International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 9 Issue 4 April - 2025, Pages: 45-51

STEM Students' Experiences: A Study of Environmental Engagement in School and Community

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Abstract: *This study examined at how STEM students at Diplahan National High School participate in school and community sustainability initiatives. Students' perceptions, motivations, challenges, and the effect of STEM education on their environmental awareness and involvement are all captured in the research using a phenomenological approach. The results showed that STEM students apply their scientific knowledge and problem-solving abilities to real-world issues, acknowledging their role in addressing environmental issues. Their involvement was limited, though, by time constraints and academic workload, which made it challenging to strike a balance between extracurricular environmental activities and school obligations. Notwithstanding these difficulties, students actively participated in campaigns like clean-up campaigns, tree planting, and the creation of environmentally friendly projects, demonstrating the power of hands-on learning in promoting environmental awareness. The study highlighted how crucial it was to foster school-community partnerships, offered institutional support, and incorporated sustainability into the STEM curriculum to increase students' engagement with environmental initiatives. For educators, legislators, and other interested parties looking to improve environmental advocacy and education among STEM students, these findings provided insightful information.*

Keywords: *STEM (Science, Technology, Engineering, and Mathematics) Students, Environmental Awareness*

Introduction

Environmental degradation, particularly pollution, has escalated to critical levels in recent years, positioning ecological awareness as a vital global priority. Addressing this challenge requires the proactive involvement of communities, with a particular emphasis on the active engagement of young people.

In the Philippines, schools have focused on the promotion of environmental awareness and sustainability, especially through educational programs aimed at fostering a sense of responsibility and consciousness among students. Among these students, those who are under the Science, Technology, Engineering, and Mathematics (STEM) tracks are considered leaders as they are more into problem-solving and community-oriented initiatives that deal with urgent environmental issues.

Diplahan National High School, a public institution in the province, served as a training ground for how students influenced their local communities through both academic learning and extracurricular activities. However, there remained confusion in understanding the extent of STEM students' involvement in environmental activities and how their learnings directly impact their actions and participation in environmental and community-related efforts.

This study aimed to determine how the students of Diplahan National High School, who are enrolled in the STEM program, engaged with environmental issues and contributed to the sustainability efforts of their local community. It investigated the participation of students in environmental programs, identified factors that motivated or hindered such involvement and explore
how the integration of environmental education within the STEM curriculum influenced the actions of students toward community involvement and sustainability practices.

The findings of this study were of great value in providing insights into how schools nurture students with the necessary knowledge, skills, and attitudes to become proactive participants in addressing environmental challenges. They also offered recommendations on strengthening school-community partnerships, promoting ecological advocacy, and enhancing the role of education's stewardship in fostering a long-term environment.

Statement of the Problem

This study focused on Stem XII Students' Experiences: A Study of Environmental Engagement in School and Community at Diplahan National High School in School Year 2024-2025.

Specifically, this study sought to answer the following questions:

1. How do STEM students at Diplahan National High School perceive their role in environmental engagement at school and community?
2. What challenges do STEM students face in participating in environmental activities in school and community?
3. What activities do STEM students participate in for environmental initiatives?

Results and Discussion

This chapter presented an analysis, and interpretation of the validation of "STEM Students' Experiences: A Study of Environmental Engagement in School and Community." The findings emphasize the degree of participation, difficulties encountered, and the influence of STEM-related environmental activities on students' learning and community involvement. The goal of this analysis is to shed light on how STEM education encourages students to take environmental awareness and action.

Perceptions of STEM (Science, Technology, Engineering, and Mathematics) Students of their roles in Environmental Engagement.

In order to better understand Grade 12 students' involvement in environmental initiatives, the difficulties they encounter, and their role in promoting sustainability, we conducted interviews with them to learn more about their perspectives and experiences in relation to "STEM Students' Experiences: A Study of Environmental Engagement in School and Community." Their distinct experiences and perspectives on environmental engagement in educational and community contexts are reflected in each subject that arose from their statements.

Problem-Solvers. As we gathered data from our interviews with our respondents. One to ten respondents shared the theme in terms of problem- solving. Putting a focus on critical thinking, lifelong learning, and using STEM knowledge to address practical problems, especially environmental ones. It emphasizes the capacity to assess issues, create original solutions, and support sustainability initiatives. (PR1 &PR7)

"As a STEM student, I may not be as knowledgeable as others, but I am continuously learning and developing the skills needed to tackle real-world challenges. I believe that STEM equips me with the problem-solving mindset and innovative thinking necessary to address environmental issues. With my growing knowledge and dedication, I aspire to contribute to sustainable solutions that can help protect and preserve our planet."

