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STEM-FOCUSED GREEN SERVICE LEARNING: ENHANCING INTERACTIVE LEARNING AND SUSTAINABILITY WITH INAQ

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Abstract

The STEM-Focused Green Service Learning: Enhancing Interactive Learning and Sustainability with INAQ program, themed "From Waste to Wealth: Creative Sustainability," represents a collaborative initiative between Universiti Sains Islam Malaysia (USIM) and Sekolah Kebangsaan Taman Tasik Jaya (STAJA), Seremban. This program integrates Naqli and Aqli Knowledge (INAQ) to promote students' engagement in science, technology, engineering, and mathematics (STEM) while nurturing environmental awareness and empathy through translational learning. The program objectives aimed to (i) strengthen students' understanding of the relationship between recycled materials and Qur'anic values, (ii) cultivate creativity and innovation in sustaining the environment aligned with the Sustainable Development Goals (SDGs), and (iii) increase interest in STEM learning through hands-on, service-based activities. A module comprising six sustainability-oriented activities—ranging from chalk making with eggshells to eco-friendly paper production—was developed and implemented with 139 school students. Post-program surveys were used to evaluate learning impact. Results showed significant improvement in knowledge recall (86.21%) and application (84.83%), with strong positive feedback (mean ≈87.5%) across all activities. Over 85% of participants demonstrated enhanced understanding of STEM concepts and their Qur'anic integration, while 56.55% expressed increased interest in STEM-related careers.

Keywords: STEM, SDG, INAQ, recycled materials, green service learning.

INTRODUCTION

The Malaysian government, in its effort to align with global standards and advance its innovation and development strategy (Liew & Teoh, 2022; Shahril Sabudin et al., 2018), has emphasized the importance of Science, Technology, Engineering, and Mathematics (STEM) education through policies like the National Scientific and Technology Enrolment Policy of 1970 and the Malaysia Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2013). These initiatives aim to maintain a 60:40 ratio of Science/Technical to Arts education, a policy that has been in place since 1967 (Sarala Thulasi Palpanadan & Venosha Ravana, 2022; Shahali et al., 2017).

However, despite numerous initiatives under the Malaysia Education Blueprint 2013–2025 (Ministry of Education Malaysia, 2013), STEM enrolment remains below the targeted 60:40 ratio, with recent reports indicating that upper secondary STEM participation is still under 45% (Lee, 2025; Nurul Asyikin Mohamed Radzi & Suhaila Sulaiman, 2018). This persistent shortfall poses a critical challenge to Malaysia's ambition of cultivating a future-ready workforce, particularly as the nation seeks to double its pool of engineers to 375,000 by 2030 to support high-tech industries and economic transformation (Putra, 2025). Addressing the lack of interest among students in STEM is therefore

critical to achieving the country's long-term objectives. The Malaysian Blueprint 2013-2025 aims to provide students with better knowledge and skills to meet the demands of a rapidly changing industrial world (Ministry of International Trade and Industry, 2017; Miller-Idriss & Hanauer, 2011).
Recently, the Ministry of Higher Education (MOHE) is concerned about the lack of student interest in STEM fields, which could affect the workforce needs in high-tech sectors. This concern is justified as data shows that only 22.8% of form four students are taking the science stream, with Sabah recording the lowest percentage at 12.35%. This has led to a decline in applications for STEM courses at the higher education level, which in turn reduces the number of graduates available for high-tech sectors (Rohaida Mohd Saat & Hidayah Mohd Fadzil, 2022).

Hence, to attract student interest in STEM, the MOHE also has implemented several initiatives. Among them is the MySTEM Ambassador program at higher education institutions (HEIs), which promotes STEM to school students. Additionally, MOHE supports the establishment of the National STI Talent Committee, which will analyze the demand and supply of talent in the fields of science, technology, and innovation (STI). Collaboration with the Ministry of Education Malaysia (MOE) is also crucial in efforts to increase student participation in STEM at the school level as preparation for entry into HEIs. These efforts are expected to boost student interest and participation in STEM fields, ensuring that the country does not face a shortage of talent to meet the needs of high-tech industries, such as Microsoft's investment in cloud infrastructure and artificial intelligence (AI) (Izwan Abdullah, 2024).

This approach is associated with the integration of knowledge, skills, and values of STEM education towards today's individual lifestyle, society, and environment. The dedicated module was designed for student-oriented activity where students must be able to explore and understand problem-solving issues related to the environment, especially recycling. Students' interest can become more synergetic with sustainability awareness and engaging problem-solving activities by thinking creatively and innovatively towards lifelong education, communication skills, and collaboration. Transformation in the education system is inevitable to sustain strong social engagement and spur investment in a country. The new frameworks of education will influence student's behavior, which will have an impact on their level of accomplishment and involvement. Malaysian commitment to Sustainable Development Goal 4 (SDG4), ensures inclusive and equitable education and promotes lifelong learning opportunities for all by 2030 (Mohamed Azmi Mohd Rasheed Khan, 2024; Wafry Khairul Ziad et al., 2021; Zaher Atwa et al., 2016).

