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Determinants of Students' Problem-Solving Ability across Diverse Communities: Evidence from the Mapping the Terrain Survey

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Abstract

Students' problem-solving ability (PSA) is important in both school and daily life, making it essential to understand and identify the factors that influence its development. This study aims to examine the prevalence and determinants of PSA among secondary and higher secondary students in Muslim societies. This study used data from the Advancing Education in Muslim Societies: Mapping the Terrain 2019-2020 project. The PSA status was treated as the response variable, while socio-demographic factors were analyzed as predictors. To achieve the study's objectives, both bivariate and multivariate statistical methods were utilized to analyze the data. The bivariate analysis revealed a significant relationship between PSA and various socio-demographic factors, including religion, type of school, academic grades, and country of residence. Notably, Muslim students demonstrated higher PSA than Christian and Buddhist students but lower than Hindu students. Students attending private schools showed the higher PSA compared to their public-school counterparts. Furthermore, PSA tended to decline with increasing age and higher grade levels. Socio-demographic factors significantly influenced students' PSA in the Muslim Societies Mapping Terrain. The study recommends introducing an age-based, problem-oriented learning approach to enhance PSA, especially for private school and Muslim students. These findings can guide the development of comprehensive programs to improve PSA among students in Muslim societies.

Keywords: Problem-solving ability; Socio-demographic factors; Problem-oriented learning approach; Muslim societies.

AMS Classification: Primary 62P25; Secondary 62J05, 62H15, 97C70.

1. Introduction

Human beings need to maintain cooperation and stay connected with friends, family, and colleagues to lead a hassle-free daily life, which strengthens existing bonds. However, as society

and technology advance, people face increasing complexity and a variety of problems. These problems can be classified into two main categories: close-ended, which have straightforward solutions, and open-ended, which have multiple solutions processes and are more challenging to solve. Problem-solving ability (PSA) is a fundamental skill everyone should possess to navigate the complexities of modern life. It involves cognitive processes for finding means to achieve goals [27] and depends on the ability to compile and process information [20]. For students, the PSA is an important skill that involves using both analytical and creative thinking to make decisions. They can enhance their PSA through various techniques such as teamwork, creativity, resilience, emotional intelligence, analysis, and communication. It is an essential competency for school students, enabling them to solve diverse problems in dynamic educational settings. Problem-solving involves recognizing the gap between the current state and the desired goal state, and overcoming obstacles to reach that goal [24]. Developing PSA through judgment and critical thinking is important in education [25]. It is a cognitive-affective-behavioral process by which people attempt to resolve real-life problems in a social environment. Students may develop their PSA through effort, appropriate teaching methods, and approaches [31]. Again, teaching social PSA to students enhances their knowledge, peer acceptance, empathy, and positive expectations related to PSA and behaviors [23]. Despite their importance, problem-solving skills are frequently underemphasized in educational settings, and in certain subjects, they are entirely absent from the curriculum. With the right support and resources, students can develop these skills and become more confident and capable problem-solvers.

Numerous studies have shown that PSA, either independently or in combination, can reduce or minimize the impact of life stress on individuals [14-17]. Various factors can influence students' PSA. According to Beaver [4], problem solvers should incorporate certain attitudes into their problem-solving efforts. Confidence and self-perception also play a role in successful problem-solving [12]. Students' attitudes toward problem-solving are evaluated based on their independence, hard work, discipline, cooperation, and communication [19]. The researchers have identified several factors associated with poor PSA, including ineffective instruction [35], lack of linguistic knowledge [5], reading difficulties in word recognition [18], poor reading comprehension [1], and challenges in decoding problems [33]. Although students' PSA is multifactorial, existing research has mostly focused on a limited number of factors. This emphasizes the need for further studies incorporating multidimensional factors to help researchers and policymakers better understand the current status of students' PSA and the factors that influence it. Therefore, the specific objectives of this study are to explore the prevalence of PSA among secondary and higher secondary school students by socio-demographic factors, and to determine the factors associated with PSA among these students in Muslim societies.

