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RESEARCH ARTICLE

Analyzing teachers' perceptions regarding STEAM education in schools

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Abstract

Science, technology, engineering, arts, and mathematics (STEAM) is one of the most effective educational approaches for assisting learners in acquiring the necessary twenty-first-century skills and competencies. While highly developed countries have invested heavily in STEAM education to empower their younger generations for the future, such efforts may not exist in developing nations. The STEAM approach can change training and education; however, its success depends on several interrelated factors. Teachers play a critical role in the success of STEAM education, which necessitates their active involvement in its adoption and implementation in schools. Teachers' beliefs and perceptions regarding STEAM methodologies require further scholarly scrutiny, and this study aims to examine Azerbaijani teachers' attitudes and perceptions toward STEAM in schools, exploring the barriers and challenges they face and their suggestions for improvement. A survey of 192 Azerbaijani teachers yielded data that were largely analyzed using the Mann-Whitney U test and one-way Analysis of Variance (ANOVA). The results suggest that Azerbaijani teachers have a positive perception toward implementing Science, Technology, Engineering, Arts, and Mathematics (STEAM) education in schools. Attitudes, however, varied according to years of work experience, gender identity, and location. Higher work experience, being female, and working in an urban school were associated with more positive attitudes toward STEAM education.

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1. INTRODUCTİON

In the contemporary landscape, there is a growing demand for skills such as creativity, responsibility, problem-solving, leadership, decision-making, collaboration, communication, entrepreneurship, and critical thinking, termed as 21st-century skills, are highly needed. Science, technology, engineering, arts, and mathematics (STEAM) is one of the most effective educational approaches for assisting learners in acquiring 21st-century skills and competencies (Hasibuan et al., 2022). Several researchers, including Thibaut et al. (2018) and Chaya (2023), have emphasized the need to adopt and implement STEAM education in schools. Furthermore, as Madani (2020) indicated, pedagogical approaches related to STEAM are now regarded as the most effective strategies for achieving the ever-changing demands in both developed and developing nations. Developed countries such as Japan, England, and the USA have invested heavily in STEAM education to empower their young generation. However, the adoption of STEAM education is far from universal, and the situation in developing nations generally differs from that in more economically developed nations.

In Azerbaijan and other post-Soviet countries, STEAM (though a highly espoused area owing to its integrative approach that combines both interdisciplinary application and knowledge) is not well developed, and thus may experience various challenges (Pardimin & Hikmah, 2023). The main idea behind STEAM is that both practical skills and theoretical knowledge are necessary, because learners gain access to knowledge from multiple fields and can instantly apply it. Despite its potential to change training and education, the success of STEAM, both in Azerbaijan and worldwide, depends on numerous interrelated factors. For example, Aliyeva and Rzayeva (2019) noted that Azerbaijan experienced challenges related to system regulations, which may make it difficult to implement STEAM successfully. Other factors highlighted in the literature as influencing the success of educational programs and innovative practices in Azerbaijan include student-faculty interactions, quality of interactions, nature of interactions, and learning environment (Isaeva et al., 2023). The availability of proper policy frameworks, resources, and equipment is undoubtedly another prerequisite for successful STEAM.

Teachers play an integral role in the success of STEAM education, because the successful adoption and implementation of STEAM and other innovative solutions in schools require the active involvement of educators. Therefore, as Tunc and Bagceci (2021) highlighted, teachers' levels of preparedness and perceptions considerably influence the successful implementation of STEAM education. Despite the role that teachers play, most studies (Balta et al., 2023; Japashov et al., 2022; Yerdelen et al., 2016) have focused only on students' perceptions toward STEAM, with only a few examining teachers' attitudes toward STEAM. Furthermore, as Madani (2020) indicated, teachers' beliefs and perceptions about methodologies and approaches for implementing STEAM are yet to be studied in-depth. Therefore, this study seeks to pay more attention to teachers' perceptions of STEAM in Azerbaijani schools and how such an understanding can impact its implementation.

Objectives of the study

This study aims to uncover Azerbaijani teachers' perceptions of STEAM in educational settings, exploring the factors shaping these views. It delves into perceived benefits, such as fostering critical thinking and interdisciplinary connections, and scrutinizes challenges, ranging from resource constraints to collaborative coordination issues. By illuminating these aspects, the study seeks to inform educational strategies, aiding evidence-based policymaking. With a focus on actionable insights, it contributes to the ongoing discourse on educational reform in Azerbaijan, fostering innovative and transformative practices in line with global educational trends.

Research questions

The research questions this study seeks to answer are:

1) What are the perception levels of teachers regarding STEAM?
2) Do teachers' perception levels of STEAM vary according to their gender, location, and duration of professional experience?
3) What are the opinions of teachers regarding the benefits of STEAM education?
4) What are the opinions of teachers regarding the barriers to STEAM education?

Literature review

Although STEAM is becoming increasingly popular, few investigations have been conducted on its implementation in Azerbaijan and other post-Soviet countries. Although limited, these studies provide valuable insights into teachers' perceptions of STEAM

education, its effectiveness, barriers to and challenges in implementation, and suggestions for improving STEAM adoption and implementation.

