate the potential of such interventions in alleviating math anxiety. However, the significant variations based on country, age, and years of training experience underscore the need for targeted strategies in implementation. The findings emphasize that a one-size-fits-all approach may not be suitable in diverse educational contexts. Instead, a tailored approach that considers cultural nuances, age-related preferences, and experience levels is essential. The recommendations aim to guide educators, policymakers, and researchers in fostering a more inclusive and effective integration of video libraries in mathematics education, ultimately contributing to the ongoing improvement of teaching practices and the reduction of math anxiety among both current and future educators.

Limitations and Future Research

It is crucial to acknowledge the limitations of the study, such as the potential influence of cultural biases and the need for more extensive research to validate the findings. Future studies could explore additional variables and employ diverse methodologies to provide a comprehensive understanding of the relationship between resources like video libraries and math anxiety.

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