Therefore, in response to government policies, students enrolled in the STREAM Mentoring Course at Universiti Sains Islam Malaysia (USIM) recognized the need to strengthen STEM education through the Integration of Naqli and Aqli Knowledge (INAQ). This approach is embodied in STREAM—Science, Technology, Religiosity, Engineering, Artistry, and Mathematics—which emphasizes the essential role of science in daily life while highlighting the harmony between scientific discoveries and Tauhidic values. To achieve these objectives, a SULAM programme was implemented that integrated the nature of science with Quranic perspectives to enhance students' interest in STREAM, while simultaneously promoting sustainability through recycling-based activities aimed at fostering environmental awareness. From an Islamic perspective, science is viewed as an exploration that leads humanity toward discovery while acknowledging the greatness of Allah SWT and adhering to Islamic principles (Zarkasih et al., 2019; Malak Abou Faour & Zalpha Ayoubi, 2018).

STREAM aims to strengthen students' awareness of the connection between scientific knowledge and the Quran in daily life while providing a holistic impact on the development of both scientific and Islamic knowledge through the Service Learning Malaysia – University for Society (SULAM) pedagogical approach. The primary goal of implementing the SULAM program is to ensure the achievement of academic course learning outcomes by engaging university students in organizing community service projects.

METHODOLOGY

This project was conducted through a STREAM mentoring module under the SULAM program, titled Innovative Eco-Friendly Science and INAQ. The module combined sustainability-focused activities, such as recycling projects, with hands-on science experiments. This integrated approach aimed to

incorporate STEM education with Tauhidic values while promoting environmental awareness, creativity, and active student engagement.

Innovative Eco-Friendly Science and INAQ Module Development

Thirty-five students enrolled in the STREAM Mentoring course, where the main requirement was the development of a STREAM module. The chosen theme for this module was "From Waste to Wealth: Creative Sustainability", with a focus on integrating content from the Secondary School Science Syllabus. The students were divided into six groups, each responsible for creating one of the six activities to be included in the module. Each group had the freedom to select and develop their activity, ensuring it aligned with both the recycling theme and the science syllabus. A series of discussions were held to finalize the activities and develop the module, which was titled 'Innovative Eco-Friendly Science and INAQ,' designed for secondary school students. The selected activities are summarized in Figure 1.

Figure 1: Innovative Eco-Friendly Science and INAQ Module

Studies on integrating the Quran with STEM, such as the Q-STEAM module (Muzakkir and Zulnaidi, 2024), show that embedding Quranic verses into science learning enhances students' conceptual understanding and spiritual awareness through hands-on activities and reflection. Meanwhile, a review on Islam's perspective on sustainability (Bsoul et al., 2022) highlights that values such as "*Amanah"* and the human role as khalifah provide a strong ethical foundation for environmental education. Together, these approcahes form an essential basis for the INAQ project, which integrates STEM learning, green community service activities, and Quranic reflection to cultivate students' knowledge, values, and sustainable actions. This combined approach addresses the current gap by uniting STEM pedagogy, sustainability, and Islamic values within a single experiential learning framework.

Engagement Session with the Target Community

At the phase of community engagement, all 35 students in the STREAM Mentoring course participated in a series of discussion sessions to identify the community they wanted to assist. Working in small groups, they determined the specific needs of the community. As a result of these discussions, Sekolah Kebangsaan Taman Tasik Jaya (STAJA) was selected as the target community. Subsequently, multiple