Perception of STEAM education in Azerbaijani schools

Several studies have already been conducted on the perceptions of various stakeholders in Azerbaijan and other post-Soviet countries toward STEAM. However, most studies focus on the perceptions of learners and not teachers, which highlights the significance of this research and may help bridge the gap. For example, Japashov et al. (2022) explored Kazakh students' interest in STEAM education, in which researchers established that students generally have a positive attitude toward careers in STEAM. Students who were the primary respondents in studies by Yerdelen et al. (2016) and Balta et al. (2023) agreed on generally positive perceptions of science, technology, engineering, and mathematics (STEM) education and careers. Nonetheless, there were variations among students depending on their gender and location. Japashov et al. (2022) established that rural students showed the highest levels of interest in STEM, whereas the lowest levels were reported by urban students studying at private schools. The findings of other researchers, including Balta et al. (2023), overlap with those of Japashov et al. (2022) regarding the role of gender and socioeconomic status in influencing students' interest in STEAM education and careers. Specifically, Balta et al. (2023) highlighted the complexity of the factors (both external and internal) that interact to influence students' attitudes toward STEAM. The authors underscore that a student's development or lack of interest in STEAM is influenced by many internal factors, such as self-efficacy, or external factors, such as gender stereotypes, which interact through complex processes (Balta et al., 2023). Based on this observation, STEAM education must be approached from a multifaceted perspective, considering both internal and external factors. However, Yerdelen et al. (2016) reported contrasting findings to those of Balta et al. (2023) and Japashov et al. (2022), especially regarding the role of gender, which has no significant effect on the attitudes of a child toward STEAM education.

Japashov et al. (2022) further established that factors such as education level, parental occupation, and family size does not impact students' interest in STEM. Similarly, Yerdelen et al. (2016) emphasized the role of the family's socioeconomic status in influencing attitudes toward STEM, but noted the irrelevance of gender. Specifically, Yerdelen et al. (2016) showed that a financially poor socioeconomic background predisposes individuals to negative perceptions of STEAM, which can primarily be linked to a lack of adequate exposure and information about the benefits of STEAM. Such a negative attitude can be changed by raising awareness, especially by targeting students and instructors from low socioeconomic backgrounds.

Barriers and factors influencing teachers' perceptions of STEAM education

To understand the factors influencing teachers' perceptions toward STEAM education, it is essential to consider field training. Field training is one factor linked to the perceptions that teachers have toward STEAM education. Nepeina et al. (2020) explored the impact of field training on STEM education, focusing on Russia, Azerbaijan, and other Commonwealth of Independent States. In this study, the authors identified positive attitudes toward STEAM among teachers and students, especially regarding fulfilling their practical duties. Similarly, Alghamdi (2023) drew attention to the need for more training and professional development in the implementation of STEAM. Alghamdi (2023) found a strong correlation between teachers' beliefs toward STEAM education and their professional training levels.

Work experience, gender, and location were the major factors affecting teachers' perceptions of STEAM education. Japashov et al. (2022) offered valuable insights into how gender and location (rural versus urban) influence Kazakh students' attitudes toward STEM education and careers. Other factors highlighted in the literature as influencing attitudes toward STEAM are the availability of information about STEAM, access to traineeship, and class levels (Madani, 2020). Images of science and experts in STEAM, influential individuals, teaching and learning, attainment, and age or years of work experience have been identified as essential factors that influence attitudes and decisions regarding STEAM (Regan & DeWitt, 2014). These factors can either be barriers or enablers of STEAM education in Azerbaijan and can be the basis for making suggestions for improving STEAM education practices globally.

Potential contributions of the present study

The reviewed literature highlights a gap in research regarding teachers' perceptions of STEAM implementation in Azerbaijani schools. While existing studies on this topic have predominantly focused on learners' perceptions and experiences with STEAM, they often neglect the critical role of teachers and their perspectives. These studies have also presented inconsistent and inconclusive findings regarding perceptions toward STEAM, the challenges faced, and the influencing factors.

In light of this gap, our study contributes to the existing knowledge by specifically exploring Azerbaijani teachers' attitudes toward implementing STEAM. While there is a plethora of studies on students' perceptions of STEAM, only a limited number delve into teachers' attitudes. By concentrating on the perspectives of Azerbaijani teachers, we aim to provide valuable insights into their lived and perceived experiences, addressing various factors, barriers, and offering suggestions to enhance STEAM implementation in Azerbaijani schools.

2. METHODS AND MATERİALS

Data collection method

A STEAM perception survey was conducted as the primary method of data collection. Adopting a survey as a means of data collection was justified because it enabled comparisons between subjects and generated data to examine the correlations between relevant variables.

Instrument and variables

A STEAM perceptions survey, which was a 10-item survey (See Appendix 1) was conducted among 192 Azerbaijani teachers to gather data on the perceptions, attitudes, and factors that influence the implementation of the STEAM approach. Questions on these aspects were primarily close-ended and followed a Likert scale format. There was also an open-ended question to gather data from the participants regarding their recommendations for improving the implementation of STEAM in Azerbaijani schools.

In extant research, various outcomes and variables have been included based on assumptions, theory, and evidence. The importance of integrating STEAM in schools has been questioned because educators' perceptions affect the success of implementation (Balta et al., 2023; Yerdelen et al., 2016). Some factors that affect teachers' perceptions toward the importance of STEAM are levels of preparedness, resources, and specific benefits, such as equipping students with critical thinking, creativity, and problem-solving skills (Madani, 2020; Nepeina et al., 2020). Similarly, the barriers, enablers, and opportunities for implementing STEAM in Azerbaijani schools were included based on evidence drawn from existing scholarly work.