(PR1 03/06/25)

PR1 shared that they may not be as knowledgeable as others but are continuously learning and developing the skills needed to tackle real-world challenges. It was also tackled in the respondent's response that STEM equips them with a problem-solving mindset and innovative thinking, which are essential for addressing environmental issues. The ability to develop sustainable solutions to environmental problems is a key focus of STEM education. According to a study by Beers (2011), STEM education fosters the development of these skills, preparing individuals to tackle complex issues such as climate change, resource management, and environmental sustainability.

"Us STEM students often see ourselves as key contributors to environmental solutions, leveraging our technical skills to address ecological issues."

(PR7 03/06/25)

PR7 shared that STEM students see themselves as top contributors to environmental solutions. According to Bybee (2013), STEM education fosters problem-solving and critical thinking skills, equipping students with the ability to develop innovative strategies for environmental sustainability. Research also highlights that STEM-oriented approaches, such as environmental engineering, data-driven analysis, and renewable energy solutions, contribute significantly to ecological conservation efforts (National Research Council, 2012). Moreover, Rieckmann (2017) emphasizes that STEM education promotes sustainability competencies, empowering students to take active roles in mitigating environmental issues. These findings support the perspective that STEM students are key contributors to environmental solutions, utilizing their technical expertise to drive positive ecological change.

Challenges STEM (Science, Technology, Engineering, and Mathematics) students face in participating in environmental activities in school and community.

In order to better understand Grade 12 students' involvement in environmental initiatives, the difficulties they encounter, and their role in promoting sustainability, we conducted interviews with them to learn more about their perspectives and experiences

in relation to "STEM Students' Experiences: A Study of Environmental Engagement in School and Community." Their distinct experiences and perspectives on environmental engagement in educational and community contexts are reflected in each subject that arose from their statements.

Academic and Extracurricular Activities. As we collected data from our interviews with our respondents. From one to ten respondents, the theme revolved around academic and extracurricular activities. This explains that having much academic and extracurricular activities present significant challenges for STEM students in participating in environmental engagement. STEM programs are often demanding, with heavy coursework, laboratory work, research projects, and exams, leaving students with limited time to dedicate to extracurricular activities, including environmental causes. (PR5 & PR8)

"Despite our potential contributions, several challenges prevent us from fully engaging in environmental activities. The most common issue is time constraints our schoolwork is demanding, and many of us struggle to balance academics with extracurricular initiatives." (PR5 03/06/25)

PR5 highlights the challenge of time constraints that STEM students face in balancing their academic workload with extracurricular activities, particularly environmental initiatives. It reflects the common difficulty that students, especially those in demanding fields, encounter when trying to allocate time for non-academic pursuits. The intense focus on coursework, research, exams, and lab work often leaves little room for other commitments, even those related to important causes like environmental sustainability. Many STEM students may feel overwhelmed by their academic responsibilities, making it hard to participate in extracurricular activities, even though they may be interested in contributing to environmental efforts. One relevant reference is a study by Titus, H. & Herbst, P. (2013) titled "Student Engagement in Environmental Issues and Challenges: An Examination of Barriers in STEM Programs," which discusses the difficulties that STEM students face in finding time to engage in environmental issues due to their academic and extracurricular commitments.

"One of our biggest challenges is balancing academics with environmental efforts. With heavy load works and tight schedules, finding time to actively participate becomes difficult."

(PR8 03/06/25)

PR8 also shared that one of the biggest challenges is balancing academics with environmental efforts. Balancing academic responsibilities with extracurricular environmental activities presents significant challenges for students, particularly due to heavy coursework and tight schedules. Research indicates that while participation in extracurricular activities can enhance skills such as time management and organization, overcommitment may lead to increased stress and hinder academic performance. Wilson (2009) found that overly time-consuming extracurricular engagements can interfere with academic success, suggesting that both students and counselors should advocate for a balanced approach to academics and activities. Similarly, a study by the National Association for Campus Activities highlights the importance of students managing their time effectively to excel in both academic and extracurricular domains. Therefore, it is crucial for students to develop strategies that allow them to participate in environmental initiatives without compromising their academic obligations.

Activities STEM (Science, Technology, Engineering, and Mathematics) students participate in for Environmental Initiatives.

In order to better understand Grade 12 students' involvement in environmental initiatives, the difficulties they encounter, and their role in promoting sustainability, we conducted interviews with them to learn more about their perspectives and experiences in relation to "STEM Students' Experiences: A Study of Environmental Engagement in School and Community." Their distinct experiences and perspectives on environmental engagement in educational and community contexts are reflected in each subject that arose from their statements.