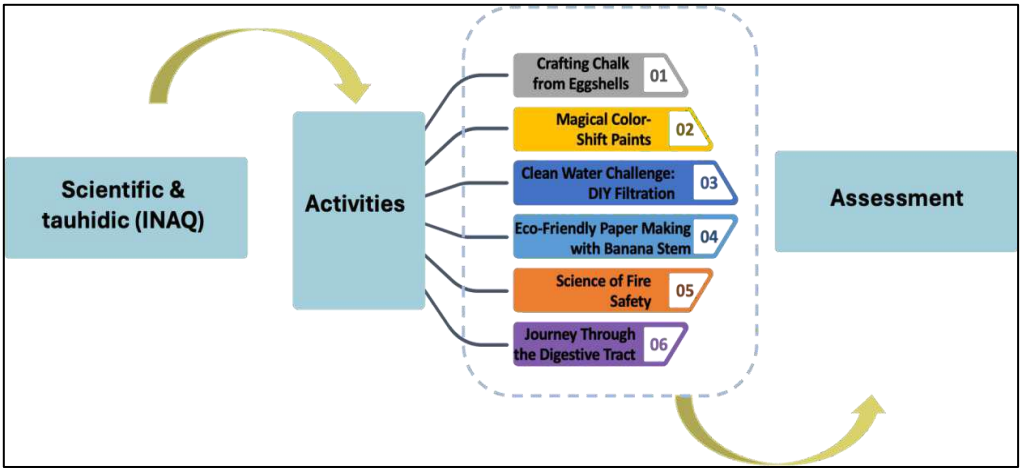
consultations were held with the school administration to reach a mutual agreement between the school and the STREAM Mentoring students.

Module Implementation

Innovative Eco-Friendly Science and INAQ" module was implemented at STAJA as part of an initiative led by students from the STREAM Mentoring course. This project aims to integrate environmental sustainability into the secondary school science curriculum. STAJA, selected as the target community through discussions and consultations, collaborated closely with the mentoring students to align the module with the school's educational objectives. The module was designed to engage students in practical science activities that explore the principles of recycling and eco-friendly practices.

The implementation was carried out in three phases: first, the introduction of the module, where educators (among STREAM Mentoring course students) from each activity provided a theoretical background and an overview of the modules and their objectives of activities developed to the school's students. This was followed by the hands-on phase, where school students participated in six different activities, each developed by the mentoring groups, to apply scientific concepts selected to real-world environmental issues by adapting Science syllabus. Each activity also explained the connection between scientific principles and tawhidic concepts within its development (Liza Nopita Sari & Putri Bintang, 2022; Siti Nurwanis Mohamed et al., 2020). The final phase involved evaluating the module's effectiveness through feedback and surveys from both students and teachers. This assessment focused on the students' understanding of sustainability and their ability to apply what they learned in practical contexts. The results of this evaluation will guide future improvements to the module and inform its potential expansion to other schools. The summary of implementation is presented in Figure 2.