Seven questions were asked to measure the perception of STEAM's impact on student performance using a set of ordinal responses (1 = positive impact; 2 = no significant impact; 3 = negative impact). A similar approach was applied to assess teachers' perceptions toward the effectiveness of STEAM educational practices (1 = highly effective; 2 = moderately effective; 3 = ineffective) and the impact of STEAM education on students' problem-solving, creativity, and critical thinking (1 = Yes, significantly; 2 = To some extent; 3 = No, not at all). Other areas that were assessed through ordinal responses were related to familiarity with STEAM (1 = very familiar; 2 = somewhat familiar; 0 = not familiar), the importance of integrating STEAM in Azerbaijani schools (1 = very important; 2 = moderately important; 0 = not important), the extent of preparedness and equipment to teach STEAM (1 = fully; 2 = moderately; 0 = not at all), and the perception of available resources and support (1 = strongly supported; 2 = moderately supported; 0 = insufficient).

The focus was also on exploring the perceived or experienced benefits and challenges of STEAM education in Azerbaijani schools from the teachers' point of view. Thus, two research questions (Q5 and Q6) were specifically designed to gather information on the benefits and barriers that arise from the implementation of STEAM education in Azerbaijani schools. Participants were asked whether they believed that STEAM education in schools encouraged critical thinking and problem-solving skills, stimulated creativity and innovation, or fostered interdisciplinary connections between the subjects. Other benefits of STEAM listed in the survey are that it enhances students' engagement and motivation and prepares learners for future opportunities.

The third research question examined the significant challenges and barriers to implementing STEAM education in Azerbaijani schools. In this case, the participants needed to determine what they perceived as the major barrier to STEAM among the five factors. These five factors were the limited availability of resources such as equipment, lack of teacher training and professional development, curriculum constraints and time limitations, insufficient support from school administration or stakeholders, and lack of collaboration and interdisciplinary coordination among teachers.

Sample

Teachers who participated in the survey were recruited by chance, using random sampling. Thus, while some participants were recruited through Facebook, others were invited individually to participate in the online survey. The author acknowledges the limitations of nonrandom sampling in terms of the generalizability of the findings; therefore, the findings should be interpreted in

this light. There were no criteria for recruitment, as any teacher, regardless of their experience or knowledge of STEAM, was allowed to participate voluntarily. The absence of criteria is justified because at a minimum, all teachers have some basic knowledge and experience in STEAM education.

Data analysis

Data were statistically analyzed using the SPSS software package. Initially, the total scores for the questionnaire items consisting of seven questions were calculated, and it was determined whether the data showed a normal distribution. Skewness was calculated as -1.082 and kurtosis as 0.619. Given that these values fell within the range of -2 to +2, it was decided that the data obtained from the survey had a normal distribution (Bono et al., 2019). Descriptive statistics (means, standard deviations, and percentages) were calculated for the data obtained from the questionnaire.

In assessing the level of teachers' perceptions on the scale, the criteria for the X̄/K value were considered, with 0–1.66 indicating "low," 1.67–3.33 indicating "moderate," and 3.34–5 indicating "high" perception levels. To determine whether teachers' perceptions of STEAM education differed based on their gender, the Mann-Whitney U test was conducted, as the groups were not homogeneously distributed. An independent samples t-test was employed to assess whether there was a difference in perceptions based on place of residence, and the one-way analysis of variance (ANOVA) analysis was performed to determine if there were differences based on the duration of professional experience.

Findings

Demographic data

A total of 192 (n = 192) teachers from Azerbaijani schools participated in the survey, of whom 92% (177/192) were women and 8% (15/192) were men. Regarding the vital demographic characteristics of the participants, the largest proportion (35.94%; 69/192) had work experience of 0–10 years. Similarly, 51% (98/192) were city dwellers, and 49% (94/192) lived in rural areas. Table 1 presents the demographic characteristics of the participants.

Table 1. Demographic Characteristics of the Participants

		N	Percentage
Gender	Male	15	7.81%
	Female	177	92.19%
Location	Rural areas	94	48.96%
	City (urban)	98	51.04%
Work experience	1–10 Years	69	35.94%
	11–20 Years	58	30.21%
	Over 20 Years	65	33.85%

Perceptions levels of teachers regarding STEAM education

In Table 2, the descriptive values and X̄/K results of the scores obtained from the survey determining teachers' perception levels about STEAM education are presented.

Table 2. Perceptions of Teachers Regarding STEAM Education

Scale	N	Min.	Mak.	ss	X̄	X̄/K	level
STEAM Perception	192	5	15	1.97	10.88	1.55	low

As shown in Table 2, among the 192 teachers, the lowest score obtained from the STEAM perception survey was 5, the highest was 15, and the average was 10.88. The X/K result is calculated as 1.55, indicating that the teachers' perception levels of STEAM are low.

The variation in teachers' perception levels of STEAM is based on their gender, place of residence, and professional experience durations.

The results of the Mann-Whitney U test conducted to determine whether there was a difference in STEAM perception levels based on teachers' genders are provided in Table 3.

Table 3. The difference in STEAM perception levels based on gender

Groups	N	Mean Rank	Sum of Ranks	U	P
Female	117	94.67	16756.5	1003.5	.109
Male	15	118.1	1771.5		

According to the results of the Mann-Whitney U test presented in Table 3, no statistically significant difference was observed between the STEAM perceptions of female and male teachers ($U = 1003.5$, $p > 0.05$). It can be concluded that gender did not have a significant impact on STEAM perception level in this sample group. The results of the independent samples t-test conducted to determine whether there was a difference in teachers' STEAM perception levels based on their place of residence are presented in Table 4.