2. Data and Methods

Data: This cross-sectional study used data from 'The Advancing Education in Muslim Societies (AEMS): Mapping the Terrain Survey' which was conducted in 15 Muslim-majority communities around the world in 2019-2020 [29]. The AEMS is an umbrella initiative of the International Institute of Islamic Thought (IIIT), a premier international organization focused on providing a platform for the unique perspective of Muslim thinkers, scholars, and practitioners in the humanities and social sciences. In this survey, the data were collected from four distinct groups of respondents: secondary and higher secondary school students (n_1=11,391), school teachers (secondary and higher secondary) (n_2=2,218), university students (n_3=4,399), and university instructors (n_4=593). This study focused exclusively on data from secondary and higher secondary

school students. After carefully cleaning the data set, a final sample of 8,773 school students was used for this analysis.

Methods: The AEMS survey used the Youth Life Skills Evaluation scale [28] to measure students' PSA. This scale is a tool used to measure improvements in life skills among disadvantaged children aged 15-24 years old. The actual value was obtained from 4-points Likert Scale data for each respondent by summing the responses (1: Never, 2: Sometimes, 3: Often, 4: Always) for 12 items with maximum (48) and minimum (12) values. A unit-free index (ranging from 0 to 1) for PSA is constructed as:

$$\text{Dimension Index (DI)} = \frac{\text{Actual value} - \text{Minimum value}}{\text{Maximum value} - \text{Minimum value}}.$$

The individual DI score is divided into two parts considering the median score of DI (0.722) as a cutoff point. These estimated scores were then recorded as a binary variable with categories labelled 'lower PSA' (less than the median value, coded '0') and 'higher PSA' (greater than and equal to the median value, coded '1'), which is considered as a dependent variable (y). Respondents' age, sex, religion, school type, academic grade level, and country of the school students are treated as factors. For details the classification and coding of the variables are presented in Table 1.

Table 1: Coding for different variables with their indicators

Selected variables	**Coding**
Dependent variable	
Problem solving ability (PSA) status (y)	Lower PSA (DI<0.722): 0; Higher PSA (DI>0.722): 1
Independent variables	
Age (in years) (x_1)	<18:1; 18-24: 2
Sex (x_2)	Female: 1, Male: 2
Religion (x_3)	Muslim: 1, Christian: 2, Buddhist: 3, Hindu: 4
Type of schools (x_4)	Private: 1, Public: 2
Academic grades (x_5)	Grade 8: 1, Grade 9: 2, Grade 10: 3, Grade 11: 4, Grade 12: 5
Country (x_6)	Bosnia: 1, Indonesia: 2, Jordan: 3, Kyrgyzstan: 4, Morocco: 5, Tanzania: 6, Tatarstan: 7, Bangladesh: 8, Algeria: 9, India: 10, Kenya: 11, Mauritius: 12, Sudan: 13, Malaysia:14, USA: 15

Statistical analyses: The study employed univariate analysis- descriptive statistics and frequency distributions to depict the characteristics of the participants. Cronbach's α was used in Likert scale data to measure the internal consistency or reliability of the scale [20]. A bivariate analysis-correlation analysis among the items of PSA was used to quantify the degree to which the items of PSA are related. The Chi square (χ^2) test- a bivariate analysis was employed to ascertain the association between PSA and socio-demographic factors of the respondents. In multivariate analysis, the binary logistic regression model was used to identify the socio-demographic determinants of PSA.

The multi-collinearity between each explanatory variable in the regression model was checked by examining the standard error (SE) for the regression coefficients (β_i). However, there is no exact method to detect the multicollinearity problem in logistic regression analysis. This study used the magnitude of SE to detect it. If the magnitude of SE lies between 0.001 and 0.50, it can be considered as no evidence of a multi-collinearity problem [7]. The magnitudes of SE were found to lie between the accepted ranges, indicating an absence of a multi-collinearity problem. Statistical

significance was accepted at p<0.05. The results of regression analysis were presented by odds ratios (ORs) with a 95% confidence interval (CI). The ORs quantify the likelihood of the outcome variable (PSA) occurring relative to a reference category. An OR greater than 1 indicates higher odds of the outcome occurring, while an OR less than 1 indicates lower odds.