Figure 2: Correlation between activities during implementation of module



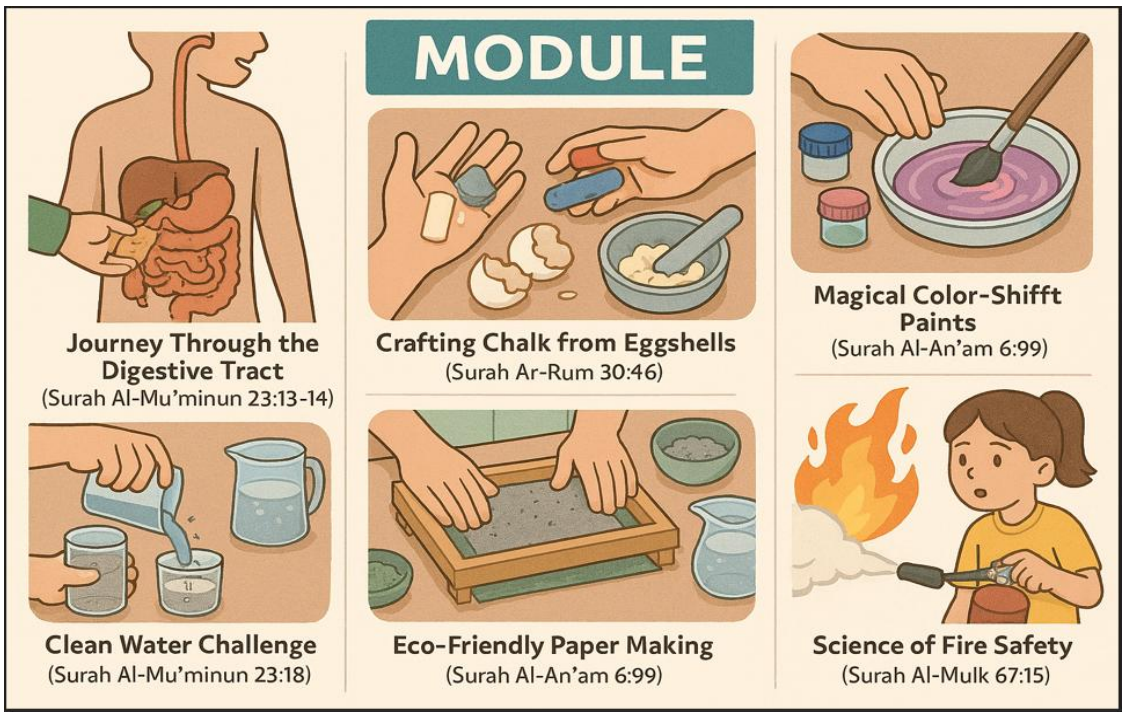
Assessments

Assessment was conducted based on a set of questionnaires designed specifically for the effectiveness of the program. In addition, each activity also provides a set of questionnaires to analyze the effectiveness of each activity conducted. The assessment criteria, focused on participant understanding, the effectiveness of the module, the success of the program, and suggestions for future improvements. Analysis was performed using the 5-point Likert scale, with the highest percentage selected by participants, which helped in drawing inferences and establishing relationships between different aspects of the module. This process ultimately provides valuable insights for educators to refine and enhance the module's functionality and the activities developed.

RESULTS AND DISCUSSION

The STREAM mentoring module integrated scientific concepts with Tauhidic values through experiential learning activities. Tawhidic (INAQ) refers to the integration of Islamic principles with scientific inquiry, enabling students to reconcile scientific theories with Qur'anic perspectives. This approach demonstrates how science and faith can complement each other, fostering both intellectual and spiritual growth (Kaco et al., 2024; Hassan et al., 2024; Zarkasih et al., 2019; Zanaton H. Iksan et al., 2016). The module featured activities such as Journey Through the Digestive Tract (linked to Surah Al-Mu'minun 23:13–14), Crafting Chalk from Eggshells (Surah Ar-Rum 30:46), Magical Color-Shift Paints (Surah Al-An'am 6:99), Clean Water Challenge (Surah Al-Mu'minun 23:18), Eco-Friendly Paper Making (Surah Al-An'am 6:99), and Science of Fire Safety (Surah Al-Mulk 67:15). These activities reinforced sustainability, creativity, and resource stewardship while aligning STEM education with Tauhidic values (Kaco et al., 2024) such as highlighted in Figure 3.

Figure 3: STEM and Tauhidic synergy: Creative, sustainable, and value-driven learning activities (Image generated using Microsoft Copilot - AI image generator, 2025)



Demographic Backgrounds

A total of 139 respondents who participated in this program completed the questionnaire regarding their perceptions of the program's implementation. Among them, 76 respondents (54.6%) were female, while 63 respondents (45.4%) were male. Only one respondent was of Indian ethnicity, while the remaining 138 respondents were Malay. The respondents' ages ranged from 10 to 12 years old, with 58 respondents (41.7%) aged 10, 39 respondents (28%) aged 11, and 42 respondents (30.3%) aged 12.

Perceptions of the Overall Program's Achievements

Apart from the demographic backgrounds, the survey also contains several statements designed to measure the level of achievement of the objectives in the overall program and each activity/dimension. Overall, the responses from all participants indicated high mean scores across all dimensions of the program evaluation. The first dimension, Understanding of Recycling, was measured through five items in the instrument, yielding a mean score of 4.58 (SD = 0.51). This result suggests that participants generally demonstrated a strong understanding of the recycling-related activities introduced during the

program. An example of an item under this dimension is: “I can easily understand the activities or lessons related to recycling.”

The second dimension assessed participants’ Perceptions of the Trainers/Facilitators, based on four items. The analysis recorded a mean score of 4.47 (SD = 0.69), indicating that respondents viewed the facilitators positively and felt they were engaging throughout the activities. An example of an item in this dimension is: “The trainer/facilitator successfully attracted my interest to participate in their activities.”

The third dimension focused on Satisfaction with the Clarity of Information in the Module, measured through three items. Respondents recorded a mean score of 4.42 (SD = 0.60), reflecting their agreement that the learning instructions and activity guidelines were clearly communicated. A sample item includes: “The instructions for each learning session or activity were delivered clearly.”

The fourth dimension, Satisfaction with the Soft Skills Value in the Module, comprised five items and recorded a mean score of 4.34 (SD = 0.65). This indicates that participants perceived the program as effective in enhancing interpersonal and leadership skills. One example item is: “I can develop leadership skills through the learning activities conducted.”

Finally, the fifth dimension assessed participants’ Perceptions of the Overall Effectiveness of the Program in Relation to STEM Elements. Eight items were included in this dimension, with a recorded mean score of 4.69 (SD = 0.43) and this was the highest among all dimensions. This suggests that the program was highly successful in fostering enjoyment and interest in STEM-related learning. A representative item reads: “I am happy to learn various STEM activities through this program.”

