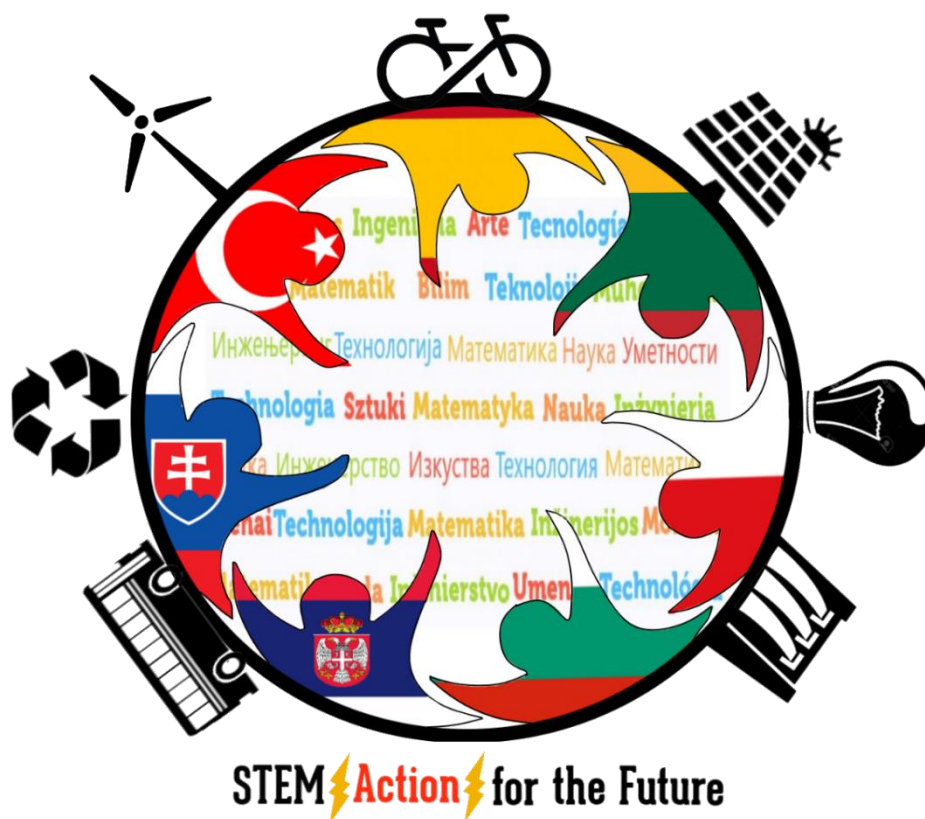




**“STEMAction for the Future”**  
2021-1-ES01-KA220-SCH-000029752

## STEM Attitude Scale for Students

### ANALYSIS & RESULTS



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## **INTRODUCTION**

In this report, we investigated the STEM attitudes of students who participated in and those who did not participate in the STEM trainings in C4 Lithuania, C5 Bulgaria, C6 Slovakia, C7 Turkiye and C8 Poland.

## **PROCEDURE**

A 33-item STEM Attitude Scale (see Appendix 1) was used to measure the effectiveness of STEM trainings. All items were 7-point Likert Style from 1 (Strongly Disagree) to 7 (Strongly agree).

The questionnaire was administered to students who had participated in the STEM trainings and to those who had not. It was administered after the trainings had concluded. A total of ten students (five of whom participated in the training and five of whom did not) were requested to complete the questionnaire from each partner school.

All analysis were conducted with SPSS. In order to evaluate the suitability of the data for analysis, first, common method bias and outliers were checked. Then, it was checked whether the data exhibited a normal distribution. Finally, reliability analysis was examined. We performed, internal consistency in order to determine the reliability of the scale. We also checked the assumption of equal variances. The Levene test was not significant. Besides the assumption of equal variances, if the data were normally distributed and reliable, independent t-test was conducted (Hair et al., 2010).

For common method bias, first we calculated the standard deviation of the answers of the participants. Fifteen questionnaires equal to zero standard deviation were excluded because of biased answers. Second, for outlier analysis,

mahalonobis distances were calculated. Significant mahalonobis distances were excluded from the analysis. For the normal distribution, third, skewness and kurtosis values were checked. All values were between -2 and +2, which mean that data distributed normally (Hair et al., 2010). Fourth, the common method bias test was carried out using Harman's single factor test. The result 35.92%, which is less than 50%. Hence, common method bias did not influence the results (Hufnagel and Conca, 1994). Finally, reliability was checked. Cronbach's alpha value was .94, which means that values are reliable (Hair et al., 2010).

## PARTICIPANTS

A total of 200 students participated in the study. However, valid 182 questionnaires were evaluated. Out of 182 students, 105 students (57.7%) participated in the trainings, whereas 77 students (42.3%) did not participate in. Most students were female (122; 67%) and the rest were male (60; 33%) students. 46 students were from Bulgaria (25.3%), 14 were from Lithuania (7.7%), 36 were from Polan (19.8%), 38 were Slovakia (20.9%), 29 were from Spain (15.9%), the other 19 were from Turkiye (10,4%).

