

Integration of Climate Action - SDG 13 to Science Instruction: A Basis for Climate Education Policy

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Abstract. Science education plays a crucial role in promoting climate action among students by equipping them with essential knowledge and skills regarding climate complexities, which in turn fosters active participation and critical thinking skills. The study investigated the integration of SDG-13 (Climate Action) into science education within the public secondary schools in Masbate Province, Philippines, to serve as a basis for the crafting of the climate education policy in the future. Using mixed-methods, the quantitative data were collected from 23 participants, consisting of science teachers, master teachers, and school heads, using a researcher-made survey questionnaire to determine their level of readiness and perceived challenges. The findings demonstrated a high level of teachers' preparedness and a strong positive perception of climate-related content and activities in schools. However, teachers showed a low familiarity with the SDG-13 framework. While the study found moderate positive correlations between teacher preparedness and school support factors, namely school guidelines, admin-teacher collaboration, adequate resources, and external partnerships, the study warrants a larger sample size of participants to further strengthen these findings. Meanwhile, the qualitative data from participants' open-ended responses confirmed the challenges they faced in integrating climate action into their lessons. This highlights the need for specialized teacher training, more accessible and adequate teaching materials, and strategies to address student disengagement. The study revealed that while teachers are willing to integrate climate action into science instruction, its practical implementation is hindered by the lack of formal knowledge and institutional support, highlighting the need for targeted climate education policy to strengthen resource allocation, professional development, collaborative strategies, and other support factors.

Keywords: Climate action; Climate education policy; SDG-13; Science instruction; Teachers

1.0 Introduction

Climate Action is a key component of global efforts to combat climate change and its impacts, as part of the Sustainable Development Goals (SDGs), particularly SDG-13. This goal underscores the need for deeper awareness and practical solutions to address the adverse effects of fluctuating climate temperatures on the community and society. As Almeida *et al.* (2024) note, climate action encompasses various strategies aimed at mitigating the Earth's increasing heat through collaboration among countries, nongovernmental organizations, the private sector, and social-focused groups. Moreover, science education plays an essential role in promoting SDGs, especially SDG-13 (Climate Action), aiming to improve awareness and equip students with the necessary skills and knowledge on climate complexities (Priatna & Khan, 2024; Dolan, 2024). As cited by Kang & Tolppanen (2024), science education fosters personal willingness among the students to participate in any

climate-action solutions.

Integration of SDG-13 into science education promotes awareness and action among students. It enhances students' familiarity with other SDGs as well and helps to develop critical thinking about climate-related impacts, especially on humans (Mikhailova *et al.*, 2024; Suaco, 2024). Teachers are expected to implement experiential and hands-on activities to provide students with the necessary skills to address climate-related problems and to promote innovation and scientific literacy (Pareek & Pandey, 2025). In the results, students are empowered to act as agents of climate resilience, promoting a conducive and healthy environment (Ab Rahman & Rosli, 2024).

However, educational institutions and teachers still face challenges in integrating SDG-13 into science curricula, including a lack of specific training on climate action, limited teaching materials, and student disengagement from climate action lessons. Teachers need adequate training on integrating climate action into science lessons. In the meantime, the lack of training for the teachers hinders their ability to develop sustainable behaviors among the students effectively (García-Vinuesa, 2024), as training is identified as an important tool to advance climate change education. Nurhaliza *et al.* (2024) highlight the importance of equipping teachers with various teaching strategies to promote and integrate SDG-13 effectively. The lack of resources and materials also hinders teachers' ability to convey sustainable goal efforts, particularly climate action. As a result, students tend to show no interest in any climate action activities. The disengagement of students in climate action stemmed from the use of fear and crisis narratives in instruction, which disempower and disengage them. Teachers should focus on empowering students and envisioning them as active agents of change to fully engage them (Bartlett *et al.*, 2022; McClellan & Davis, 2023).

While previous studies highlighted the essential role of science education in cultivating awareness regarding climate action, there has been limited attention towards teachers' readiness and institutional support mechanisms, particularly in the Philippine Education system. Moreover, there is a lack of groundwork for designing policies that formalize the integration of SDG-13 in secondary education. This study aims to analyze the readiness of secondary public schools and their teachers in Masbate Province to integrate climate action, identify the perceived challenges hindering the full integration of SDG-13 into the science curriculum, and formulate recommendations for effective integration. The collected data will serve as a basis for designing and formulating climate education policy, resulting in the successful incorporation of climate action in science education.

2.0 Methodology

2.1 Research Design

This study utilized mixed-methods research, specifically a sequential explanatory design. This study collected and analyzed the quantitative data first, followed by the analysis of the qualitative data to further explain the quantitative findings. The use of both quantitative and qualitative data provides a comprehensive scope in investigating educational issues. It delivers numerous benefits both to schools and their stakeholders by implementing effective policies and activities (Almalki, 2016).