Activities Effectiveness

Activity 1: Journey Through the Digestive Tract

Assessment was conducted on 139 students, consisting of 76 females and 63 males. The results based on the Journey Through the Digestive Tract activity which focuses on the Human Digestive System, revealed that 86.21% of students stated that this module helped them remember the names of the organs in this system. Meanwhile, 84.83% indicated that the module assisted them in applying the knowledge in their studies, as shown in Table 1. Through this project, students were able to create a model of the human digestive system, which indirectly helped them recognize and remember the organs within the human digestive system.

Table 1. Effectiveness feedback for Journey Through the Digestive Tract Activity

Question	Likert Scale				
	1	2	3	4	5
Journey Through the Digestive Tract helps me remember the names of the organs in the human digestivesystem.	0.69 %	2.76%	10.34%	44.14%	42.07%
	Positive feedback Percentage			**86.21%**	
Human Digestive System model developed is suitable for helping me apply it in my studies.	1.38%	0.00%	13.79%	38.62%	46.21%
	Positive feedback Percentage			**84.83%**	

Activity 2: Crafting Chalk from Eggshells

Table 2 shows that 83.45% chose Likert scale 4 and 5, indicating that they agree and strongly agree that the eggshell chalk activity module was enjoyable for students. Additionally, this module also helped increase their knowledge in producing chalk from eggshells, which is one of the waste materials found at home. Furthermore, 88.28% who selected scales 4 and 5 also believed that this activity is an interesting method to enhance students' knowledge in the field of science. This activity indirectly stimulates students' interest and increases their inclination towards science in the future.

Table 2. Effectiveness feedback for Crafting Chalk from Eggshells Activity

Question	Likert Scale				
	1	2	3	4	5
I found the eggshell chalk experiment fun to do.	0.00 %	0.00%	16.55%	25.52%	57.93%
	Positive feedback Percentage			**83.45%**	
I found the eggshell chalk activity to be an interesting way to increase knowledge about science.	0.69%	0.69%	10.34%	42.07%	46.21%
	Positive feedback Percentage			**88.28%**	

Activity 3: Magical Color-Shift Paints

Based on the findings for the Magical Color-Shift Paints activity, Table 3, there were two items discussed regarding the module used in teaching the human digestive system. It was found that 82.76% of students chose Likert scale 4 and 5. This indicates that the majority of students agree and strongly agree that this module was effective in helping them apply the concepts of acids and alkalis. However, the remaining 17.24% of students chose Likert scale 1, 2, and 3. This means that they either disagreed, were unsure, or had less positive views on the effectiveness of this module. These respondents may have faced difficulties in understanding the content of the module or may have a different learning style that does not align with the module's approach. Additionally, 84.43% of students chose Likert scale 4 and 5, indicating that the majority of students agree and strongly agree that they were able to connect science and art. Meanwhile, the remaining 15.57% of respondents chose Likert scale 1, 2, and 3, indicating that they either disagreed, were unsure, or had less positive views on the suitability and effectiveness of the module in linking science and art.

Table 3. Effectiveness feedback for Magical Color-Shift Paints Activity

Question	Likert Scale				
	1	2	3	4	5
I can identify acidic and alkaline substancesused in everyday life.	1.38%	2.76%	13.10%	25.52%	57.93%
	Positive feedback Percentage			**83.45%**	
I was able to learn about the relationship between art and science.	1.38%	0.69%	10.34%	42.07%	46.21%
	Positive feedback Percentage			**88.28%**	

Activity 4: Clean Water Challenge: DIY Filtration

Table 4 shows the feedback after the DIY Water Filter Activity Module. The findings indicate that 95.17% of students chose a Likert scale of 4 and 5. This shows that the majority of students agree and strongly agree that creating a DIY water filter helps them understand the water filtration process. It is likely that they agree because this DIY activity provides them with hands-on experience and self-directed learning that clarifies the concept of water filtration, which might be difficult to grasp through theory alone. This activity may also attract students' interest and increase their engagement in learning. Furthermore, 88.96% of students chose a Likert scale of 4 and 5. This indicates that the majority of students agree and strongly agree that they gained benefits and new knowledge from the DIY water filter activity. It is likely that they agree because this activity not only provides theoretical knowledge but also practical applications that are useful in everyday life. This activity may have also introduced them to new concepts in science and technology that they were previously unaware of.

