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A STEM Model to Engage Students in Environmental Sustainability Program Through Problem-solving Approach- Case Study in Qatar

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ABSTRACT

- Environmental development was highlighted as one of the vision's four pillars following the launch of Qatar's national Vision 2030.
- The importance of developing people's awareness of their duty in maintaining the country's environment for future generations.
- Environmental education can be combined with various approaches, such as STEM and problem-solving skills, making it an excellent way to engage students in a sustainable program.
- A distinctive E-STEM program titled "Problem-Solving" (PS) was developed in Qatar amid regular educational reforms to improve primary school pupils' problem-solving abilities.
- During this study, 346 kids (202 females and 144 males) from 14 different public and private primary schools were given STEM workshops on environmental issues, encouraging them to develop solutions to the problem.
- The study used a mixed-method approach to measure program efficacy,
  - t-test statistical analysis
  - pre-and post-questionnaires
  - SWOT analysis

OBJECTIVES

The sole goal of the research was to familiarize participants with problem-solving abilities and their application in everyday life through tackling environmental concerns. The following are the research questions that will be addressed during our investigation:

1. Were the participants able to develop problem-solving abilities in order to solve challenges in their everyday lives?
2. Was the integration of collaborative problem-solving abilities with an E-STEM program successful due to the program design and content?
3. Will students in Qatar gain a better awareness of environmental challenges as a result of the program?
4. The research elicited excellent primary students' attitudes and self-efficacy in conducting scientific experiments.
5. To entice Qatari youngsters to complete the program's objectives, a rigorous, supportive learning environment based on environmental issues was established.
6. By using collaborative problem-solving skills as a framework in an E-STEM program, the project studied the numerous possibilities for students to improve scientific skills.

METHODOLOGY

Table 1 shows the demographics of the participants as well as the percentage of students. The overall number of participants during the two years program was 346.

Workshops	Number of Participants			
	M	%	F	%
W-1 Environmentally Friendly Challenge	28	35	52	65
W-2 Waste Challenge	43	37	73	63
W-3 Water Problems	25	35.2	46	64.8
W-4 Rise of Earth Temperature	48	60.8	31	39.2
Total	144	41.6	202	58.4

METHODOLOGY

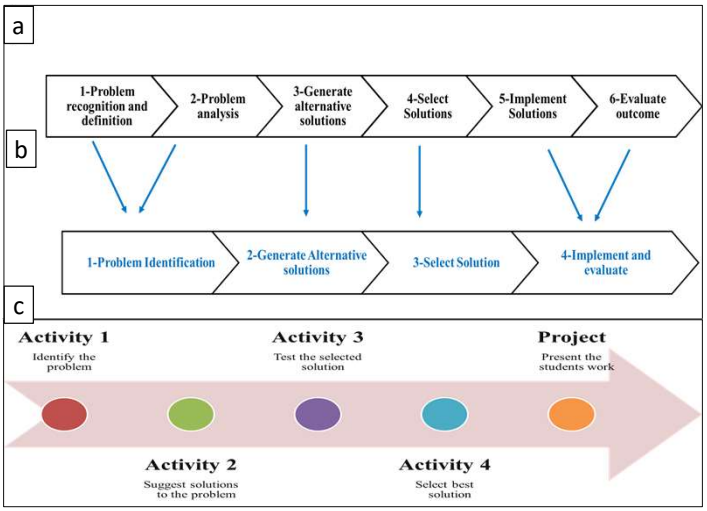

Figure 1: Schematic diagram of "Problem-solving" program methodology. a-Illustrates the Rational Problem-Solving Approach, proposed by John Dewey in 1910. b- the modified approach executed by the course facilitators. c- The activity layout is provided for all workshops, W-1, W-2, W-3, and W-4

RESULTS and DISCUSSION

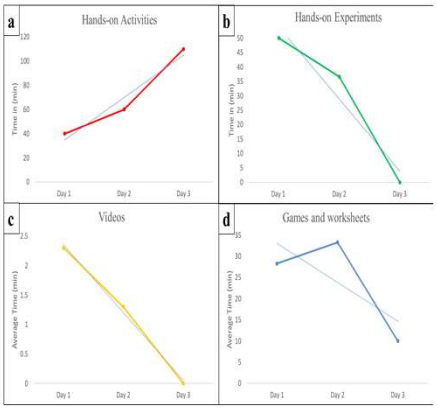

Figure 2: A diagram illustration of the duration of the various educational tools applied during each workshop. (a) Hands-on Activities (b) Hands-on experiments. (c) Videos. (d) Games and worksheets

Figure 3:Different design prototypes of W-1 and W-2.) recycled table from bottles and Styrofoam

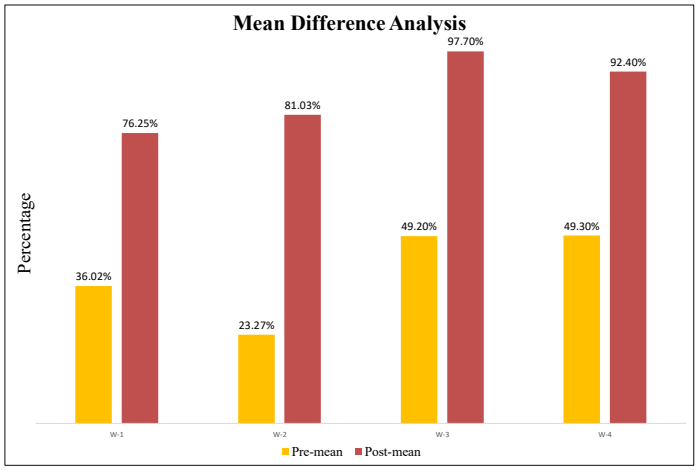

Figure 4: The comparison between the Pre-test and Post-test means the difference of students' population (n=346) over the program's two-year period. The Red and Green lines represent the pre-test mean and post-test mean percentage of the questionnaire analysis data collected from the two-year experiment. Again, the program proves to be effective in improving students' attitudes by a significant margin.

RESULTS and DISCUSSION

CONCLUSION

- The goal of the research was to create a unique curriculum that combined E-STEM learning with problem-solving.
- The increase in the students' problem-solving skills was interrupted by the statistical analysis results of pre-post surveys.
- The curriculum allowed for an extension by incorporating other workshops and examining new problems for which STEM knowledge and problem-solving talents may bring creative answers.
- Furthermore, adding a functional working prototype to the design project would help students visualize their ideas as an accurate model.
- Finally, a virtual platform might be used to implement this software. For example, during the COVID-19 pandemic in early 2020, we developed several virtual problem-solving seminars due to the COVID-19 situation.

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