

Green Skills Integration in Technology and Livelihood Education (TLE): Basis for the Development of a Framework and Enhancement Program toward Future-Ready Learners

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ABSTRACT

This study investigated the integration of green skills in Technology and Livelihood Education (TLE) in public secondary schools, in line with Republic Act No. 9512 and the initiatives of the Department of Education.

To achieve this, a descriptive-correlational design was employed using a validated questionnaire administered to TLE teachers and students. Data were analyzed using weighted mean and Pearson product-moment correlation.

Findings revealed that teachers were moderately ready to integrate green skills (WM = 3.39), with strong conceptual knowledge but limited training exposure (WM = 2.61). Teaching strategies and resources were often used (WM = 4.05), particularly in promoting applied sustainability practices (WM = 4.49). Students demonstrated positive perceptions (WM = 3.51), recognizing the relevance of green skills to future careers (WM = 3.63). Teachers encountered moderate challenges (WM = 3.21), mainly due to insufficient resources (WM = 3.58), while students reported slight challenges (WM = 2.34). No significant relationship was found between teachers' readiness and students' perceptions ($r = 0.029$, $p > 0.05$), nor between teaching strategies and perceptions ($r = -0.055$, $p > 0.05$).

Furthermore, the findings highlight the need for enhanced training, resource provision, and policy-aligned interventions.

Keywords: Green Skills, TLE, Teacher Readiness, Sustainability Education, Student Perception, Philippines

INTRODUCTION

Education in the 21st century faces the challenge of preparing learners not only with technical competencies but also with sustainability-oriented knowledge and values. With the increasing global concern for environmental protection, climate change mitigation, and sustainable development, there is a growing demand for individuals who possess green skills—competencies that promote environmental responsibility, efficient resource management, and sustainable production practices. These competencies are considered essential in preparing future generations to participate in a green economy and contribute to sustainable communities.

In the Philippine educational system, Technology and Livelihood Education (TLE) plays a vital role in developing learners' practical, technical, and entrepreneurial skills. Through its different specialization areas, such as Information and Communication Technology (ICT), Electrical Installation and Maintenance (EIM), Cookery, and Housekeeping, TLE equips students with competencies that are directly applicable to employment and livelihood opportunities. However, with the evolving global workforce and the increasing demand for environmentally responsible practices, there is a need to strengthen the integration of sustainability principles within TLE instruction.

The Philippine government has recognized the importance of sustainability education through policies such as Republic Act No. 9512, also known as the Environmental Awareness and Education Act, and the Department of

Education's Greening the Curriculum initiative. These policies emphasize the integration of environmental awareness and sustainable practices across learning areas. Despite these initiatives, studies indicate that the implementation of sustainability concepts in classroom instruction remains inconsistent, particularly in technical and vocational subjects.

The green skills gap is the difference between the environmental skills needed for sustainable development and the skills that teachers and students actually have. This gap shows that we need to include knowledge, attitudes, and practices about sustainability in education, especially in Technology and Livelihood Education (TLE), to get future generations ready to be responsible for the environment. The integration of green skills in education has become increasingly essential in the 21st century due to global environmental challenges. Technology and Livelihood Education (TLE), being a practical and skills-oriented subject, plays a crucial role in equipping learners with sustainable competencies. However, there remains a significant gap in the effective integration of sustainability concepts, particularly in terms of teacher readiness, instructional strategies, and student outcomes. This study, therefore, aims to investigate the integration of green skills in TLE and propose a framework that can contribute to the development of future-ready learners who are technically competent, environmentally responsible, and adaptable to the demands of a sustainable society.

METHODOLOGY

Research Design

This study employed a descriptive–correlational research design to examine the integration of green skills in Technology and Livelihood Education (TLE). The descriptive component of the study aimed to determine the current status of teachers' readiness, teaching strategies and resources, students' perceptions, and the challenges encountered in integrating green skills in TLE instruction.

Meanwhile, the correlational component sought to determine whether significant relationships exist between selected variables, particularly between teachers' readiness and students' perceptions, teaching strategies and resources and students' perceptions, and teachers' readiness and instructional practices.