Table 4. Effectiveness feedback for Clean Water Challenge: DIY Filtration Activity

Question	Likert Scale				
	1	2	3	4	5
Creating this DIY water filter helped me understand the water filtration process.	0.00%	0.00%	4.83%	33.79%	61.38%
	Positive feedback Percentage				**95.17%**
I gained benefits and new knowledge from the DIY water filter.	0.00%	0.00%	11.03%	32.41%	56.55%
	Positive feedback Percentage				**88.96%**

Activity 5: Eco-Friendly Paper Making with Banana STEM

Banana stem paper is a type of paper made using fibers from the stem of the banana plant. This paper is often used in the creation of handicraft products, greeting cards, gift wraps, and other items that require specialty paper. In addition to being an eco- friendly alternative due to the use of organic waste materials, this paper also has a unique texture and an aesthetically appealing appearance. Therefore, the results from Activity 5, which involves producing paper from banana stems, show that 92.41% agree that this module helps enhance students' knowledge in producing paper from banana stems, as shown in Table 5. This activity likely provides students with direct experience in the process of making paper from banana stems. Practical experiences like this are often more effective in helping students understand concepts and processes because they can observe and participate in every step of production, focusing on experiential learning. Meanwhile, 88.27% agree that this module indirectly aids understanding in the field of science. The activity involves various aspects of science, including biology (structure and function of plants), chemistry (filtration and paper production processes), and ecology (use of organic waste materials). This interdisciplinary teaching helps students see how different science concepts are interconnected, while also raising awareness of the importance of environmental conservation, which is relevant to daily life.

Table 5. Effectiveness feedback for Eco-Friendly Paper Making with Banana Stem Activity

Question	Likert Scale				
	1	2	3	4	5
This paper making activity helped increase my knowledge about paper production.	0.69%	1.38%	5.52%	31.72%	60.69%
	Positive feedback Percentage				**92.41%**
I feel that this activity can help me improve my understanding of science.	0.69%	0.69%	10.34%	37.24%	51.03%
	Positive feedback Percentage				**88.27%**

Activity 6: Science of Fire Safety

Activity 6, which is the fire extinguisher module, is an activity that introduces various types of fire extinguishers with different functions. The activity also adopted an approach where students created fire extinguishers based on theoretical learning in the classroom and applied it outside the classroom. Table 6 shows that 87.59% of students agreed that the fire extinguisher they created was easy to make, and 87.58% of students agreed that this tool contained various useful information for them. The outcome of this activity helps students understand the basic concepts of fire and its extinguishment, as well as provides them with knowledge and skills that are useful for their safety and the safety of others in emergency situations, in addition to producing fire extinguishers from recycled materials.

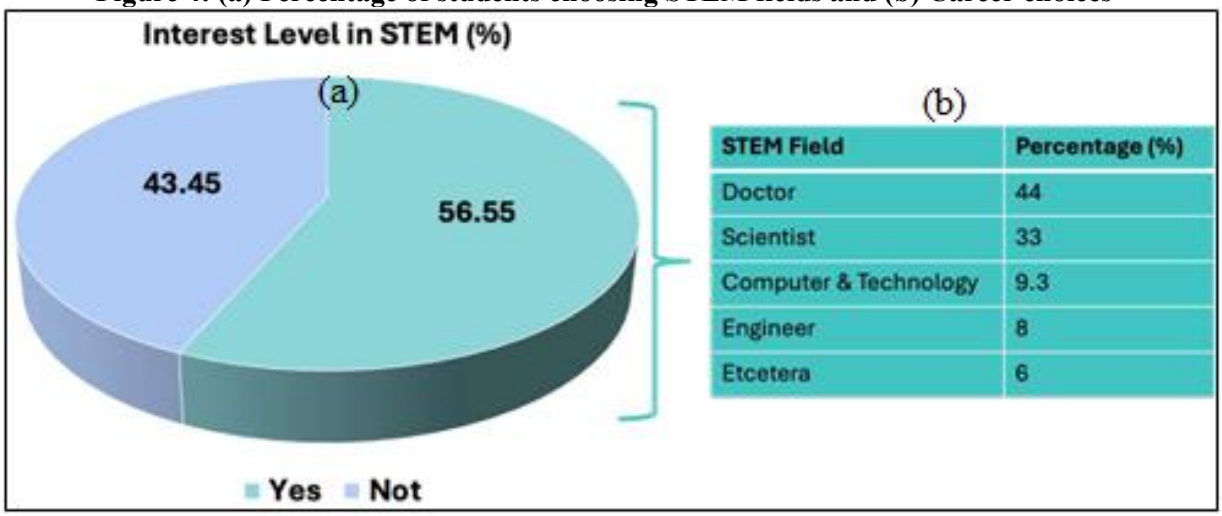
Table 6. Effectiveness feedback for Science of Fire Safety Activity

Question	Likert Scale				
	1	2	3	4	5
This science of fire safety activity helped increase my knowledge about fire safety.	0.69%	1.38%	5.52%	31.72%	60.69%
	Positive feedback Percentage				**92.41%**
I feel that this activity can help me improve my understanding of science.	0.69%	0.69%	10.34%	37.24%	51.03%
	Positive feedback Percentage				**88.27%**