The model summary provides information about the goodness-of-fit of the logistic regression model. Model fitness was checked using Hosmer-Lemeshow goodness of fit test ($p > 0.05$) [22]. The -2Log likelihood (-2LL), Cox & Snell R^2, and Nagelkerke R^2 values help evaluate how well the model fits the data, with higher values indicating better fit [13]. The receiver operating characteristic curve (ROC) was also used to determine the cut off scores for independent predictors of the lower vs. higher PSA of school students. The accuracy of significant predictors was determined within the area under the ROC (AUC). All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 26.0 (SPSS Inc., Chicago, IL, USA).

3. Results

This cross-sectional study included 8,773 secondary school students from 15 Muslim-majority communities and districts. Problem-solving skills are closely linked to students' attitudes. Generally, students develop PSA based on their attitudes toward problem-solving, which can vary significantly among individuals. The following subsections present the background characteristics of the respondents, their attitudes toward PSA, inter-item correlations, associations between PSA and socio-demographic factors, and the determinants of PSA.

Background characteristics of the respondents

Table 2 presents descriptive statistics about the respondents' ages, sexes, religions, academic grades, school types, countries, and PSA status. This study identified that, around 90.1% of the respondents were under the age of 18, with 58.6% being female, 89.3% identifying as Muslim, 54.7% enrolled in public schools, 30.4% in Grade 10, 21.5% residing in India, and 51.5% demonstrating higher PSA.

Table 2: Background characteristics of the respondents

Variables	Categories	Frequency, *n*	Percentage (%)
Age (in years)	<18	7903	90.1
	18-24	870	9.9
Sex	Female	5138	58.6
	Male	3635	41.4
Religion	Muslim	7837	89.3
	Christian	577	6.6
	Buddhist	166	1.9
	Hindu	193	2.2
Type of schools	Private	3976	45.3
	Public	4797	54.7
Academic grades	Grade 8	102	1.2
	Grade 9	1695	19.3
	Grade 10	2667	30.4
	Grade 11	2605	29.7
	Grade 12	1704	19.4
Country	Bosnia	714	8.1
	Indonesia	332	3.8
	Jordan	418	4.8
	Kyrgyzstan	687	7.8
	Morocco	323	3.7

	Tanzania	636	7.2
	Tatarstan	371	4.2
	Bangladesh	677	7.7
	Algeria	457	5.2
	India	1890	21.5
	Kenya	441	5.0
	Mauritius	411	4.7
	Sudan	374	4.3
	Malaysia	819)	9.3
	USA	223	2.5
Problem solving ability status	Lower ability	4259	48.5
	Higher ability	4514	51.5
	Total, *N*	8,773	100.0

Attitudes toward problem-solving among students

Table 3 shows the background characteristics of students' attitudes toward PSA. Notably, all students consistently exhibited a positive attitude towards problem-solving tasks. The overall mean and standard deviation (SD) of students' attitudes towards problem-solving were 3.118 and 0.866, respectively, indicating consistently positive attitudes on a 4-point Likert scale, with a Cronbach's α of 0.787, which suggested a moderate to high level of internal consistency among the items. It indicated that they are relatively well-correlated and likely measure the same underlying construct. However, the reliability of the scale could be further improved by refining the items or increasing the sample size.

Table 3: Attitudes toward problem-solving among school students, $N = 8{,}773$.