The use of a descriptive–correlational design was appropriate for this study because it allowed the researcher to describe existing conditions and examine relationships among variables without manipulating them. According to Calderon and Gonzales (2020), descriptive research is widely used in educational studies to obtain factual information about current conditions, practices, and attitudes, while correlational research helps determine the degree of relationship between variables.

Through this research design, the study aimed to provide a comprehensive understanding of how green skills are integrated in TLE instruction and how these practices contribute to the development of sustainability competencies among students.

Reyes et al. (2019) elucidate that descriptive research facilitates the collection of factual data regarding individuals' behaviors, attitudes, and problems, but developmental research transcends mere description by building models or programs that respond to the recognized needs.

Research Locale

Schools	Teachers	Students	Total
School A	15	60	75
School B	25	80	105
School C	30	100	130

School D	20	80	100
Total	80	320	400

Figure 1. Respondents of the Study

This study was conducted in selected public high schools in Caloocan City that offer Technology and Livelihood Education (TLE). These schools were chosen due to the presence of established TLE programs and their accessibility to students from diverse socio-economic backgrounds. Such diversity makes these schools suitable venues for examining the integration of green skills within TLE instruction.

Caloocan City is recognized as one of the highly urbanized areas in Metro Manila, comprising residential, commercial, and industrial zones. This setting exposes learners to varied community needs and real-life contexts, allowing for a more comprehensive understanding of how both teachers and students engage with sustainability practices in TLE.

School A is a public high school found in Caloocan City, Philippines, and it operates under the Schools Division Office of Caloocan City. The creation of this was tied to the 1975 Reorganization Plan, which brought local municipal schools into the city system. The school helps a big city community and works together with local, regional, and national partners to improve education.

School B is located in North Caloocan City and became its own national high school after splitting from a previous annex campus. It serves students in its community and aims to provide easy-to-reach and good secondary education through the Schools Division Office of Caloocan City.

School C is a public high school in North Caloocan that was created to meet the growing educational needs of the local community. It became its own school in the 1970s and has been growing ever since, adding more buildings and facilities to support the increasing number of students.

School D is a public high school that started in 1967 and is found in Caloocan City. It provides programs for both Junior and Senior High School, along with specialized academic paths that cater to different learning needs. The school is known for doing well academically and for helping students grow in the division.

The selected schools served as a practical setting for the study, providing insights into the strengths and limitations of urban public school implementation of TLE. The findings of the study are expected to contribute to a deeper understanding of the current state of TLE instruction and to inform strategies for integrating green skills effectively. While the results are primarily applicable to the selected schools in Caloocan City, they may also serve as a reference for other institutions in similar urban contexts.

Participants of the Study

This study involved two groups of participants from selected public secondary schools in Caloocan City that offer Technology and Livelihood Education (TLE). The respondents consisted of Technology and Livelihood Education (TLE) teachers and Junior High School students who were currently enrolled in TLE subjects during the School Year 2025–2026.

The total population of the selected schools consisted of 80 TLE teachers and 320 students, for a total population of 400 respondents. Since all identified respondents participated in the study, the response rate was 100%. The teacher-respondents were composed of 80 TLE teachers who were actively teaching TLE specialization areas such as Information and Communication Technology (ICT), Electrical Installation and Maintenance (EIM), Cookery, and Housekeeping. Their participation was essential in determining the level of teachers' readiness, instructional strategies, available resources, and the challenges encountered in integrating green skills into TLE instruction.

The student-respondents were composed of 320 Junior High School students from Grades 7 to 10 who were currently taking TLE subjects. These students were selected to provide insights regarding their perceptions of green skills integration and their level of future readiness in relation to sustainability practices and environmental awareness.

The total number of respondents included in the study was 400 participants, consisting of 80 teachers and 320 students. The sample size was determined using the Raosoft sample size calculator, which is widely used in educational research to identify an appropriate number of respondents that can produce reliable and representative results. The computation was based on a 95% confidence level and a 5% margin of error, ensuring that the selected sample adequately represents the population of TLE teachers and students in the selected schools.

Through the participation of both teachers and students, the study was able to gather comprehensive data on the integration of green skills in Technology and Livelihood Education, allowing for a deeper understanding of instructional practices, learner perceptions, and the development of future-ready competencies among students.