2.2 Participants and Sampling Technique

A total of 23 respondents were selected through convenience sampling due to practical and geographical limitations; thus, individuals who are willing and available to participate in the study were included. Respondents were comprised of science teachers, master teachers, and school heads from the three congressional districts of Masbate Province. Convenience sampling is utilized for practicality; however, it presents limitations, as the sample may not represent the broader teacher population and could introduce bias. Only the science teachers, master teachers, and school heads in public secondary schools in Masbate Province are included in this study. At the same time, individuals outside these roles who are not actively engaged in science instruction were excluded.

2.3 Research Instrument

The study employed a researcher-made questionnaire, created using Google Forms, which served as a source of both quantitative and qualitative data. The research instrument aimed to determine the readiness and

preparedness of both the school and science teachers in integrating SDG-13 (Climate Action) into the science curriculum, as well as their perceived challenges and recommendations. The questionnaire was divided into five sections namely (1) demographic profile, (2) level of readiness of the school and teachers using the 5-point Likert scale, (3) level of the preparedness and support systems (5-point Likert scale), (4) perceived challenges, and (5) open-ended question seeking for the valuable suggestions and insights which will provide qualitative findings. Due to resource and time constraints, the instrument was not formally validated or pilot tested; however, the researcher ensured item consistency and clarity by conducting a thorough review of the questions and seeking informal feedback from colleagues to refine ambiguous wording.

2.4 Data Gathering Procedure

Data were collected by sharing a survey link online with participants through online messaging applications and other common social media platforms.

2.5 Data Analysis Procedure

The collected data were encoded and analyzed using the IBM SPSS (Statistical Package for Social Sciences) tool for accurate computation and interpretation of the descriptive statistics, including frequency counts, means, standard deviations, variance, skewness, and kurtosis. The descriptive statistics were used to determine the level of preparedness of both schools and teachers in integrating SDG-13 into science instruction. Meanwhile, qualitative data from the participants' responses to the open-ended questions were also analyzed using thematic analysis. Inductive coding was also used to narrow down the recurring themes and concepts from the collected responses, rather than predetermined categories. Inductive coding refers to analyzing the data to develop themes, concepts, and categories. The study also used Pearson Correlation (r) and p-value to determine the relationship between teachers' preparedness and school support factors, namely school guidelines, admin-teacher collaboration, adequate resources, and external partnerships.

2.6 Ethical Considerations

The Google Forms included a brief statement explaining the purpose of the study and guaranteeing the participants the utmost confidentiality, and emphasizing that their participation was purely voluntary. Moreover, there was no collection of participants' names, school affiliations, addresses, and other personal details. Informed consent was also obtained before the participants answered the survey. Although no formal institutional ethics review was conducted, the researcher followed the standard ethical practices in educational research, namely voluntary participation and confidentiality.

3.0 Results and Discussion

3.1 Science Teachers' Demographic Profile

Table 1 shows that the majority of the 23 respondents were categorized as moderately experienced educators, with the largest group (47.8%, $N = 11$) having 6 to 10 years of service, and a significant majority (82.6%, $N = 19$) holding Teacher I - III positions focusing on a classroom-level perspective. Meantime, three respondents are engaged in school management, consisting of two Principal I-III ($N=2$) and one Master Teacher I ($N=1$) serving as Teacher-in-Charge.

Table 1. Demographic Profile of Science Teachers		
Demographics	Frequency N	Percentage
Years in Service		
Less than 3 years	3	13.0
6 to 10 years	11	47.8
11 to 15 years	7	30.4
16 years above	2	8.7
Total	23	100
Current Position		
Teacher I-III	19	82.6
Master Teacher I-III	2	8.7
Principal I-III	2	8.7
Total	23	100
Congressional District		
1 st	5	21.7
2 nd	7	30.4

3 rd	11	47.8
Total	23	100

Teachers serve as primary implementers of climate action in their daily lessons, while school heads provide administrative support and resources needed for climate action instruction. The respondents reveal their insights, experiences, challenges, and recommendations in integrating climate action into science instruction.

3.2 Preparedness of Schools and Teachers on Climate Action Integration

The descriptive statistics in Table 2 reveals a positive perception among the 23 respondents regarding the presence of climate-related content and initiatives in their school, with all indicators ranging from 3.70 to 4.39. The highest agreement was on the presence of climate-related content in science curriculum (M = 4.39) and the promotion of environmental awareness (M = 4.35). Meanwhile, the respondents demonstrated low familiarity with SDG-13 (M = 3.70), indicating that despite being aware of various climate action initiatives, they lacked a comprehensive understanding and connection to the global framework. Standard Deviations, which range from 0.656 to 1.063, show the varying levels of agreement across all indicators. Most responses are negatively skewed, demonstrating a strong tendency of agreement among the participants in support of climate-related initiatives. Overall, there is a need for targeted training and curriculum alignment to strengthen the integration of SDG-13 into science instruction.

Table 2. Descriptive Statistics of Preparedness of the Schools and Teachers on Climate Action Integration

	N	R	Min	Max	Sum	Mean	SD	var	Sk	K
I am familiar with the UN Sustainable Development Goals, especially SDG-13.	23	4	1	5	85	3.70	1.063	1.130	-.814	.520
Climate-related content is present in our science curriculum.	23	2	3	5	101	4.39	.656	.431	-.617	-.484
Our school has initiated climate-focused activities or science-related campaigns.	23	4	1	5	90	3.91	1.041	1.083	-1.138	1.532
Our school actively promotes environmental and climate awareness among students.	23	3	2	5	100	4.35	.832	.692	-1.285	1.447
Our school has programs or projects promoting awareness of climate change.	23	3	2	5	94	4.09	.900	.810	-.591	-.527
SDG 13 (Climate Action) integration aligns with our school's science teaching goals.	23	2	3	5	95	4.13	.815	.664	-.255	-1.432
I feel prepared to teach/integrate climate-related topics in science.	23	2	3	5	97	4.22	.671	.451	-.280	-.627

The table clearly shows the high level of preparedness of the teachers and schools about climate action; however, there is a low result regarding the familiarity with the specific UN Sustainable Development Goals, specifically SDG-13. This suggests that while teachers are willing to teach climate action, there may be a gap in their formal knowledge of the specific global framework. Franco *et al.* (2019) revealed that teachers faced struggles with the conceptual challenges of climate change, leading to misconceptions that can be passed on to the students.

3.3 Support of the School to Climate Action Integration

Table 3 shows a strong point regarding the schools' best performance in leveraging support from external partnerships for climate education (M = 3.65). However, teachers only showed moderate agreement on the presence of clear guidelines or policies (M = 3.39) and on having collaborative planning (M = 3.39). On the other hand, the availability of adequate resources and materials for integrating SDG-13 in science education had the lowest mean (M = 3.26), highlighting that effective integration of SDG-13 in science education would require not just external partnerships, clear guidelines and policies, and collaboration, but also providing the necessary resources and materials.

The study showed the importance of collaboration among schools, community agencies, and other stakeholders to provide a supportive learning environment and promote a sense of awareness and involvement among the students into climate action (Lawson & Lawson, 2020), emphasizing the educational approaches that will motivate the students to participate in climate action initiatives such as recycling and waste collection which focus on hands-on activities rather than theories and discussions alone (Damanik & Saliman, 2023).

Table 3. *Descriptive Statistics of the Support of the School on Climate Action Integration*

	N	R	Min	Max	Sum	Mean	SD	var	Sk	K
Our school has clear guidelines or policies on integrating climate education.	23	4	1	5	78	3.39	1.076	1.158	-.171	-.261
There is collaborative planning between administrators and teachers to promote climate education.	23	4	1	5	78	3.39	1.270	1.613	-.535	-.325
Our school has adequate resources and materials for integrating SDG 13 (climate action) in science education.	23	4	1	5	75	3.26	1.176	1.383	-.191	-.399
External partnerships (NGOs, LGUs, DENR) are leveraged to support climate education.	23	4	1	5	84	3.65	1.191	1.419	-.838	.323

The data also revealed that while teachers and schools display a sufficient level of preparedness in integrating climate action, as reflected in high means scores on familiarity with SDG-13 (Table 1), the resource availability hinders the full integration of climate action into daily lessons, as presented in Table 2. This gap highlights the need for improved resource allocation and deeper collaboration to realize effective climate education integration fully.

Correlation Between Teacher Preparedness and School Support Factors for SDG-13 Integration

Table 4 shows a moderate positive correlation ($p < 0.05$) between teachers' preparedness to teach climate-related topics and the four support factors for integrating SDG-13. This only means that as school support (such as clear guidelines, collaboration, and resources) increases, teachers tend to feel more prepared to integrate climate action. However, the p-values for these relationships ($p = 0.073$ for school guidelines, $p = 0.071$ for external partnerships, $p = 0.069$ for adequateness of resources, and $p = 0.134$ for admin-teacher collaboration) are slightly above the standard 0.05 threshold for statistical significance. In other words, there may be a relationship, but a larger sample size is needed to strengthen these findings. This also suggests that schools should strengthen their internal systems for effective climate action education – such as providing clear policies, investment in materials, and building active partnerships. As for policymakers, teachers' readiness goes beyond attending training but requires sustained institutional support.

Table 4. *Correlation Between Teacher Preparedness and School Support Factors for SDG-13 Integration*

Support Factor	Pearson r	p-value
School Guidelines	0.381	0.073
Admin-Teacher Collaboration	0.322	0.134
Adequate Resources	0.385	0.069
External Partnerships	0.383	0.071

3.4 Experienced Challenges in Integrating SDG-13 in Science Instruction

Based on participants' responses, three clustered themes emerged that captured the significant challenges faced by teachers and schools in integrating SDG-13 in teaching science subjects: (1) Professional Development Gaps, (2) Instructional Resource Limitations, (3) Student Engagement Challenges. These themes reflect both systemic and classroom-level barriers that hinder effective climate action education.

Professional Development Gaps

The major challenge of SDG-13 integration is the lack of individualized and specialized training for teachers, which highlights the professional development gap experienced by science teachers. Without the specific training about SDG-13, teachers may lack the necessary pedagogical approaches, improved scientific knowledge, and confidence in effectively integrating climate action concepts into science lessons. As one teacher cited, “No teacher training specific to SDG-13”. This finding aligns with Olawumi (2023), highlighting the need for development of professional programs focusing on climate action to equip teachers with the relevant knowledge and pedagogical skills to integrate climate action into daily lessons. On the other hand, the limited knowledge of teachers, both in content and pedagogy, negatively impacts their teaching of subjects (Mavuso *et al.*, 2022). Another teacher noted that “there is a need for training sessions and seminars about SDG-13”.

Instructional Resource Limitations

The scarcity of the necessary materials severely impedes effective science instruction. The materials can include textbooks, manuals, multimedia resources, visual aids, and even internet connections. Moreover, providing teachers with relevant and accessible resources is essential for a deeper understanding of the students regarding climate action and all other related concepts. As one teacher stated, “Sufficient training and teaching materials for climate action must be provided,” highlighting both material and systemic gaps. Klinsky & Sagar (2023) emphasize that, alongside inadequate training for teachers, the limited technological resources and materials also hamper the endorsement of climate action. Therefore, resource development and knowledge sharing help to achieve the desired climate goals. As one teacher mentioned, “Teachers should attend seminars and training about SDG 13 (Climate Action) integration and be provided with adequate resources and materials”.

Student Engagement Challenges

Student disengagement plays a critical pedagogical challenge which may stem from various reasons, namely (1) topics being perceived as too complex, (2) overwhelming science lessons, (3) lack of cohesiveness between curriculum and local realities, and (4) no relevance to their daily lives. Therefore, teachers need to innovate their teaching methods to capture the interests of students and develop their critical thinking and problem-solving skills. Additionally, this approach will make climate action more relatable to students by engaging them in finding solutions to various climate problems and issues. As one recommendation emphasized, “there is a need to integrate climate change topics into existing science curricula through hands-on activities, real-world examples, and interdisciplinary projects while providing teacher training and fostering community engagement”. As cited by Monroe *et al.* (2019), teaching climate concepts must be personally relevant and meaningful among the students by providing relatable and local examples for them to achieve complete comprehension. By focusing on empathy, social responsibility, and practical applications, students will be more encouraged to participate in climate action initiatives (Bartlett *et al.*, 2022).

4.0 Conclusion

This study focused on the integration of SDG-13 (Climate Action) into Science Instruction, examining the level of preparedness of teachers, the support of the school, and the challenges faced in the integration of climate action. Findings revealed that a generally high level of teachers’ preparedness and active school efforts were evident in promoting climate awareness. However, familiarity with the SDG-13 framework remained notably low. Moderate positive correlations were observed between teacher preparedness and school support factors, namely guidelines, collaboration, resources, and external partnerships; however, a larger sample of participants is needed to further strengthen the findings. The study also disclosed the significant challenges that hinder the full implementation of climate education, namely a lack of training specific to SDG-13, limited access to resources and materials, and student disengagement in climate topics. These barriers reveal the immediate need for a tailored professional development program, contextualized and relevant resources, and engaging pedagogical strategies. Finally, the effective integration of SDG-13 into science education requires not only the willingness of teachers but also the deliberate alignment of policies, support systems, and curriculum advancements. The results of this study serve as a foundational basis for crafting a comprehensive climate education policy that highlights the significance of resource allocation, teacher-capacitation, and student-centered learning experiences to achieve a more responsive and climate-resilient future generation.

5.0 Contributions of Authors

The author was the sole person responsible for the conceptualization and design of the study, development of research instruments, data collection, data analysis and interpretation, and writing of the manuscript.

6.0 Funding

This research received no specific grant funding from any agency or institution.

7.0 Conflict of Interests

The author declares that there is no conflict of interest in the conduct of this study.

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