Program Effectiveness

Overall reflection on the students' interest in the STEM field at the school shows that there is still not much difference between students who are interested in STEM and those who are not. This is shown in Figure 4(a), where 56.55% of students are interested in the STEM field compared to 43.45% of students who are not. Students interested in STEM have listed their career choices as shown in Figure 4(b). Among the chosen careers are doctor, engineer, scientist, teacher, computing, and several other fields. Meanwhile, students who are not interested in STEM stated that they find the field difficult and that it does not offer high salaries. Therefore, it is hoped that STEM-based activity modules can cultivate interest in more students in the future to pursue STEM, thereby contributing to the development of technology and innovation that will benefit society in the future.

Figure 4: (a) Percentage of students choosing STEM fields and (b) Career choices



Impact

The impact of this program on USIM students includes an increased understanding that everything happens for a reason and through a process. As a result, this program will be the starting point for individuals to continually impart knowledge and do good for the community, helping to shape knowledgeable individuals. Through this program also, we realize that USIM students were able to plan the design of materials or learning activities, select reusable items, and create creative solutions to improve problems or face challenges in their studies by integrating the STREAM and INAQ concepts (Mohamed Azmi Mohd Rasheed Khan, 2024).

The community also benefited from the program, as it helped to create a society that understands how His creations came to be on this earth. Additionally, this program helped raise students' awareness of recyclable materials and the importance of preserving a green environment. Through this practical experience, students were able to utilize reusable materials to facilitate their learning. The

activities conducted also stimulated critical and creative thinking among students and fostered the ability to find new solutions.

CONCLUSION

Overall, the STREAM Mentoring Course with the theme of "From Waste to Wealth: Creative Sustainability" had successfully achieved its goals of increasing student engagement and enhancing creative skills. The interactive learning experience gained through this program not only enriched students' academic knowledge but also instilled noble values and soft skills. With the proposed improvements, this program has the potential to make an even greater impact in the future, helping to produce a generation that is knowledgeable, creative, and morally upright.

RECOMMENDATION

There is a plan for the next SULAM project to develop a STREAM mentoring module focused on environmental sustainability, specifically targeting the issue of microplastic pollution that endangers aquatic ecosystems. This module will feature an activity on producing bioplastic from waste materials such as potato peels and rice husks, using corn starch as the primary polymer. Through this activity, students will learn about polymer chemistry, renewable resources, and biodegradable alternatives, promoting waste-to-wealth innovation as a solution to plastic pollution. The module aligns with STREAM and INAQ principles by integrating scientific inquiry with Qur'anic values of stewardship (khalifah) and avoiding wastefulness (israf), fostering eco-awareness, creativity, and the convergence of science, sustainability, and Islamic ethics.

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REFERENCES

Bsoul, L., Omer, A., Kucukalic, L., & Archbold, R. H. (2022). *Islam's perspective on environmental sustainability: A conceptual analysis*. Social Sciences, 11(6), 228.

Cynthia Miller-Idriss & Elizabeth Hanauer. (2011). Transnational higher education: offshore campuses in the Middle East. Comparative Education, 47(2), 181–207.

Hassan M.H.A., Kaco, H., & Rahim, F. (2024, September 26). SULAM nature appreciation module: Science and the Quran in harmony. In e-Proceeding International Seminar on Islamic and Science (7th ed., pp. 570–574).

Izwan Abdullah. (2024, Julai 17). KPT bimbang graduan sektor berteknologi tinggi tak mencukupi. Harian Metro. https://www.hmetro.com.my/mutakhir/2024/05/1086617/kpt-bimbang-graduan-sektor-berteknologi-tinggi-tak-mencukupi

Kaco, H., Hassan, M.H.A., Mohd Noor, K.M., Mohd Alwi, N.H., Othman, S.S., & Md Jusoh, S.N. (2024, September 26). Interactive learning experience through SULAM project by integrating sustainable environment activities with INAQ. In e-Proceeding International Seminar on Islamic and Science (7th ed., pp. 480–496).

Lee, W. (2025, July 12). STEM education in Malaysia: Progress, challenges, and the road ahead. Newswav. https://newswav.com/article/stem-education-in-malaysia-progress-challenges-and-the-road-ahead-A2507_BwXK9N.

Liew Yon Foi, & Teoh Hong Kean. (2022). STEM education in Malaysia. An organizational development approach. International Journal of Advanced Research in Future Ready Learning and Education, 29 (1),1-19. Akademia Baru Publishing (M) Sdn Bhd.