Sampling Technique

When it comes to choosing the participants, the study was used both a purposive sampling and stratified random sampling. A stratified random sampling technique was employed to ensure representation from different schools offering TLE. Respondents were grouped according to school, and proportional sampling was applied. A purposive sampling technique will be used to select respondents who are directly involved in the delivery and experience of TLE instruction. The sample size was determined based on the total population of teachers and students in the chosen schools. The researcher was choosing teachers and students who are most connected to the study and can give the best insights about including green skills. Rather than picking anyone who's free, the participants are selected thoughtfully based on their experience, job, and how well they can add value to the research.

The study used Raosoft's method for figuring out how many samples to take, along with a targeted way of choosing participants, to make sure the data collected was trustworthy and really important. This approach ensured that both teachers and students have their views included when creating the framework for adding green skills into TLE.

Research Instrument

A structured questionnaire was developed by the researcher to gather data on teacher readiness, current teaching strategies and resources, students' perceptions, and the challenges encountered in integrating green skills into Technology and Livelihood Education (TLE). The research instrument underwent content validation by three experts in education and sustainability; the Education Program Supervisor (EPS) in TLE of the Schools Division Office (SDO) Caloocan, a research adviser, and a PhD student specializing in English Language Education, ensuring clarity, appropriateness of content, and grammatical accuracy. In addition, the questionnaire was reviewed by a (PSDS) from Caloocan City to ensure the validity of its measurement design and statistical suitability.

To establish reliability, the instrument was pilot-tested and achieved a Cronbach's alpha coefficient. All values exceeded the acceptable threshold of 0.93, indicating that the instrument is reliable. These validation and reliability procedures ensured that the instrument was both valid and dependable for data collection in the study.

To establish the reliability of the research instrument, a pilot test was conducted among respondents who were not included in the actual study. The reliability analysis yielded the following Cronbach's alpha coefficients: Teacher Readiness Scale, Teaching Strategies and Resources, Student Perception Scale, Teacher Challenges Scale, and Student Challenges Scale. All coefficients exceeded the acceptable threshold of 0.93, indicating satisfactory internal consistency and reliability of the instrument.

The research instrument is composed of six main parts designed to gather comprehensive quantitative data relevant to the study. Part I focuses on the respondent profile and collects the demographic information of both teachers and students. For teachers, this includes sex, age, years of teaching experience, highest educational attainment, and TLE specialization or area taught, while for students, it includes sex and grade level. This section serves purely descriptive purposes in characterizing the respondents.

Part II examines teachers' readiness in integrating green skills in Technology and Livelihood Education (TLE). It assesses their knowledge of green skills concepts, confidence in integration, exposure to training and professional development, willingness to adopt green teaching strategies, and preparedness to guide students in sustainability practices. A 5-point Likert scale is used to measure the level of agreement of the respondents.

Part III determines the teaching strategies and resources used by teachers in integrating green skills. It covers the use of project-based learning, integration of environmental issues into lessons, utilization of instructional materials that support sustainability, encouragement of students to apply green skills, and the availability of teaching resources. This section also uses a 5-point Likert scale to measure the frequency of practice.

Part IV identifies the challenges encountered in integrating green skills into TLE, including lack of training or professional development, insufficient instructional materials and resources, limited time for integration, lack of administrative support, low student interest in environmental topics, insufficient budget and facilities, and curriculum limitations. Responses are measured using a 5-point scale to determine the severity of each challenge.

Part V focuses on students' perceptions of green skills integration in their TLE classes. It assesses environmental awareness, perceived importance of green skills for future careers, engagement and interest in sustainability lessons, ability to apply learning in environmental protection, and motivation when sustainability topics are included. A 5-point Likert scale is likewise used to determine their level of agreement.

Part VI, which is aligned with recent panel recommendations, evaluates students' future readiness as influenced by green skills integration. It measures sustainability competencies, employability skills, adaptability to change, as well as innovation and creativity, ensuring alignment with the study's goal of developing future-ready learners.