## FINDINGS

The STEM attitudes of students who participated in and those who did not participate in the STEM trainings, were investigated through independent samples t-test.

Tablo 1. Comparison of the STEM attitudes of students

| Dependent Variable         | Independent Variable          | N   | M    | SD  | t    | DF  | p     | Cohen's d        |
|----------------------------|-------------------------------|-----|------|-----|------|-----|-------|------------------|
| STEM attitudes of students | Participated in trainings     | 105 | 5.28 | .92 | 4.19 | 180 | <.001 | .63<br>(.33-.93) |
|                            | Not participated in trainings | 77  | 4.72 | .87 |      |     |       |                  |

Students participated in STEM trainings had significantly higher STEM Attitude scores ( $M = 121$ ,  $SD = .92$ ) than did not those taking STEM trainings ( $M = 4.72$ ,  $SD = 4.72$ ),  $t(180) = 4.19$ ,  $p = <.001$ . The effect size, measured by Cohen's  $d$ , was  $d = 0.63$ , indicating a medium effect.

## **CONCLUSION**

We may conclude that STEM trainings conducted within the project have significant impact to gain students positive attitudes towards STEM field.

## **REFERENCES**

- Hair, J., Black, W. C., Babin, B. J. & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River, New Jersey: Pearson Educational International.
- Hufnagel, EM. & Conca, C. (1994). Users response data: the potential for errors and biases. *Inf Syst Res.*, 5(1), 48–73. doi:10.1287/isre.5.1.48

## Appendix 1. STEM Attitude Questionnaire

Dear Students,

In this questionnaire, you are expected to evaluate your own attitudes towards STEM. Read each statement and then choose that best answer that shows how you feel (1: strongly disagree, 7: strongly agree). For the success of our project, it is important that you answer each question sincerely. Thank you for your contribution.

STEMAction for the Future Project Team  
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### Voluntary Participation Consent

Participation in the questionnaire is completely voluntary. The answers will be kept completely confidential and evaluated only by the researchers. The data will only be used for scientific purposes and will not be shared with the third parties. The questionnaire does not contain questions and situations that may cause personal discomfort. However, if you feel uncomfortable with the questions or any other reason during participation, you can stop answering.

☐ I voluntarily participate in this study, and I accept the use of my answers for scientific purposes.

### Demographics

**Gender** : ☐ Female ☐ Male

**Mobility** : ☐ Participated ☐ Not participated

**Country:** .....

**Instructions: Select one level of agreement for each statement to indicate how you feel.**

| Items                                                                       | SD<br>1 | 2 | 3 | 4 | 5 | 6 | SA<br>7 |
|-----------------------------------------------------------------------------|---------|---|---|---|---|---|---------|
| 1. I enjoy participating in science-related activities.                     | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 2. I am interested in science course.                                       | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 3. I am curious about science.                                              | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 4. I enjoy working on science at home.                                      | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 5. Mathematical operations are enjoyable.                                   | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 6. I am interested in mathematics.                                          | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 7. Mathematics is a fun lesson.                                             | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 8. I'm interested in mathematics in extracurricular times.                  | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 9. I enjoy solving mathematical problems.                                   | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 10. I do mathematical activities in my spare time (puzzles, sudoku, etc.).  | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 11. When I have math homework, I can't wait to complete it.                 | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 12. I feel good when I deal with mathematics.                               | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 13. I like to design things.                                                | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 14. I like drawing a building, car, bridge, plane, etc.                     | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 15. I enjoy designing something in my free time.                            | 1       | 2 | 3 | 4 | 5 | 6 | 7       |
| 16. I would like to design a tool/product that will make human life easier. | 1       | 2 | 3 | 4 | 5 | 6 | 7       |

|                                                                                                                                                      |   |   |   |   |   |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|
| 17. I love to repair something at home.                                                                                                              | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. I am interested in designing a product/tool.                                                                                                     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19. I like to play with technological tools.                                                                                                         | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. I am interested in the technology.                                                                                                               | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. I like to deal with technology.                                                                                                                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22. I would like to have more courses on technology at school.                                                                                       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 23. I want more technology to be used during the course.                                                                                             | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24. I closely follow the latest innovations in technology.                                                                                           | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 25. Science, mathematics, engineering and technology are interrelated.                                                                               | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 26. Science, mathematics, technology, and engineering skills should be used together when inventing something.                                       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 27. Science, mathematics, technology and engineering fields complement each other.                                                                   | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 28. Science, mathematics, engineering and technology are very important in our life.                                                                 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 29. If I attend a course that combines science, mathematics, engineering, and technology skills, I may learn about my skills that I am not aware of. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 30. I would like to choose an engineering profession (machinery, mining, construction, architect etc.) in the future.                                | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 31. In the future, I would like to choose a profession related to science (physics, chemistry, biology, medicine, space, etc.).                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 32. In the future, I would like to have a job about the technology.                                                                                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 33. I would like to have a profession in the fields of science, mathematics, engineering, and technology so that I can be more beneficial to people. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |