Green skills integration practices of student teachers and cooperating teachers among secondary schools: Basis for enhanced instructional plan

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Abstract
Student teachers and cooperating teachers are mandated to teach and impart to students the needed skills for them to become environmentally conscious citizens upholding sustainable and economical practices. With that, the present study compares the green skills integration practices of student teachers and their cooperating teachers among secondary schools in a province in the Philippines as a basis for an enhanced instructional plan. The study utilizes the comparative design of quantitative research, wherein a questionnaire is used to gather data from 100 respondents (50 student teachers and 50 cooperating teachers) who voluntarily participated in the study. The study is implemented among public secondary schools in a province in the Philippines where the student teachers are deployed. As partners in the internship program, the cooperating teachers of the student teachers are included to compare their integration practices. A questionnaire is used to measure the green skills integration in the teaching practices. Descriptive statistics (mean and standard deviation) and inferential statistics (independent samples t-test) are used to analyze and identify significant differences in their integration practices. Findings reveal that cooperating teachers are more engaged in integrating green skills than student teachers, highlighting the need for enhanced training and support. A comprehensive learning plan, including targeted training and curriculum integration, is recommended to promote sustainable practices in education.

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1. Introduction

In today's generation, students must be taught skills not only to succeed in life but also to be responsible citizens of the world by upholding economic and environmental-friendly practices for a sustainable future. Key to such advocacy is the teaching of green skills among students at an early age.

Green skills are a set of competencies necessary for creating, manufacturing, overseeing, and managing green technologies. These competencies include technical, analytical, and problem-solving skills for promoting innovation and managing environmentally-friendly technology (Likhitha & Srinivas, 2023; Paeradigms, 2024). Green skills are increasingly recognized for promoting sustainability and addressing climate change challenges. These skills are vital for reducing environmental impact and contributing to a more just and equitable society (UNESCO, 2022; UNESCO & UNEVOC, 2017; UNIDO, 2022, as cited in Fuchs, 2024). As the world strives for sustainable development across social, economic, and environmental spheres, the demand for green skills grows (Sern et al., 2017).

Research has identified several key components of green skills. These include technological knowledge, waste management knowledge, problem-solving and critical thinking abilities, behavior, and awareness (Ibrahim et al., 2020). Furthermore, topics like carbon management, resource efficiency, environmental management, green product development, and sustainability communication are also identified as essential components of green skills (Renfors, 2024). Institutions implementing green practices must have these elements to lessen the consequences of greenhouse gas emissions and climate change.

In the education sector, a curriculum that incorporates green skills is crucial to achieving sustainability objectives. In order to prepare future professionals to address environmental concerns and promote sustainable practices, educational institutions and their initiatives are essential (Paeradigms, 2024). Teachers are critical in teaching students the green skills and cultivating a holistic sustainability viewpoint. By incorporating green skills across various disciplines, teachers can inspire students to adopt environmentally friendly practices and

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contribute to environmental preservation (Kamis et al., 2017). However, a significant research gap exists regarding applying green skills in education and their influence on sustainability transitions (Fuchs, 2024).

Despite the growing recognition of green skills, there remains a lack of clarity on what they entail and how they differ from other sustainability competencies (Wegenberger & Ponocny, 2025). Additionally, integrating green skills into education faces obstacles, including the need for qualified teachers and the ability to apply these skills in real-world settings (Kamis et al., 2017). Previous studies have focused on various aspects of green skills integration, such as technical-vocational education (Fuchs, 2024; Ismail et al., 2017; James et al., 2023), tourism education (Renfors, 2024), faculty perspectives in higher education institutions (Hamid et al., 2019), environmental education in teacher education programs (Cruz et al., 2022), students' perspectives from business programs (Balcarova et al., 2023), green technology awareness and practices of college students (Gonzaga, 2016), and environmental literacy of pre-service teachers (Manguil, 2024). However, few studies have addressed the teaching of green skills at the secondary level (Kamis et al., 2017), especially comparing the practices of student teachers and their cooperating teachers, highlighting a gap that needs to be addressed.

In the Philippines, teachers need to reinforce green skills education, given the country's high vulnerability to disasters and climate change impacts (Cruz, 2024; The World Bank Group, 2021; Salas, 2025). Educational institutions must prepare the population for these challenges through rigorous education and community action. Public school teachers in the Philippines are also mandated to teach green skills for sustainable development. The value of environmental love, "*makakalikasan*," is part of the National Motto (Republic Act No. 8491) and is taught to students (DepEd Order No. 36, s. 2013). Environmental education is strengthened through Republic Act No. 9512 and DepEd Order No. 52, s. 2011. The Department of Education (DepEd) supports green practices among schools (DepEd, 2021), integrating programs like school gardens, waste management, and tree planting under the National Greening Program (DepEd Order No. 5, s. 2014; Executive Order No. 26, s. 2011; Executive Order No. 193, s. 2015), emphasizing green education and sustainable development goals (SDGs).

Indeed, teachers' capability to integrate the said green skills is crucial. They should be trained and be provided with technical assistance if needed. It is essential to have interdisciplinary approaches and active teacher involvement in sustainability education to prepare students for future challenges (Abo-Khalil, 2024). A pro-environmental school culture enhances student engagement and sustainability despite challenges in participation (Yli-Panula et al., 2022; Tanubrata et al., 2024). Indeed, teachers are crucial in promoting sustainable development, requiring a reorientation of teacher education to emphasize systems thinking and citizen participation (Ferguson et al., 2021).

In practice, pre-service and in-service teachers must be oriented and trained to integrate green skills effectively. In the Student Internship Program in the Philippines (SIPP), which provides student teachers with practical learning experiences in host training establishments (HTEs) or cooperating schools (CMO No. 104, s. 2017), future teachers are trained to integrate into their classroom practices the necessary skills needed to develop among 21st century students as also prescribed by the professional standards for Filipino teachers (DepEd Order 42, s. 2017). These opportunities allow student teachers to create sustainable teaching resources and put their green skills to use. Pre-service and in-service teachers, however, have difficulty incorporating these resources successfully, which emphasizes the need for improved lesson integration that emphasize sustainable behaviors and green skills.

With this information and intention, the present study compares the green skills integration practices of student teachers and their cooperating teachers among secondary schools in a province in the Philippines as a basis for an enhanced instructional plan. After describing their practices and determining whether significant differences exist, an enhanced instructional plan is developed, considering the needs of student teachers and their cooperating teachers.

The study posits novelty in the sense that the integration of green skills in public secondary classrooms by comparing the student teachers' and cooperating teachers' perspectives is limitedly explored. The development of an enhanced instructional plan is also unique in the study as it provides a responsive and contextualized approach to addressing the needs incurred for better instructional practices.

2. Method

The study utilizes the comparative design of quantitative research by comparing the practices of both student teachers and their cooperating teachers in integrating the teaching of green skills to their students among public secondary schools. Comparative research examines similarities and differences between cases to describe, explore, and explain their characteristics (Iranifard & Latifnejad Roudsari, 2022) (Figure1). Using a survey questionnaire, the analysis compares student teachers' and cooperating teachers' practices in integrating green skills. After data gathering, the data gathered are analyzed using an independent samples t-test. After the analysis, an enhanced instructional plan is proposed, considering the study's results.

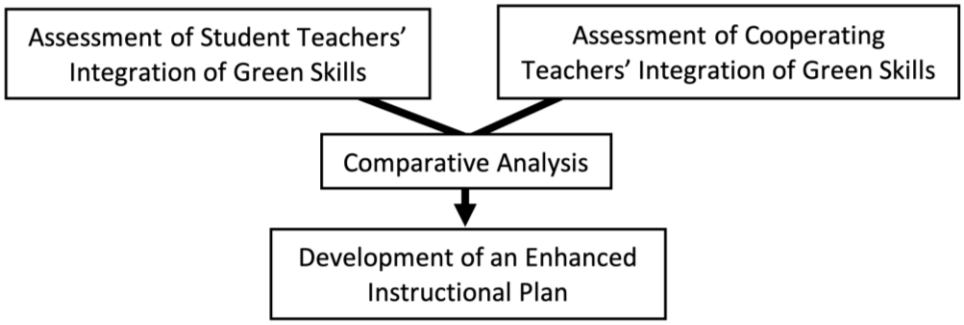

Figure 1. Paradigm of the Study

One hundred (100) individuals voluntarily participated in the study, comprising fifty (50) student teachers and fifty (50) cooperating teachers from select public secondary schools in a province in the Philippines.

A survey questionnaire is the primary data-gathering tool to solicit the needed information from the target respondents. The present study utilizes Part I of the questionnaire measuring the integration of the green skills developed by the researchers, which has an overall alpha of 0.962 (Excellent). In contrast, the Part II measuring the advocacies for green skills has not been used. The Part I used in this study has a separate Cronbach Alpha of 0.941, indicating that it is also highly reliable for the target respondents.

Descriptive statistics, such as mean and standard deviation, are used to analyze the practices of both student teachers and their cooperating teachers in integrating the teaching of green skills in their respective classes. More so, inferential statistics, such as the independent samples t-test, is used to probe possible significant differences between the integration practices of student teachers and their cooperating teachers in improving their students' green skills.

3. Results and Discussion

The survey questionnaire is responded by 100 individuals, 50 student teachers and 50 cooperating teachers among public secondary schools in a province in the Philippines.

3.1. Green Skills Integration Practices of Student Teachers and Cooperating Teachers

This section presents the integration practices of student teachers and cooperating teachers in teaching green skills among students in the public secondary schools where they are deployed and stationed, respectively (Table 1).

Table 1.Green Skills Integration Practices of Student Teachers and Cooperating Teachers

Items		Mean [Interpretation]			SD
		CT	ST	C	
1.	Create activities and initiatives highlighting environmentally conscious behavior and sustainable methods to incorporate green skills into the lesson plans.	2.54 [P]	1.84 [LP]	2.19 [LP]	0.49
2.	Provide practical assignments and agreed tasks that let students use their green knowledge, including starting school recycling programs or energy-saving projects.	2.60 [P]	1.86 [LP]	2.23 [LP]	0.52
3.	Use research-based information, studies, and actual situations to demonstrate the value of green talents across various sectors and professions.	2.58 [P]	1.88 [LP]	2.23 [LP]	0.49
4.	Pose environmental problems to students and help them devise green solutions to foster their critical thinking and problem-solving abilities.	2.66 [P]	2.06 [LP]	2.36 [LP]	0.42
5.	Incorporate educational technology, such as modeling environmental implications through simulations, video presentations, and sustainable technology integration, to enhance the teaching of green skills in the classroom.	2.48 [LP]	1.94 [LP]	2.21 [LP]	0.38
6.	Encourage participative, experiential, and immersive learning experiences where students conduct research and give presentations on green practices and technologies in groups.	2.58 [P]	2.22 [LP]	2.40 [LP]	0.25
7.	Integrate green skills within and across curriculum areas to encourage interdisciplinary and multidisciplinary learning and provide thorough knowledge.	2.68 [P]	2.40 [LP]	2.54 [P]	0.20
8.	Invite guest speakers/resource persons from green industries to share their experiences and perspectives.	1.82 [LP]	2.02 [LP]	1.92 [LP]	0.14
9.	Gain firsthand knowledge of green skills by establishing an environment in the classroom that exemplifies green practices, such as using eco-friendly products, reducing trash, and conserving energy.	2.70 [P]	1.92 [LP]	2.31 [LP]	0.55
10.	Encourage students to apply their knowledge meaningfully through projects, presentations, and reflective diaries to evaluate their grasp of green skills.	2.14 [LP]	2.54 [P]	2.34 [LP]	0.28
Composite		2.48	2.07	2.27	0.29

Items	Mean [Interpretation] CT [LP]	ST [LP]	C [LP]	SD

Scale of Means: 4 [3.26-4.00 Always | Highly Practiced (HP)], 3 [2.51-3.25 Often | Practiced (P)], 2 [1.76-2.50 Seldom | Less Practiced (LP)], 1 (1.00-1.75 Never | Not Practiced (NP)]
Legend: CT (Cooperating Teachers), ST (Student Teachers), C (Combined), SD (Standard Deviation)

The study reveals that cooperating teachers (CT) practice green skills integration more frequently than student teachers (ST). For instance, CTs often create activities highlighting environmentally conscious behavior (Mean=2.54; Practiced), while STs do so less frequently (Mean=1.84; Less Practiced). Both groups seldom provide practical assignments that allow students to use their green knowledge, with CTs scoring (Mean=2.60; Practiced) and STs (Mean=1.86; Less Practiced). CTs also tend to use research-based information to demonstrate the value of green talents (Mean=2.58; Practiced), whereas STs do this less often (Mean=1.88; Less Practiced). When posing environmental problems to foster critical thinking, CTs score higher (Mean=2.66; Practiced) than STs (Mean=2.06; Practiced). Regarding incorporating educational technology, both groups score fairly similarly, with CTs at (Mean=2.48; Less Practiced) and STs at (Mean=1.94; Less Practiced). CTs encourage participative learning experiences more frequently (Mean=2.58; Practiced) than STs (Mean=2.22; Less Practiced). Both groups integrate green skills within and across curriculum areas, with CTs scoring (Mean=2.68; Practiced) and STs (Mean=2.40; Less Practiced). Inviting guest speakers is less practiced by both, with CTs at (Mean=1.82; Less Practiced) and STs at (Mean=2.02; Less Practiced). CTs more frequently establish classroom environments exemplifying green practices (Mean=2.70; Practiced) compared to STs (Mean=1.92; Less Practiced). However, STs encourage students to apply green skills knowledge through projects more often (Mean=2.54; Practiced) than CTs (Mean=2.14; Less Practiced).

When the responses of student teachers and cooperating teachers are combined, they practiced integrating green skills within and across curriculum areas to encourage interdisciplinary and multidisciplinary learning and provide thorough knowledge (Mean=2.54; SD=0.20). Meanwhile, they less practiced the following: encouraging participative, experiential, and immersive learning experiences where students conduct research and give presentations on green practices and technologies in groups (Mean=2.40; SD=0.25); posing environmental problems to students and help them devise green solutions to foster their critical thinking and problem-solving abilities (Mean=2.36; SD=0.42); encouraging students to apply their knowledge meaningfully through projects, presentations, and reflective diaries to evaluate their grasp of green skills (Mean=2.34; SD=0.28); gaining firsthand knowledge of green skills by establishing an environment in the classroom that exemplifies green practices, such as using eco-friendly products, reducing trash, and conserving energy (Mean=2.31; SD=0.55); providing practical assignments and agreed tasks that let students use their green knowledge, including starting school recycling programs or energy-saving projects (Mean=2.23; SD=0.52); using research-based information, studies, and actual situations to demonstrate the value of green talents across various sectors and professions (Mean=2.23; SD=0.49); incorporating educational technology, such as modeling environmental implications through simulations, video presentations, and sustainable technology integration, to enhance the teaching of green skills in the classroom (Mean=2.21; SD=0.38); creating activities and initiatives highlighting environmentally conscious behavior and sustainable methods to incorporate green skills into the lesson plans (Mean=2.19; SD=0.49); and inviting guest speakers/resource persons from green industries to share their experiences and perspectives (Mean=1.92; SD=0.14). Overall, the composite scores indicate that green skills integration is less practiced by both groups (Mean=2.27; SD=0.29), with CTs at (Mean=2.48; Less Practiced) and STs at (Mean=2.07; Less Practiced).

The results indicate that cooperating teachers generally demonstrate a higher level of engagement in integrating green skills into their teaching practices than student teachers. While both groups show some commitment to promoting sustainability, the practices are not yet consistently or frequently implemented. More training and assistance are required to incorporate green skills into educational environments since this indicates that student teachers and cooperating teachers need to be prepared to encourage environmentally conscious conduct in their students. This aligns with literature highlighting the role of leadership and professional development in promoting sustainable education practices (Akinsemolu & Onyeaka, 2025; Alzoraiki et al., 2023; Monika, 2024).

3.2. Comparison Between the Green Skills Integration Practices of Student Teachers and Cooperating Teachers

This section presents the comparison between the integration practices of student teachers and cooperating teachers in teaching green skills among students in the public secondary schools (Table 2).

Table 2.Comparison Between the Green Skills Integration Practices of Student Teachers and Cooperating Teachers

Group	Mean	SD	t-value	p-value	Remarks | Decision
Cooperating Teachers	2.48	1.00	3.50	0.00	Significant | Do Not Accept H_0
Student Teachers	2.07	0.87			

The table compares green skills integration practices between cooperating teachers and student teachers. The mean scores indicate that cooperating teachers (Mean=2.48; SD=1.00) are more engaged in integrating green skills than student teachers (Mean=2.07; SD=0.87). Given the statistical significance of the difference indicated by the t-value of 3.50 and the p-value of 0.00, which is lower than the 0.05 alpha, the null hypothesis (H0) is rejected. Indeed, cooperating teachers show significantly higher engagement in integrating green skills into their teaching practices than student teachers. The results show that cooperating teachers are more engaged in integrating green skills than student teachers, aligning with literature highlighting student teachers' challenges in promoting climate change education (Yli-Panula et al., 2022).

3.3. Enhanced Instructional Plan

The comprehensive learning plan aims to enhance the integration of green skills in educational settings by focusing on targeted training programs for teachers, mentorship initiatives that pair student teachers with experienced cooperating teachers and embedding green skills into the core curriculum. This approach ensures that student teachers and cooperating teachers are well-equipped to promote environmental awareness and sustainable practices, fostering a culture of sustainability throughout the educational system. The instructional plan can be seen in Table 3

Table 3. Instructional Plan

Objectives	Activities	Resources Needed	Expected Outcome / Output
Enhance Teacher Competency	Develop and conduct targeted training programs for student teachers and cooperating on green skills.	Training materials, expert trainers, funding for workshops.	Teachers equipped with knowledge and skills to integrate green practices into teaching.
Foster Mentorship and Collaboration	Establish mentorship programs pairing student teachers with experienced cooperating teachers.	Structured mentorship guidelines, time allocation for mentorship activities.	Improved practical skills and confidence in student teachers to implement green skills.
Integrate Green Skills into Curriculum	Embed green skills and sustainability topics into the core curriculum.	Curriculum development resources, teacher training on new content.	Consistent integration of green skills across all educational levels and subjects.
Promote Environmental Awareness	Organize workshops and seminars on environmental sustainability for students and teachers.	Guest speakers, educational resources, event planning.	Increased awareness and engagement in environmental issues among the school community.
Monitor and Evaluate Progress	Implement assessment tools to track the integration and impact of green skills.	Evaluation frameworks, data collection tools.	Data-driven insights to refine and improve green skills integration strategies.

4. Conclusion

The findings reveal that cooperating teachers are significantly more engaged in integrating green skills into their teaching practices than student teachers, highlighting the need for enhanced training and support to foster environmentally conscious behavior in educational settings. To enhance the integration of green skills in educational settings, the study develops a comprehensive learning plan that includes targeted training programs for teachers, mentorship initiatives pairing student teachers with experienced cooperating teachers, and embedding green skills into the core curriculum to ensure consistent implementation.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

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Declaration of Conflicting Interests

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