Table 4. The variation in STEAM perception levels based on the places of residence of teachers

Groups	N	X	ss	sd	t	p
Rural areas	94	10.47	2.13	190	2.841	.005
City (urban)	98	11.47	1.74			

According to the results of the independent samples t-test conducted to determine whether there is a difference in STEAM perceptions between teachers working in rural and urban areas, a statistically significant difference was observed between teachers in urban and rural areas ($t = 2.841$, $p < 0.05$). Table 4 shows that the mean scores of teachers in urban areas were lower than those of teachers in rural areas. The results of the one-way ANOVA analysis conducted to determine whether there was a difference in teachers' STEAM perception levels based on their professional experience duration are presented in Table 5.

Table 5. The variation in STEAM perception levels based on teachers' professional experience durations

	Sum of Squares	df	Mean Square	F	p	Difference
Between Groups	39.829	2	19.914	5.319	0.006	0–10 years and
Within Groups	707.65	189	3.744			above 20
Total	747.479	191				

According to the results of the one-way ANOVA, the STEAM perception levels of teachers with different experience durations differed significantly ($F = 5.319$, $p < 0.05$). The calculated effect size ($\eta^2 = 0.05$) indicates that this difference is of moderate magnitude. The Tukey post-hoc comparison test revealed a significant difference between the scores of teachers with 0–10 years of experience and those with over 20 years of experience.

Teachers' views on the benefits of STEAM education

The results of the descriptive analysis based on the answers to the fourth survey question are presented in Figure 1.

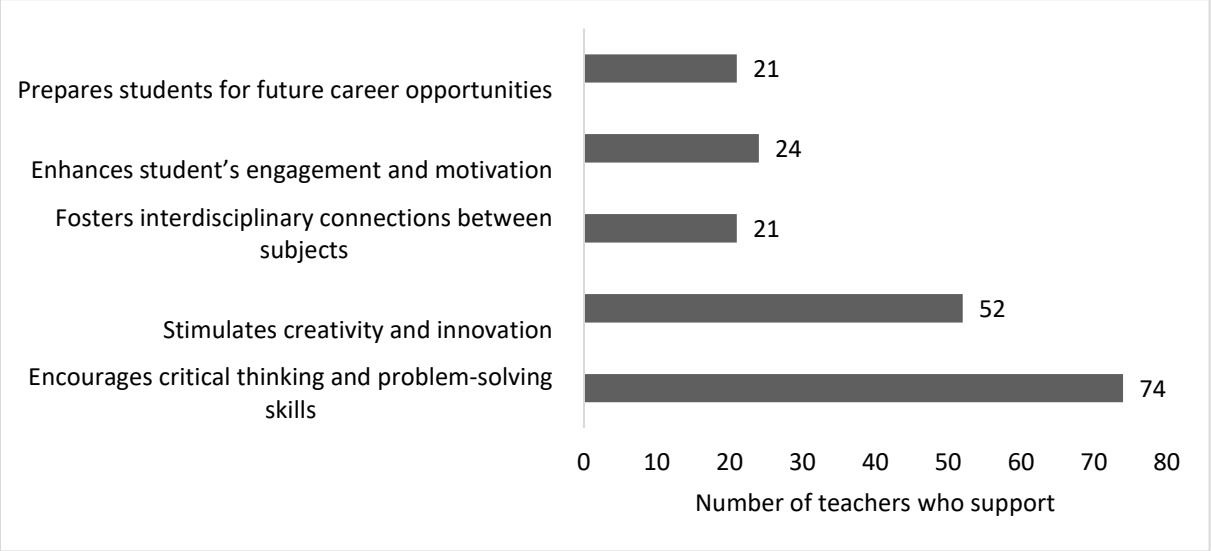


Figure 1. The Perception of Teachers about the Main Benefits of Implementing STEAM in Azerbaijani Schools

As is evident in Figure 1, a larger proportion (38.5%) of the participants agreed that one of the key benefits of adopting STEAM education was improving learners' problem-solving and critical thinking skills. Similarly, 27% of the participants selected the stimulation of creativity and innovation as a benefit of STEAM education. A summary of the benefits of STEAM education from the perspective of Azerbaijani teachers is shown in Figure 1.

Teachers' views on the barriers to STEAM education

The results of the descriptive analysis based on the answers to the fourth survey question are shown in Figure 2.