Overall, the instrument was designed to systematically gather quantitative data on teachers' readiness, teaching strategies, challenges, and students' perceptions of green skills integration in TLE, while also assessing students' future readiness. The results were served as a basis for proposing a framework to strengthen sustainable education practices.

Data Gathering Procedure



Figure 2. Diagram of Data Gathering Procedure

The researcher implemented the subsequent steps to guarantee valid and reliable outcomes. The researcher employed a systematic methodology to gather the requisite data for the investigation. Initially, authorization was

secured from the school administrators of the chosen public high schools in Caloocan City, guaranteeing that the study was executed with appropriate consent and backing from the school authorities.

Prior to data collection, permission to conduct the study was secured from the school heads of the participating schools. All participants were informed about the purpose of the study, voluntary participation, confidentiality of responses, and their right to withdraw at any time without penalty. Written informed consent was obtained from teacher participants, while parental consent and student assent were secured for student respondents. The study complied with ethical standards for educational research. An official letter of request was submitted to the school administrators to obtain permission for conducting the study. Following the receipt of consent, the researcher established a timetable for the dissemination of survey questionnaires to the participants. Upon receiving approval, the questionnaires were disseminated to the chosen respondents. Ethical considerations, including confidentiality, voluntary involvement, and informed consent, were rigorously upheld. The participants were TLE educators instructing Technology and Livelihood Education courses, together with students registered in TLE classes for the academic year 2025–2026.

Prior to distributing the questionnaires, the researcher elucidated the study's objective and furnished directions on how to complete the instrument. Participants were assured that their replies would be kept anonymous and utilized exclusively for academic purposes. The survey was segmented into categories to collect thorough information. The initial section gathered demographic information from the respondents, including age, gender, grade level, teaching experience, highest educational qualification, and TLE specialization. The subsequent sections analyzed educators' preparedness to incorporate green skills, the pedagogical strategies and resources employed, students' perspectives of green skills integration, and the obstacles faced by both educators and students. The concluding session permitted participants to offer more observations or recommendations.

The questionnaires were administered face-to-face during the second semester of School Year 2025–2026. Teachers completed the survey during scheduled departmental meetings, while students answered the questionnaire during their TLE classes under the supervision of the researcher and classroom teachers. The average completion time ranged from 15–20 minutes. Completed questionnaires were collected immediately after administration to ensure a high retrieval rate. The researcher directly administered the questionnaires to guarantee that the respondents comprehended the instructions completely. Educators facilitated the dissemination of the survey during class to promote increased student engagement. Respondents were provided ample time to complete the questionnaires at their convenience, ensuring submission by the specified deadline.

Upon recovery, the finalized questionnaires were gathered and examined for thoroughness and precision. The data were subsequently organized, coded, and readied for analysis. When responses were ambiguous or insufficient, clarification was requested from the respondents to guarantee the precision and dependability of the final data set.

During the data gathering procedure, ethical principles were rigorously maintained, encompassing voluntary participation, confidentiality of information, and respect for respondents' perspectives. Prior to completing the questionnaire, participants were apprised of the study's objectives, methodologies, potential risks and benefits, their ability to decline or withdraw from participation, and the guarantee of anonymity. By signing the consent form, they demonstrated their voluntary involvement and comprehension that their responses would be kept confidential. The researcher guaranteed adherence to these processes to acquire precise and dependable data that would facilitate the formulation of a framework for incorporating green skills into TLE.

RESULTS AND DISCUSSION

This chapter presented the findings of the study based on the data gathered from the respondents. It provided a systematic analysis and interpretation of the results in relation to the research questions and objectives. The chapter discussed the respondents' profile, teachers' readiness in integrating green skills, teaching strategies and resources used in TLE, challenges encountered, students' perceptions, and their future readiness. Each result was carefully interpreted and supported with relevant literature to provide a clear understanding of the study's implications in enhancing the integration of green skills in Technology and Livelihood Education.

A. Profile of the Teachers

Table 1.1 Gender Representation among TLE Teachers

Category	Frequency (f)	Percentage (%)
Female	67	83.75%
Male	13	16.25%
Total	80	100.00%

Table 1.1 presents that the respondent pool is heavily female-dominated, with women making up 83.75% of the teaching force surveyed. In terms of sex, the majority of the respondents are female, comprising 67 or 83.75% of the total population, while only 13 or 16.25% are male. This indicates that the teaching workforce in Technology and Livelihood Education (TLE) is predominantly female.