Items	Never	Sometimes	Often	Always	Mean ± SD	Description
1. I think of possible results before I act	534	1762	2781	3696	3.15± 0.930	Always
2. I develop ideas by gathering information	283	1449	3202	3839	3.21±0.830	Always
3. When facing a problem, I identify options	305	1759	3406	3303	3.11±0.840	Always
4. I can easily express my thoughts	522	2443	3233	2575	2.90±0.894	Often
5. I am able to give reasons for my opinions	312	1885	3082	3494	3.11±0.862	Always
6. Important to get information to support my opinions	281	1379	3034	4079	3.24±0.831	Always
7. Usually have more than one source of information	349	2143	3206	3075	3.03±0.868	Always
8. I plan how to get information on a topic	481	2005	3127	3160	3.02±0.899	Always
9. I support my decisions by the information I get	279	1593	3324	3577	3.16±0.831	Always
10. I listen to ideas of others even if disagree	534	1762	2781	3696	3.10±0.925	Always
11. I compare ideas when thinking of a topic	329	1586	3521	3337	3.12±0.834	Always
12. I keep my mind open to different ideas when planning to decide	303	1334	2820	4316	3.27±0.842	Always
Overall mean					3.118±0.866	Always
Cronbach's *α*					0.787	Acceptable

Note: 'SD, standard deviation'

Results of bivariate analysis

Inter-item correlations were employed to examine the relationships among individual items within a scale or test. These correlations are important for assessing the internal structure, reliability, and validity of scales and tests, providing essential information for their development, refinement, and validation. Table 4 presents the results of the inter-item correlations, where correlations among the 12 items ranged from 0.119 to 0.327. These findings suggest that while the items are reasonably homogenous, they also capture sufficiently unique variance to avoid redundancy with each other. The significance level typically used to determine whether a correlation coefficient differs significantly from zero is not applicable in the context of inter-item correlation. Unlike hypothesis testing, inter-item correlation aims to evaluate the degree of association between items [10]. Therefore, significance levels are not used for inter-item correlations.

Table 4: Inter items correlations

Items	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}	I_{11}	I_{12}
I_1	1											
I_2	.284	1										
I_3	.251	.268	1									
I_4	.126	.188	.208	1								
I_5	.190	.219	.238	.315	1							
I_6	.222	.301	.213	.199	.259	1						
I_7	.205	.255	.266	.202	.255	.276	1					
I_8	.257	.327	.246	.196	.229	.299	.300	1				
I_9	.233	.288	.235	.191	.250	.306	.287	.347	1			
I_{10}	.168	.148	.167	.119	.162	.175	.183	.169	.211	1		
I_{11}	.218	.243	.255	.214	.215	.250	.244	.257	.266	.239	1	
I_{12}	.220	.277	.232	.219	.261	.268	.252	.298	.277	.235	.315	1

Note: 'I_1: I think of possible results before I act', 'I_2: I develop ideas by gathering information', 'I_3: When facing a problem, I identify options', 'I_4: I can easily express my thoughts', 'I_5: I am able to give reasons for my opinions', 'I_6: Important to get information to support my opinions', 'I_7: Usually have more than one source of information', 'I_8: I plan how to get information on a topic', 'I_9: I support my decisions by the information I get', 'I_{10}: I listen to ideas of others even if disagree', 'I_{11}: I compare ideas when thinking of a topic', 'I_{12}: I keep my mind open to different ideas when planning to decide'

Table 5 presents the results regarding students' PSA levels and their associated socio-demographic factors. Among the students surveyed, 48.5% exhibited lower PSA, while 51.5% demonstrated higher PSA. Significant differences in PSA were observed across different student groups. The bivariate analysis (χ^2- test) identified significant associations (p<0.05) between PSA levels (lower vs. higher) and socio-demographic factors such as religion, type of school, academic grades, and country of residence.

Table 5: Association between socio-demographic factors and problem-solving ability of the school students ($N = 8{,}773$).