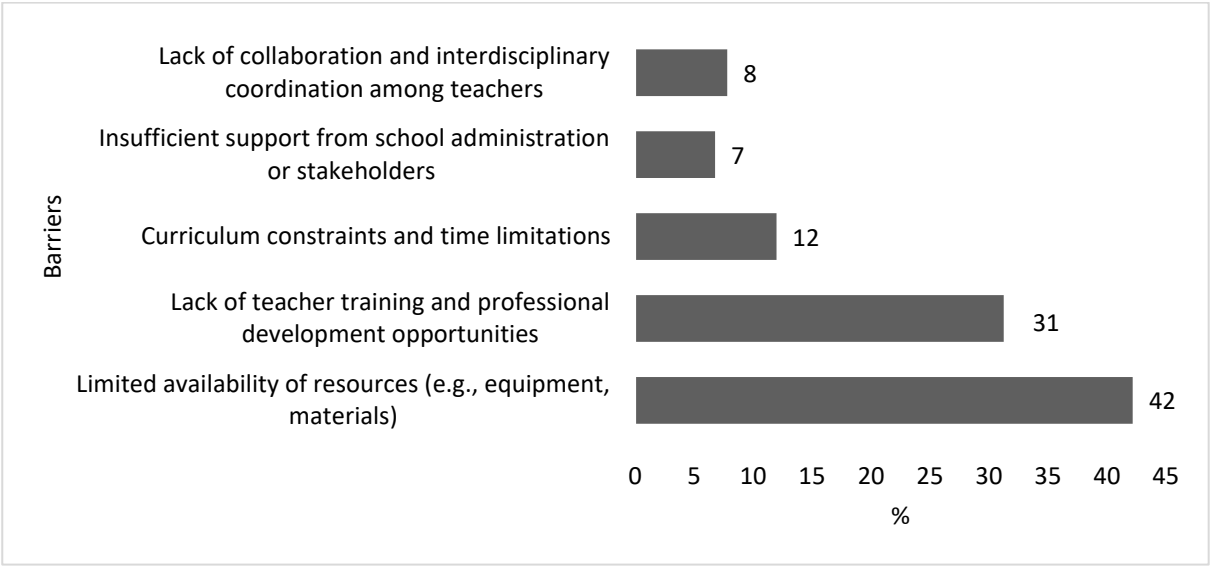


Figure 2. The Perception of Azerbaijani Teachers about the Significant Barriers to STEAM Education in Schools

Of the participants, 42.2% perceived the limited availability of resources such as equipment and materials as a major barrier to STEAM. In comparison, 31.3% believed that the lack of training and professional development significantly hindered STEAM adoption and its effective implementation in Azerbaijani schools. Furthermore, 12.0% and 7.8% of the participants believed that curriculum constraints and time limitations, as well as a lack of collaboration and interdisciplinary coordination among teachers were major barriers to STEAM in Azerbaijani schools, respectively. A summary of the major barriers and challenges to STEAM in Azerbaijani schools is shown in Figure 2.

Teachers' recommendations for integrating and enhancing STEAM education

Teachers have provided recommendations for the successful implementation of STEAM in schools. The results are shown in Figure 3.

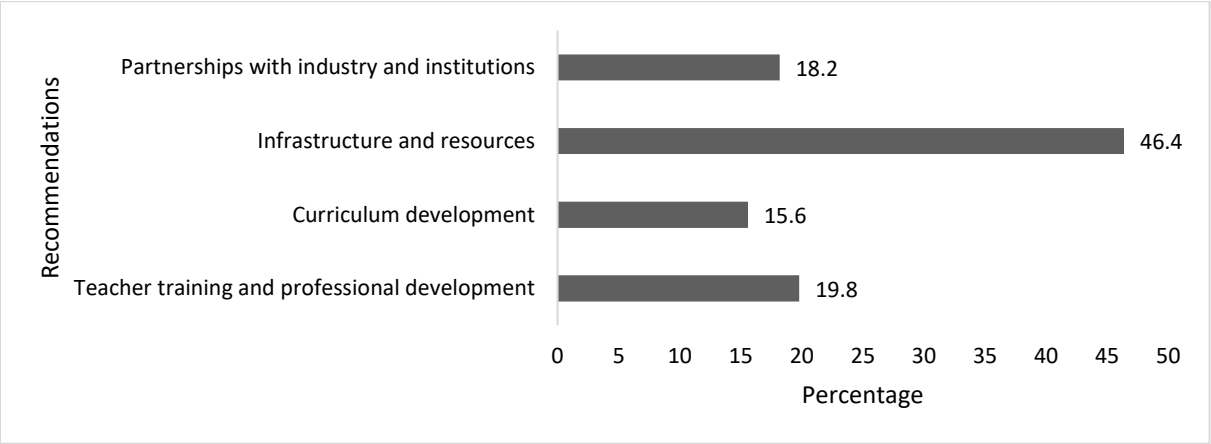


Figure 3. The Recommendations of Azerbaijani Teachers on Integrating and Enhancing STEAM Education

Of the teachers, 46.4% emphasized the need for infrastructure and resources, 19.8% advocated for the enhancement of teachers' professional development through various programs and training, 18.2% highlighted the importance of collaboration between the school industry and institutions, and 15% expressed the necessity for curriculum development to integrate STEAM.

3. DİSCUSSİON

Teachers' competencies and attitudes toward STEAM are critical for its success. This study aimed to determine the perceptions of Azerbaijani teachers toward STEAM in schools. The survey data established that Azerbaijani teachers generally had positive attitudes toward STEAM. The t-test findings revealed the existence of a significantly positive attitude toward STEAM. These findings are consistent with those of extant research, including Yerdelen et al. (2016), Balta et al. (2023), and Japashov et al. (2022), which show the existence of positive attitudes toward both STEM education and careers. However, it is essential to note that, while this study focused on teachers, all other studies were primarily conducted among students.

Azerbaijani teachers' positive attitudes toward STEAM education are demonstrable in diverse areas. A significant proportion of teachers familiar with STEAM education, had high levels of preparedness to incorporate this approach, and understood the importance of integrating STEAM education into Azerbaijani schools. Similarly, the fact that a significant number of participants perceived current STEAM practices in Azerbaijani as highly effective demonstrates their positive attitudes. Other research findings demonstrating that Azerbaijani teachers have a positive perception of implementing STEAM in schools include that they consider it impactful in promoting creativity, critical thinking, and problem-solving skills among students. One of the original contributions of this study is that, unlike existing investigations such as Yerdelen et al. (2016) and Japashov et al. (2022), it provides a different perspective by considering the experiences and opinions of teachers and not just students, as has primarily been the case in the past. These findings on teachers' perceptions can significantly affect policymaking and practices when streamlining STEAM education in Azerbaijani schools. Schools can successfully provide quality STEAM education if they properly understand the perceptions and beliefs of teachers toward STEAM development. Teachers play a crucial role in student talent development because their experience and prior views influence the delivery of STEAM education.