The results show that most TLE teachers are female (83.75%), indicating a female-dominated workforce. This aligns with global and local trends where teaching, particularly in technical-vocational and Home Economics-related fields, is commonly dominated by women (UNESCO, 2021; OECD, 2020). This suggests that gender distribution in TLE reflects broader workforce patterns in education rather than being unique to the study context.

Training and programs for green skills should take into account the teaching experiences and strengths of the majority of female teachers. In order to have a more balanced viewpoint and method of instruction, schools might also urge more male teachers to join TLE.

Table 1.2 Age Demographics of Respondents

Category	Frequency (f)	Percentage (%)
46 & above	28	35.00%
26 to 35	22	27.50%
36 to 45	19	23.75%
25 & below	11	13.75%
Total	80	100.00%

Table 1.2 shows that the workforce is mature and seasoned, with the largest segment (35%) aged 46 and above, ensuring a wealth of life experience in the classroom. With respect to age, the largest group of respondents falls under 46 years old and above, accounting for 28 or 35.00%. This is followed by those aged 26 to 35 years old with 22 respondents or 27.50%, and those aged 36 to 45 years old with 19 or 23.75%. The smallest group consists of teachers aged 25 years old and below, with 11 respondents or 13.75%. This suggests that a considerable portion of the respondents are relatively mature and experienced educators.

This supports Darling-Hammond et al. (2020) and Avalos (2019), who emphasize that experienced teachers generally possess stronger pedagogical competence and classroom management skills, which are essential in integrating new approaches such as green skills and sustainability education.

Veteran teachers are good at teaching the fundamentals, but they might require extra help with newer subjects like green skills. Schools need to offer training that helps teachers get used to new ways of teaching, particularly when it comes to sustainability.

Table 1.3 Professional Longevity and Experience

Category	Frequency (f)	Percentage (%)
11 to 20 years	32	40.00%
5 & below	20	25.00%
21 or higher	17	21.25%
6 to 10 years	11	13.75%
Total	80	100.00%

Table 1.3 presents a significant 40% of teachers have between 11 to 20 years of service, representing a stable and highly experienced middle-career group. In terms of years of teaching experience, most respondents have 11 to 20 years of experience, representing 32 or 40.00%. This is followed by those with 5 years and below (20 or 25.00%), and those with 21 years or higher (17 or 21.25%). The least number of respondents falls under 6 to 10 years of experience, with 11 or 13.75%. This implies that a significant number of teachers possess substantial teaching experience.

The result on teaching experience (11–20 years) further supports this. According to OECD (2020) and Cedefop (2022), experienced teachers are more adaptable to instructional innovation but still require targeted training when integrating emerging competencies such as Education for Sustainable Development (ESD).

Having experienced teachers is helpful because they can handle lessons smoothly. But they still need new training on green skills so they can mix their experience with fresh teaching ideas about sustainability.

Table 1.4 Academic Qualifications of the Teaching Staff

Category	Frequency (f)	Percentage (%)
Master's Degree	41	51.25%
Bachelor's Degree	35	43.75%
Doctorate Degree	4	5.00%
Total	80	100.00%

Table 1.4 shows that over half of the respondents (51.25%) have elevated their professional standing by earning a Master's Degree, reflecting a high commitment to academic excellence. Regarding highest educational attainment, more than half of the respondents (41 or 51.25%) have earned a Master's degree, while 35 or 43.75% hold a Bachelor's degree. Only a small proportion, 4 or 5.00%, have obtained a Doctorate degree. This indicates that most teachers have pursued graduate studies, which may contribute to their professional competence.

Most teachers hold master's degrees, which aligns with Avalos (2019) and UNESCO (2021), who highlighted that higher educational attainment improves instructional quality and supports curriculum innovation, particularly in sustainability integration.

Because teachers have a good education, they will find it easier to grasp and use green skills in their teaching. Schools should use this opportunity to provide specialized training on sustainability, helping them to get even better.

Table 1.5 Areas of Technical-Vocational Expertise

Category	Frequency (f)	Percentage (%)
Home Economics	52	65.00%
Others	13	16.25%
Industrial Arts	7	8.75%
ICT	6	7.50%
Agri/Fishery Arts	2	2.50%
Total	80	100.00%

Table 1.5 presents that the Home Economics is the primary area of expertise, with 65% of teachers specializing in this field, followed by a diverse group of 'Other' vocational disciplines. In terms of TLE specialization, the majority of respondents specialize in Home Economics, accounting for 52 or 65.00%. This is followed by those categorized under others (13 or 16.25%), which include Food and Beverage, Biology, Business Education, and Garments Trade. Industrial Arts (7 or 8.75%), ICT (6 or 7.50%), and Agriculture and Fishery Arts (2 or 2.50%) comprise smaller proportions. This suggests that Home Economics is the dominant area of specialization among the respondents.

In terms of specialization and subject taught, most teachers are in Home Economics. This is expected because sustainability concepts such as recycling, food management, and resource conservation are naturally embedded in this field (UNESCO-UNEVOC, 2021).

Because Home Economics covers sustainability topics, it's simpler to include green skills in this field. But other fields like ICT and Industrial Arts need to be improved too, so green skills can be included in all TLE subjects, not just one.

Table 1.6 Actual Subject Distribution in the Classroom

Category	Frequency (f)	Percentage (%)
Home Economics	56	70.00%
Industrial Arts	13	16.25%
ICT	9	11.25%
Agri/Fishery Arts	2	2.50%
Total	80	100.00%

Table 1.6 shows that the Home Economics remains the most taught subject at 70%, showing a slight increase over specialization—likely due to high student demand or curriculum requirements. Similarly, in terms of TLE area taught, most respondents are teaching Home Economics, with 56 or 70.00%. This is followed by Industrial Arts (13 or 16.25%) and ICT (9 or 11.25%), while only 2 or 2.50% are teaching Agriculture and Fishery Arts. This further confirms the prevalence of Home Economics as the primary teaching area in TLE.

Overall, the data reveal that the respondents are predominantly female, relatively experienced, and largely concentrated in the field of Home Economics, both in terms of specialization and teaching assignment, with most holding at least a Master's degree.

Since Home Economics is commonly taught, it serves as the primary way to teach eco-friendly skills. But schools should also include sustainability in other TLE subjects to provide students with a fuller learning experience.

B. Profile of the Students

Table 1.7 Gender Composition of Student Respondents

Sex	Frequency	Percentage (%)
Male	127	39.69%
Female	193	60.31%
TOTAL	320	100.00%

Table 1.7 shows that the student group is composed of 60.31% female and 39.69% male respondents, showing a higher participation rate among female students. In terms of sex, the majority of the respondents are female, comprising 193 or 60.31% of the total population, while 127 or 39.69% are male. This indicates that female students represent a larger proportion of the respondents in the study.

This aligns with studies indicating that female students often show higher participation in school-based surveys and activities (Eccles & Wigfield, 2020).

Since more female students participated, the results may reflect their opinions more. Teachers should make sure that both male and female students are equally engaged in green skills activities.

Table 1.8 Breakdown of Respondents by Grade Level

Grade Level	Frequency	Percentage (%)
Grade 7	112	35.00%
Grade 8	6	1.88%
Grade 9	2	0.63%
Grade 10	200	62.50%
TOTAL	320	100.00%

Table 1.8 presents that the vast majority of respondents are from Grade 10 (62.50%) and Grade 7 (35.00%), with minimal representation from the intermediate grade levels. With respect to grade level, most of the respondents are from Grade 10, accounting for 200 or 62.50% of the total sample. This is followed by Grade 7 students with 112 respondents or 35.00%. On the other hand, only a small number of respondents come from Grade 8 (6 or 1.88%) and Grade 9 (2 or 0.63%).

This distribution shows that the data are largely dominated by Grade 10 students, suggesting that the findings of the study may primarily reflect the perspectives of learners at this level. Meanwhile, the minimal representation from Grades 8 and 9 indicates limited participation from these groups, which may affect the generalizability of the results across all grade levels.