		Problem-solving ability types			
Variables	**Categories**	**Lower, *n* (%)**	**Higher, *n* (%)**	**Total, *n* (%)**	***p*- values**
Age (in years)	<18	3848 (48.7)	4055 (51.3)	7903 (90.1)	0.417
	18-24	411 (47.2)	459 (52.8)	870 (9.9)	
Sex	Female	2474 (48.2)	2664 (51.8)	5138 (58.6)	0.378
	Male	1785 (49.1)	1850 (50.9)	3635 (41.4)	
Religion	Muslim	3724 (47.5)	4113 (52.5)	7837 (89.3)	0.000
	Christian	318 (55.1)	259 (44.9)	577 (6.6)	
	Buddhist	126 (75.9)	40 (24.1)	166 (1.9)	
	Hindu	91 (47.2)	102 (52.8)	193 (2.2)	

Type of schools	Private	1806 (45.4)	2170 (54.6)	3976 (45.3)	0.000
	Public	2453 (51.1)	2344 (48.9)	4797 (54.7)	
Academic grades	Grade 8	34 (33.3)	68 (66.7)	102 (1.2)	0.001
	Grade 9	848 (50.0)	847 (50.0)	1695 (19.3)	
	Grade 10	1279 (48.0)	1388 (52.0)	2667 (30.4)	
	Grade 11	1315 (50.5)	1290 (49.5)	2605 (29.7)	
	Grade 12	783(46.0)	921 (54.0)	1704 (19.4)	
Country	Bosnia	354 (49.6)	360 (50.4)	714 (8.1)	0.000
	Indonesia	190 (57.2)	142 (42.8)	332 (3.8)	
	Jordan	229 (54.8)	189 (45.2)	418 (4.8)	
	Kyrgyzstan	352 (51.2)	335 (48.8)	687 (7.8)	
	Morocco	175 (54.2)	148 (45.8)	323 (3.7)	
	Tanzania	290 (45.6)	346 (54.4)	636 (7.2)	
	Tatarstan	223 (60.1)	148 (39.9)	371 (4.2)	
	Bangladesh	225 (33.2)	452 (66.8)	677 (7.7)	
	Algeria	174 (38.1)	283 (61.9)	457 (5.2)	
	India	787 (41.6)	1103 (58.4)	1890 (21.5)	
	Kenya	165 (37.4)	276 (62.6)	441 (5.0)	
	Mauritius	267 (65.0)	144 (35.0)	411 (4.7)	
	Sudan	115 (30.7)	259 (69.3)	374 (4.3)	
	Malaysia	578 (70.6)	241 (29.4)	819 (9.3)	
	USA	135 (60.5)	88 (39.5)	223 (2.5)	
	Total	4259 (48.5)	4514 (51.5)	8773 (100.0)	

Results of multivariate analysis

The results of a binary logistic regression analysis presented in Table 5 examining the association between various demographic characteristics (age, sex, religion, type of school, academic grades, and country) and PSA status among secondary school students. This analysis provides insights into which demographic characteristics are associated with differences in the likelihood of experiencing PSA. The binary logistic regression model constructed in this study effectively examined the associations between demographic characteristics and PSA among secondary school students, providing valuable insights into factors influencing PSA in educational settings.

Students aged 18-24 years showed a statistically significant lower odds ratio (OR: 0.822, $p < 0.021$, 95% CI: 0.696-0.971) of PSA compared to those under 18 years, indicating a 17.8% decrease in the odds of PSA for this age group. There was no statistically significant difference in the odds of PSA between males and females ($p < 0.414$). Compared to Muslims (reference category), Christians had lower odds (OR: 0.723, $p < 0.001$, 95% CI: 0.593-0.881), Buddhists had lower odds (OR: 0.666, $p < 0.042$, 95% CI: 0.450-0.985), and Hindus had higher odds (OR: 1.656, $p < 0.002$, 95% CI: 1.199-2.287) of PSA. Hindus had 1.656 times higher odds of experiencing PSA compared to Muslims. Participants attending public schools had lower odds of PSA compared to those attending private schools (OR: 0.848, $p < 0.030$, 95% CI: 0.731-0.984). Grade 9 students had lower odds of PSA compared to Grade 8 students (OR: 0.616, $p < 0.030$, 95% CI: 0.398-0.955), indicating that Grade 9 students had 0.616 times the odds of PSA compared to Grade 8 students. Several countries showed statistically significant differences in the odds of PSA compared to Bosnia (reference category). Participants from Bangladesh, Algeria, Kenya, Sudan, and the United States of America (USA) had higher odds of PSA, while those from Mauritius and Malaysia had lower odds.