Hands-on and Community Activities. As we gathered data from our interviews with respondents, ranging from one to ten participants, the recurring theme centered around academic and extracurricular activities. This indicates that these areas are seen as essential to students' overall development. (PR2 & PR6)

"As a STEM student, one of the environmental activities I have participated in is a tree-planting program organized by our school. Additionally, I took part in a school-facilitated cleanup drive, contributing to efforts in maintaining a cleaner environment."(PR2 03/06/25)

PR2 generalized that taking care of the environment is a shared responsibility, which is why they actively participate in various activities to help protect it. One of the ways they contribute was through a tree-planting program. By planting trees, they not only made the surroundings greener but also helped improve the air quality for everyone. Environmental stewardship is a collective

responsibility that requires active participation from individuals and communities. According to Stern (2000), environmental responsibility is shaped by awareness, personal values, and the perceived effectiveness of actions. Community-based initiatives such as tree-planting programs play a crucial role in environmental conservation, as they contribute to biodiversity, improve air quality, and mitigate climate change (Aronson et al., 2018). Furthermore, tree-planting fosters social engagement and a sense of environmental ownership, encouraging long-term commitment to sustainability efforts (Chawla & Cushing, 2007). These findings align with the respondent's perspective, reinforcing the idea that protecting the environment is a shared duty that benefits both present and future generations.

"STEM students are often engaged in clean-up drives, tree planting, awareness campaigns, and developing eco-friendly projects."

(PR6 03/06/25)

PR6 shared that STEM students often engage in hands-on activities like tree-planting and more. This explains that engaging STEM students in environmental activities such as clean-up drives, tree planting, awareness campaigns, and developing eco-friendly projects has been shown to positively influence their environmental attitudes and career interests. For instance, a study by Demir and Köse (2022) demonstrated that participation in nature-based STEM activities significantly enhanced students' environmental attitudes and increased their interest in STEM careers, particularly in engineering and technology fields. Similarly, integrating environmental issues into STEM education has been found to improve students' problem-solving abilities related to real-world environmental challenges. These findings underscore the importance of involving STEM students in hands-on environmental projects to foster both environmental stewardship and interest in STEM disciplines.

Conclusion

STEM students are very conscious and dedicated to the sustainability of their environment but are held back from active engagement by the demands of academic work and time constraints. Experiential learning, like research projects and internships, enhances engagement by giving students the power to make their knowledge practical through solving real-world problems. Through organized programs and embedded sustainability courses, institutional support helps balance academic work with environmental activities. Using the Civic Voluntarism Model, the research highlights the need for systemic change to enable STEM students to become sustainability leaders, leveraging their technical skills to create long-term environmental effects (Verba et al., 2019).

Recommendations

For increasing the environmental activity of STEM students, the present study recommends the following measures:

1. Strengthening Institutional Support for Environmental Engagement

Schools are encouraged to integrate environmental education across the STEM curriculum through interdisciplinary teaching strategies. Administration should support the implementation of regular environmental programs, such as clean-up drives, tree planting activities, and recycling campaigns. It is also recommended that schools allocate funding and logistical support for student-led environmental clubs and research initiatives, as well as recognize and showcase students' work through school-wide events like science fairs and innovation expos.

2. Enhancing Educators' Role in Environmental Learning

STEM educators should adopt localized and relevant environmental issues in their teaching to deepen students' connection to real-world concerns. Project-based learning, fieldwork, and community immersion activities are recommended to foster critical thinking and applied learning. Teachers should also model sustainable practices in the classroom and serve as facilitators of student initiatives, guiding them to connect their scientific knowledge with meaningful action.

3. Empowering Students as Environmental Advocates

Students are encouraged to take active roles in environmental programs and apply their STEM knowledge in addressing local ecological problems. This may include developing simple technologies, conducting community-based research, or creating awareness campaigns. Students should also adopt and advocate for environmentally sustainable habits in both school and home settings, thereby serving as role models among peers.

4. Encouraging Parental Involvement in Environmental Advocacy

Parents are advised to support their children's participation in environmental activities and reinforce eco-friendly behaviors at home. They may also participate in school-based events and collaborate with teachers in monitoring and encouraging students' environmental engagement. Promoting practices such as proper waste segregation, resource conservation, and participation in local clean-up drives at home can extend learning beyond the classroom.

5. Fostering School-Community Partnerships for Sustainability

It is recommended that community leaders, local organizations, and government units' partner with schools to implement sustainability projects. Providing mentorship, venues, or materials for student projects can strengthen engagement. Recognizing and showcasing the environmental contributions of students in community events can further motivate youth involvement. Community-based environmental campaigns with student participation can also help bridge the gap between education and real-world impact.

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