Female student-respondents dominate Grade 10, followed by Grade 7, with little participation from intermediate grades. Grade 10 responders predominate, suggesting the data are mostly from TLE-exposed students. The Department of Education curriculum expects higher grade levels to apply skills, especially sustainability, more advanced.

According to the Department of Education curriculum framework and OECD (2020), higher grade levels should exhibit greater applicable skills and real-world competency integration, including sustainability practices. Since Grade 10 students have greater TLE experience, the outcomes primarily reflect their opinions. Schools must teach green skills adequately in early grades so all children learn the same.

Integrated Discussion (Teachers and Students Profile)

The results reveal a straightforward connection between teachers and students. Most of the teachers are women who have a lot of experience and are well-educated, with many holding Master's degrees and years of teaching

under their belts. This means they have a solid base in teaching and can manage classroom instruction well. But, a lot of them are also focused on Home Economics, which naturally covers sustainability topics.

Most of the students who answered the survey are girls and mostly in Grade 10, so they have had more chances to learn about TLE and have some hands-on experience. As a result, students tend to grasp and value green skills better than younger learners do.

When we bring both groups together, it shows that there's a solid base for mixing in green skills: Teachers know their stuff and have a lot of experience; Students, particularly those in Grade 10, are old enough to grasp and use the ideas presented.

But there's also a mismatch: Most teachers come from the same area of expertise (Home Economics); Most of the students are in the same grade (10th grade) This means the results might not completely show everything for all TLE areas or all grade levels.

Teachers, already know a lot and have good training, so we shouldn't only look at the basic teaching skills anymore. Rather, schools ought to: Offer clear training on eco-friendly skills and sustainable practices; Get teachers from other TLE subjects (like ICT, Industrial Arts, and Agriculture) to include green skills in their lessons too; Help teachers by providing them with resources and materials, not just what is expected of them

Students, particularly those in higher grades, can already grasp and use green skills. But: Younger students in grades 7 to 9 need to see and experience more. Students require more practical activities instead of only talking about things. Students should learn in a steady way no matter what grade they're in.

The results show that both teachers and students are well-equipped to help incorporate green skills. But for it to work well, we need to focus on better training for teachers, making sure sustainability is part of all TLE areas, and giving students in every grade the same chances to learn and use green skills.

Table 2 The Level of Teachers' Readiness in Integrating Green Skills

STATEMENT	STANDARD DEVIATION	WEIGHTED MEAN	VERBAL INTERPRETATION
1. I know the basic concepts of green skills such as recycling, energy saving, and proper waste management.	0.54	3.70	<i>Highly Ready</i>
2. I am confident in integrating green skills into my TLE lesson.	0.60	3.50	<i>Highly Ready</i>
3. I attended training, seminars, or webinars about sustainability or environmental care.	0.92	2.61	<i>Moderately Ready</i>
4. I am willing to adopt new strategies to embed green skills in my teaching.	0.55	3.65	<i>Highly Ready</i>
5. I feel prepared to guide students in applying sustainability practices.	0.67	3.46	<i>Highly Ready</i>
AVERAGE WEIGHTED MEAN		3.39	<i>Moderately Ready</i>

Legend:

SCALE RANGE	VERBAL INTERPRETATION
4.21 – 5.00	Very Highly Ready / Always Used / Strongly Agree
3.41 – 4.20	Highly Ready / Often Used / Agree
2.61 – 3.40	Moderately Ready / Sometimes Used / Neutral
1.81 – 2.60	Slightly Ready / Rarely Used / Disagree
1.00 – 1.80	Not Ready / Never Used / Strongly Disagree

Table 2 shows the standard deviation, weighted mean, and verbal interpretation of green skill integration readiness among Technology and Livelihood Education teachers. The computed weighted mean of 3.39 with a verbal interpretation of Moderately Ready implies that teachers are averagely ready to teach green skills. While teachers appear equipped, they may benefit from more training and practical experience. The indicator “I know the basic concepts of green skills such as recycling, energy saving, and proper waste management” had the highest weighted mean of 3.70 with a standard deviation of 0.54, indicating Highly Ready.