The model summary provided information on how well the logistic regression model fit the data and explained the variability in PSA. Various methods were employed to verify the model's results and assess its goodness of fit. The Hosmer-Lemeshow test yielded a χ^2 value of 5.406 with a significance level ($p > 0.05$), indicating a suitable fit for the logistic regression model. The Cox and Snell R^2 value was 0.304, suggesting that 30.4% of the variation in the dependent variable (PSA) was explained by the independent variables in the logistic model. Again, the Nagelkerke R^2 value was 0.405, indicating that 40.5% of the variation in PSA was explained by the model. The value of -2LL was 484.594, indicating a good fit of the model. The ROC curve demonstrated good

accuracy with an AUC value of 0.785 (95% CI: 0.743-0.828, $p < 0.000$), indicating that the logistic regression model performed well in predicting PSA (Fig. 1).

Table 6: Determination of factors using binary logistic regression analysis for problem-solving ability among school students.

Characteristics	Coefficient (β)	Odds ratio (OR)	p- values	95% C.I. for OR
Age (in years) (Ref.: <18)				
18-24	-0.195	0.822	0.021	0.696-0.971
Sex (Ref.: Female)				
Male	-0.037	0.964	0.414	0.882-1.053
Religion (Ref.: Muslim)				
Christian	-0.325	0.723	0.001	0.593-0.881
Buddhist	-0.407	0.666	0.042	0.450-0.985
Hindu	0.504	1.656	0.002	1.199-2.287
Type of schools (Ref.: Private)				
Public	-0.165	0.848	0.030	0.731-0.984
Academic grades (Ref.: Grade 8)				
Grade 9	-0.484	0.616	0.030	0.398-0.955
Grade 10	-0.275	0.760	0.217	0.491-1.175
Grade 11	-0.236	0.790	0.296	0.508-1.229
Grade 12	-0.261	0.770	0.255	0.491-1.208
Country (Ref.: Bosnia)				
Indonesia	-0.303	0.738	0.026	0.566-0.964
Jordan	-0.155	0.857	0.245	0.660-1.112
Kyrgyzstan	-0.151	0.860	0.254	0.663-1.115
Morocco	-0.173	0.841	0.211	0.641-1.103
Tanzania	0.120	1.128	0.335	0.883-1.440
Tatarstan	-0.228	0.796	0.102	0.606-1.046
Bangladesh	0.686	1.985	0.000	1.562- 2.523
Algeria	0.481	1.618	0.000	1.270-2.062
India	0.211	1.234	0.056	0.994-1.532
Kenya	0.730	2.076	0.000	1.585-2.717
Mauritius	-0.813	0.443	0.000	0.333-0.590
Sudan	0.789	2.201	0.000	1.671-2.899
Malaysia	-0.853	0.426	0.000	0.338-0.536
USA	-0.558	0.572	0.001	0.409-0.802

Model summary: -2Log likelihood=11644.609[a], Cox & Snell $R^2 = 0.056$, Nagelkerke $R^2 = 0.075$

Note: 'CI, confidence interval', 'a, Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

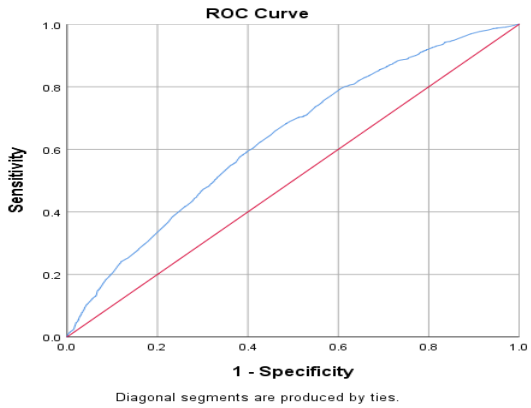

Fig. 1: The ROC curve plot of the sensitivity versus 1-specificity of a diagnostic test.