Regarding the factors related to the implementation of STEAM, work experience and location (where educators came from) significantly impacted the outcome variable. Specifically, perceptions were significantly influenced by ($p = 0.025$), location ($p < 0.05$), and years of workplace experience ($p > 0.05$). The findings revealed that there were differences between men and women when it came to the implementation of STEAM ($p > 0.05$). Evidence from extant studies supports these findings (Balta et al., 2023; Japashov et al., 2022) and is inconsistent with the findings of other investigations (Yerdelen et al., 2016). For instance, Japashov et al. (2022) established that rural students showed the highest level of interest in STEAM, whereas city students studying at private schools

showed the lowest. On the contrary, findings in the research by Yerdelen et al. (2016) showed that gender does not influence students' perceptions of STEAM education implementation in schools.

Next, the study examined the barriers and challenges in implementing STEAM education in Azerbaijani schools from teachers' perspectives. The findings suggested that the limited availability of resources, such as equipment, was the most significant barrier, with 42% of the participants highlighting this problem. Similarly, inadequate teacher training and opportunities for professional development, curriculum constraints and time limitations, insufficient support from the school administration, and a lack of collaboration and interdisciplinary coordination among teachers were also significant barriers to STEAM implementation in Azerbaijani schools. These findings were supported by those of previous investigations, including Alghamdi (2023) and Nepeina et al. (2020), which highlight the role of training and the availability of resources and how their absence can be a significant barrier to the adoption and implementation of STEAM. Therefore, schools and various stakeholders in the education sector in Azerbaijan should seek to equip and empower teachers in a way that can enable them to overcome myriad barriers and contribute to optimally realizing STEAM goals.

Finally, this study aimed to explore the benefits of STEAM and suggest ways to improve its implementation. The collected evidence was consistent with those of extant investigations in which STEAM has been linked to enhancing 21st-century skills, such as leadership, effective communication, and problem-solving (Chaya, 2023; Madani, 2020). In this study, the key benefits of STEAM that emerged included its facilitation of critical thinking and problem-solving skills, interdisciplinary connections between subjects, stimulation of creativity and innovation, enhancement of student motivation and engagement, and preparation of learners for future career opportunities. These benefits illustrate the need for various stakeholders in Azerbaijani's education sector to devise effective strategies for implementing this approach.

Strengths and limitations

This study has several limitations that may have negative implications for the applicability of the findings. The major limitation is related to the challenges of operationalizing the variables because of the need for validated tools and instruments to measure various variables, including teachers' attitudes and opinions toward STEAM. In addition, the sample of 192 teachers was small and had implications for the generalizability of the findings. Future research on this subject could improve the findings and overcome the limitations of the present study by ensuring a large sample size and adopting robust instruments for data collection and analysis.

4. CONCLUSİON AND RECOMMENDATİONS

This study examined the attitudes and perceptions of teachers toward STEAM in Azerbaijani schools, including the barriers and challenges they face, and their suggestions for improving their practices. Through quantitative survey research, it was established that Azerbaijani teachers generally perceive the implementation of STEAM education in schools positively. However, Azerbaijani teachers' attitudes toward STEAM implementation and its success are influenced by several factors, including years of work experience, gender, and location. These teachers face myriad barriers, including limited resource availability, lack of teacher training and professional development opportunities, curriculum constraints and time limitations, insufficient support from school administrators or stakeholders, and a lack of collaboration and interdisciplinary coordination among teachers.

Despite these challenges, the benefits of STEAM implementation include encouraging critical thinking and problem-solving skills, stimulating creativity and innovation, fostering interdisciplinary connections between subjects, enhancing student engagement and motivation, preparing students for future career opportunities, and justifying their adoption in Azerbaijani schools. Teachers should be well-trained, supported, and supplied with all the necessary resources and equipment to successfully implement and realize the benefits of STEAM in Azerbaijani schools.

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Declaration of interest statement

The authors report that there are no competing interests to declare. The research is conducted impartially, without any financial or

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Data availability statement

There is no associated dataset for the results or analyses presented in this paper.

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Appendices

Table 1. Demographic Characteristics of the Participants

		N	Percentage
Gender	Male	15	7.81%
	Female	177	92.19%
Location	Rural areas	94	48.96%
	City (urban)	98	51.04%
Work experience	1–5 Years	32	16.67%
	6–10 Years	37	19.27%
	11–20 Years	58	30.21%
	Over 20 Years	65	33.85%

Table 2. Paired Two Samples for Means t-test

t-Test: Paired Two Sample for Means		
	Pop.	*Sample*
Mean	1.5	1.42188
Variance	0	0.18955
Observations	192	192
Hypothesized Mean Difference	1.5	
Df	191	
t Stat	-45.253866	
P(T<=t) one-tail	2.45E-104	
t Critical one-tail	1.65287055	
t Critical two-tail	1.97246199	

Table 3. Multiple Linear Regression Results (n = 192)

ANOVA								
	df	*SS*	*MS*	*F*	*Sig*			
Regression	3	3.724306	1.2414	7.1859	0.000136			
Residual	188	32.47882	0.1727					
Total	191	36.20313						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*