Liza Nopita Sari & Putri Bintang. (2022). Konsep Sistem Pencernaan Pada Manusia Berdasarkan Alqur`An dan Hadits. Jurnal Penelitian, Pendidikan dan Pengajaran, 3 (3), 244-251.

Malak Abou Faour & Zalpha Ayoubi. (2018). The effect of using virtual laboratory on grade 10 students' conceptual understanding and their attitudes towards physics. Journal of Education in Science, Environment and Health, 4(1), 54–86.

Ministry of Education Malaysia (MOE). (2013). Malaysia Education Blueprint 2013- 2025. Putrajaya: Malaysian Ministry of Education.

Ministry of International Trade and Industry (MITI). 2017. Mini Report.

Mohamed Akhiruddin Ibrahim, Azniwati Abdul Aziz, Wan Amir Nudin Wan Ishak , Sanusi Shariff, Rasmina Hasbullah & Irwan Mohd Subri. (2017). The Intergration Concept Of Naqli And Aqli Knowledge: Study On Students' Perception. International E-Journal of Advances in Social Sciences, 3(8), 582-590.

Mohamed Azmi Mohd Rasheed Khan. (2024). 'Remajakan' pendidikan STEM sesuai keadaan mampu tarik minat pelajar. Berita Harian. https://api.bharian.com.my/rencana/lain-lain/2024/06/1263867/remajakan- pendidikan-stem-sesuai-keadaan-mampu-tarik-minat-pelajar

Muzakkir, R. A., & Zulnaidi, H. (2024). *Development and validation of the Quran – Science, Technology, Engineering, Art, And Mathematics (Q-STEAM) module*. STEM Education, 4(4), 346–363.

Nurul Asyikin Mohamed Radzi & Suhaila Sulaiman. (2018). Measuring students' interest towards engineering in technical school: A case study. Journal of Technology and Science Education, 8(4), 231-237. OmniaScience.

Putra, T. M. (2025, April 9). Enhancing STEM education: A strategic imperative for the nation's future. The Edge Malaysia. https://theedgemalaysia.com/node/750446.

Rohaida Mohd Saat & Hidayah Mohd Fadzil. (2022). Enhancing STEM Education in Malaysia through Scientist–Teacher–Student Partnerships (STSP). In: Cheng, M.M.H., Buntting, C., Jones, A. (eds) Concepts and Practices of STEM Education in Asia. Springer, Singapore.

Sarala Thulasi Palpanadan, & Venosha Ravana. (2022). Future Trajectories in Teaching-Learning Practices for STEM Education in Malaysian Secondary Schools: A Scoping Review. Asia Proceedings of Social Sciences, 9(1), 169–170. Connecting Asia Research Network.

Shahali, E. H.M., Ismail, I. & Halim, Lilia. (2017). STEM education in Malaysia: Policy, Trajectories and Initiatives. Science and Technology Trends, Policy Trajectories and Initiatives in STEM Education, 122-133. Asian Research Policy.

Shahril Sabudin, Azlin Norhaini Mansor, Subahan Mohd. Meerah & Azliza Muhammad. (2018). Teacher-Level Factors that Influence Students' Science and Technology Culture: HLM Analysis. International Journal of Academic Research in Business and Social Sciences, 8(5), 977–985. Human Resource Management Academic Research Society.

Siti Nurwanis Mohamed, Munirah Abd Razzak & Najihah Mohd Hashim. (2020). Elemen Keindahan dalam Tumbuhan Menurut al-Quran dan al-Hadith: Satu Tinjauan Awal. Jurnal al-Turath, 5(2), 1-1.

Wafry Khairul Ziad, Muhammad Fadhly Ahlamie Md Nor'Azam, Hatika Kaco*, Fadzidah Mohd Idris, Nor Raihan Zulkefly, Siti Munirah Mohd, Nur Hidayah Mohamad Jan. (2021). An evaluation of student's perception towards learning physics at lower secondary school. Jurnal Pendidikan Sains dan Matematik Malaysia, 11, 94-106. UPSI Press

Zaher Atwa, Rosseni Din & Muhammad Hussin. (2016). Effectiveness of flipped learning in physics education Palestinian high school students' achievement. Journal of Personalized Learning, 2(1), 73–85.

Zanaton H. Iksan, Md Noor Saper & Zetty Nurzuliana Rashed. (2016). Integration of Tawhidic Science through Lesson Study Approach in teaching and learning Science or Islamic Study. Tinta Artikulasi Membina Ummah, 2(1), 40-50.

Zarkasih, Kadar M. Yusuf, Hasanuddin & Susilawati. (2019). Integration of Naqli And Aqli Knowledge In Islamic Science University of Malaysia: Concept And Model. Jurnal Kependidikan Islam, 5(2), 123-143.