4. Discussion

The study findings demonstrate a statistically significant association between age and PSA, with younger students showing increased ability over older peers. Since, the younger students may exhibit more flexibility and creativity in problem-solving compared to older students, who might rely more on established patterns and solutions [16]. With age, students may become more rigid in their problem-solving approaches, relying on previously learned strategies rather than exploring new ones [3]. Despite generally positive attitudes towards problem-solving, Muslim students' exhibit lower problem-solving abilities compared to Hindu religion, but higher to Christian, and Buddhist peers. Social interaction exposes individuals to various challenges, fostering problem-solving skills. Children raised in Muslim cultures often have limited social opportunities due to conservative upbringing, impacting their PSA significantly. Building on prior researches [35-33], this study identifies socio-demographic factors associated with lower PSA among Muslim schoolchildren. Specifically, Muslim norms and cultural practices correlate with poorer PSA in this group. In this regard, several studies [21-6] argued that implementing problem-oriented learning approaches has proven effective in enhancing PSA among Muslim students. Educational institutions play a crucial role in fostering students' PSA, with significant variation observed across different school types [9]. This study identified that students in private schools are more capable of solving problems compared to those in public schools. In the private schools often have smaller class sizes, allowing for more individualized attention and tailored instruction, which can enhance problem-solving skills [8]. Compare to public schools, typically the private schools have better funding, providing access to more resources, advanced technology, and extracurricular activities that foster critical thinking and problem-solving [26], and often have the ability to hire more experienced and highly qualified teachers, who can implement effective problem-solving teaching strategies [2], usually have more flexibility in their curricula, allowing for innovative and creative problem-solving approaches that might not be present in public school settings [11]. Moreover, higher levels of parental involvement in private schools can lead to a more supportive learning environment, positively affecting students' problem-solving abilities [32]. Furthermore, the study reveals significant variations in PSA among students across different countries, influenced by distinct cultural and economic contexts [15, 34]. Students from Sudan, Kenya, Bangladesh, Algeria, and India demonstrate notably higher PSA compared to those from Bosnia and other studied countries.

5. Conclusions

This study explores the PSA among school students in Muslim societies, focusing on its development and related socio-demographic factors. It reveals significant associations between PSA and factors such as age, religion, school type, academic grades, and country of residence. Despite consistently positive attitudes towards problem-solving, Muslim students exhibit comparatively lower PSA than their Hindu peers, but higher than their Christian and Buddhist counterparts. Additionally, students in private schools demonstrate higher PSA compared to those in public schools. PSA levels decrease with age and higher grades of schooling. Again, this study identified variations in PSA among students across different countries. To enhance PSA in students within Muslim societies, educators and policymakers should implement targeted interventions to address socio-demographic disparities. Early emphasis on PSA, especially in public schools, and culturally relevant curricula can increase engagement. Continuous teacher development in interactive and problem-based learning techniques can further sustain and improve

PSA as students' progress. Collectively, these interventions may contribute to reducing disparities in PSA among various demographic segments.

Abbreviations: AEMS: The Advancing Education in Muslim Societies; AUC: Area under the ROC curve; CI: Confidence interval; DI: Dimension Index; IIIT: International Institute of Islamic Thought; OR: Odds ratio; PSA: Problem-solving ability; ROC: Receiver operating characteristic; SD: Standard deviation; SE: Standard error; USA: The United States of America; -2LL: -2Log likelihood

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Ethical approval statement: The data used in this study were obtained from secondary sources, and all necessary permissions and approvals were secured prior to their use. The authors have ensured that the data were used in accordance with ethical standards, including respecting the confidentiality and privacy of any individuals or entities represented in the data. No identifiable personal information was included in the analysis, and the data were handled in compliance with relevant ethical guidelines and regulations.

Author contributions: MNIM, MMR and MNP contributed to the study's conceptualization, developed the methodology, conducted data management, performed formal analysis, and interpreted the results. Additionally, MNIM and MMI wrote the article's first draft and reviewed and edited it. MMR and MH reviewed the article, provided supervision, and validated the research. All authors have read and agreed to the final version of the manuscript.

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