Intercept	1.186153	0.173024	6.8554	9.91E-11	0.844836	1.5275	0.844836	1.527471
Gender	-0.2562	0.113111	-2.2650	0.0247	-0.47933	-0.03307	-0.47933	-0.03307
Work Experience	0.0955	0.028344	3.3697	0.0009	0.039598	0.1514	0.039598	0.151426
Location	0.1640	0.060939	2.6913	0.0078	0.043795	0.2842	0.043795	0.284219

Table 4. The Perception of Teachers about the Main Benefits of Implementing STEAM in Azerbaijani Schools

Benefits of STEAM	***Number of teachers who support***
Encourage critical thinking and problem-solving skills	74
Stimulates creativity and innovation	52
Fosters interdisciplinary connections between subjects	21
Enhances student's engagement and motivation	24
Prepares students for future career opportunities	21

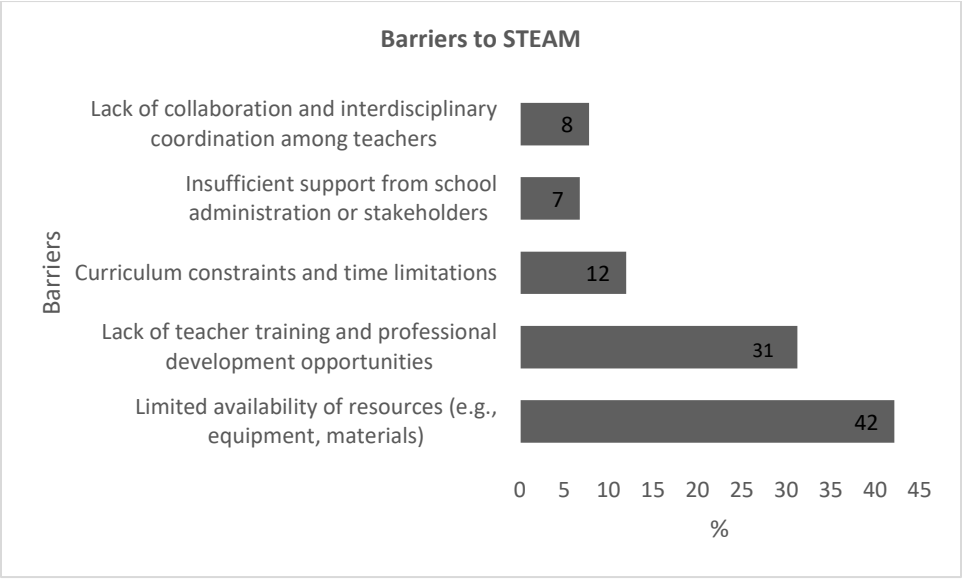


Figure 1. The Perception of Azerbaijani Teachers about the Significant Barriers to STEAM Education in Schools

Tables

Table 1. Demographic Characteristics of the Participants

	N	**Percentage**

Gender	Male	15	7.81%
	Female	177	92.19%
Location	Rural areas	94	48.96%
	City (urban)	98	51.04%
Work experience	1–10 Years	69	35.94%
	11–20 Years	58	30.21%
	Over 20 Years	65	33.85%

Table 2. Perceptions of Teachers Regarding STEAM Education

Scale	N	Min.	Mak.	ss	X	X/K	level
STEAM Perception	192	5	15	1.97	10.88	1.55	low

Table 3. The difference in STEAM perception levels based on gender

Groups	N	Mean Rank	Sum of Ranks	U	P
Female	117	94.67	16756.5	1003.5	.109
Male	15	118.1	1771.5		

Table 4. The variation in STEAM perception levels based on the places of residence of teachers

Groups	N	X	ss	sd	t	p
Rural areas	94	10.47	2.13	190	2.841	.005
City (urban)	98	11.47	1.74			

Table 5. The variation in STEAM perception levels based on teachers' professional experience durations

	Sum of Squares	df	Mean Square	F	p	Difference
Between Groups	39.829	2	19.914	5.319	0.006	0–10 years and
Within Groups	707.65	189	3.744			above 20
Total	747.479	191				

Figures

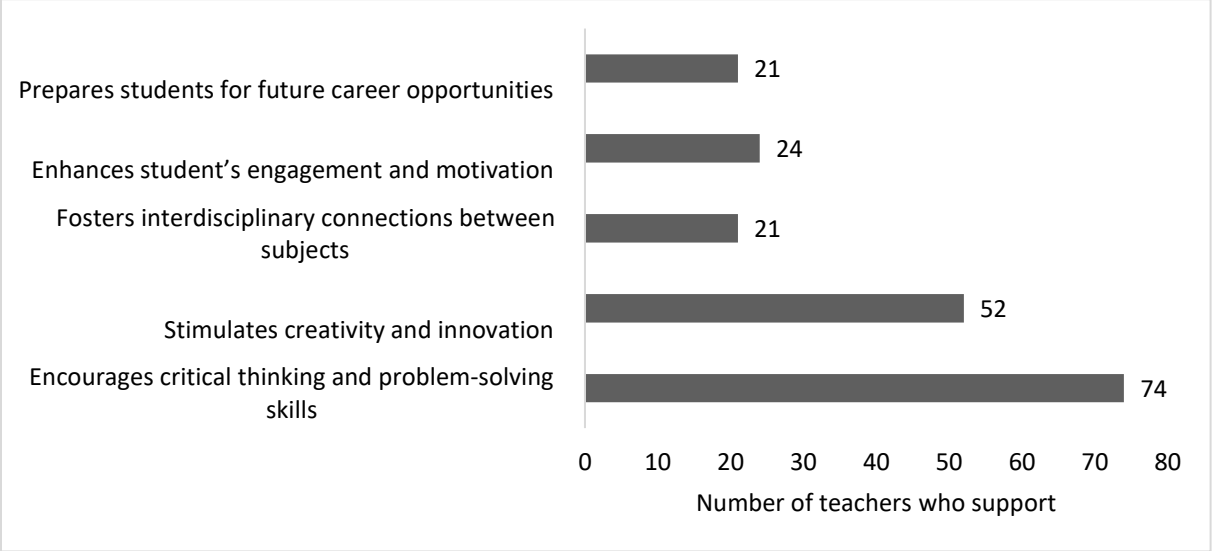


Figure 1. The Perception of Teachers about the Main Benefits of Implementing STEAM in Azerbaijani Schools

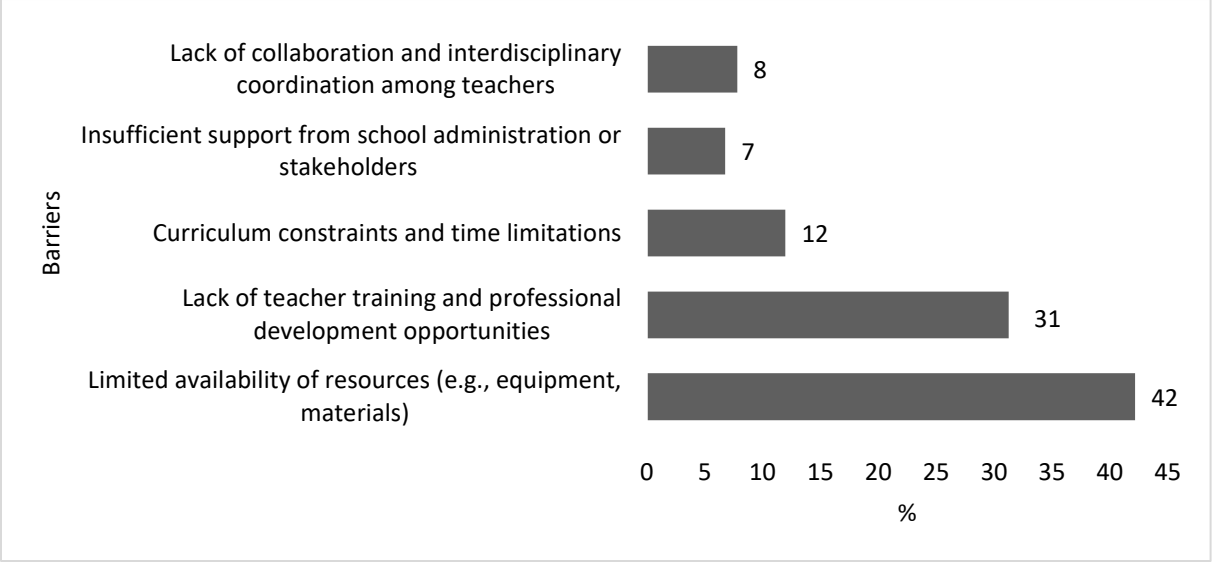


Figure 2. The Perception of Azerbaijani Teachers about the Significant Barriers to STEAM Education in Schools

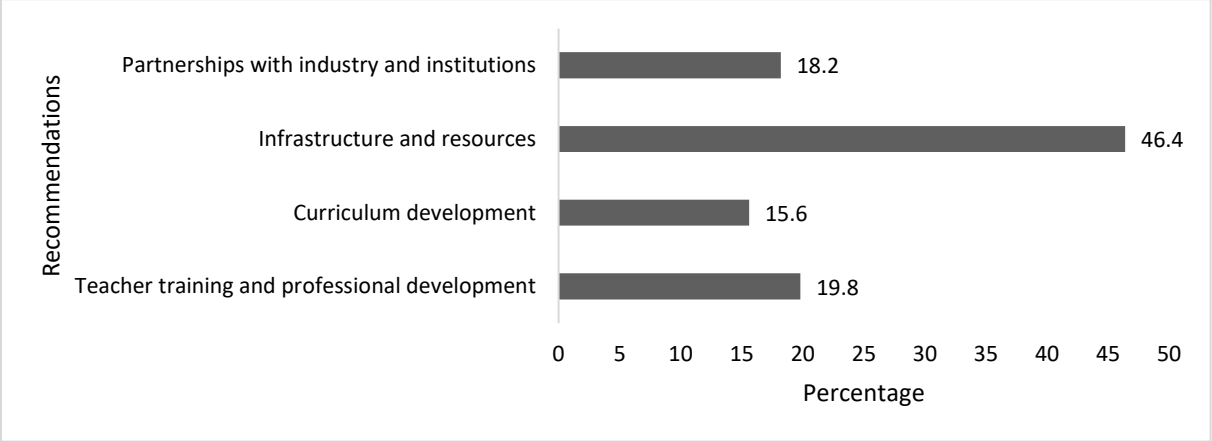


Figure 3. The Recommendations of Azerbaijani Teachers on Integrating and Enhancing STEAM Education

Figure Caption List

1) Figure 1. The Perception of Teachers about the Main Benefits of Implementing STEAM in Azerbaijani Schools
2) Figure 2. The Perception of Azerbaijani Teachers about the Significant Barriers to STEAM Education in Schools
3) Figure 3. The Recommendations of Azerbaijani Teachers on Integrating and Enhancing STEAM Education