This suggests teachers understand green skills well. Teachers were highly ready to accept new ways to embed green skills in education, with a weighted mean of 3.65 and a standard deviation of 0.55. This shows teachers are willing to innovate and implement environmental techniques.

“I am confident in integrating green skills into my TLE lesson” likewise had a Highly Ready interpretation, with a weighted mean of 3.50 and a standard deviation of 0.60, indicating that teachers feel confidence in using these concepts. The statement “I feel prepared to guide students in applying sustainability practices” had a weighted mean of 3.46 and a standard deviation of 0.67, suggesting Highly Ready readiness to help students study this topic.

The statement “I attended training, seminars, or webinars about sustainability or environmental care” had the lowest weighted mean of 2.61 and a greater standard deviation of 0.92, indicating Moderately Ready. This shows that teachers have little formal green skills training and respond differently. While teachers have strong knowledge and positive attitudes toward integrating green skills, their moderate readiness suggests they need more professional development opportunities, such as training and seminars, to better integrate sustainability concepts into TLE instruction.

This supports Cedefop (2022), UNESCO (2021), and Safee & Kosnan (2023), who found that while teachers understand sustainability ideas, many lack organized training for curricular integration. Knowledge and willingness were excellent among teachers. According to Vygotsky's (1978) constructivist theory and Wiek et al. (2019) and Pavlova & Chen (2019), teachers and students in developing sustainability competencies.

This supports Republic Act No. 9512, which requires teacher support for environmental education. Teachers already believe right and know how, therefore schools should focus on seminars, workshops, and training to improve their sustainability teaching.

Table 3 The Level of Teaching Strategies and Resources Used in TLE

STATEMENT	STANDARD DEVIATION	WEIGHTED MEAN	VERBAL INTERPRETATION
1. I use project-based learning activities related to sustainability.	0.61	3.95	<i>Often Used</i>
2. I integrate environmental issues (waste management, energy-saving, eco-friendly practices) into TLE topics.	0.62	4.15	<i>Often Used</i>
3. I use instructional materials (modules, videos, manuals) that highlight green practices.	0.76	3.95	<i>Often Used</i>
4. I encourage students to apply sustainability concepts in their projects.	0.67	4.49	<i>Always Used</i>
5. I have access to sufficient teaching resources for integrating green skills.	0.99	3.73	<i>Often Used</i>
AVERAGE WEIGHTED MEAN		4.05	<i>Often Used</i>

Legend:

SCALE RANGE	VERBAL INTERPRETATION
4.21 – 5.00	Very Highly Ready / Always Used / Strongly Agree
3.41 – 4.20	Highly Ready / Often Used / Agree
2.61 – 3.40	Moderately Ready / Sometimes Used / Neutral
1.81 – 2.60	Slightly Ready / Rarely Used / Disagree
1.00 – 1.80	Not Ready / Never Used / Strongly Disagree

Table 3 shows the standard deviation, weighted mean, and verbal interpretation of TLE teaching strategies and resources for green skills integration. The computed weighted mean of 4.05, interpreted as Often Used, shows that teachers use green skill teaching strategies and materials. This suggests a lot of sustainability-focused teaching. The indicator “I encourage students to apply sustainability concepts in their projects” had the highest weighted mean of 4.49 with a standard deviation of 0.67, interpreted as Always Used. This means teachers emphasize experiential and applied learning by encouraging students to apply green skills.

Including environmental issues in TLE subjects had a high weighted mean of 4.15 and a standard deviation of 0.62, indicating Often Used. This shows that teachers often teach waste management, energy saving, and eco-friendly behaviors. Both project-based learning activities connected to sustainability and instructional resources showcasing green practices had weighted averages of 3.95, with standard deviations of 0.61 and 0.76,

respectively, indicating Often Use. These findings recommend teachers use interactive and resource-supported methods to integrate green skills. Though still evaluated as Often Used, “I have access to sufficient teaching resources for integrating green skills” had the lowest weighted mean of 3.73 and a greater standard deviation of 0.99. This suggests that while resources are typically available, teachers may have different access, suggesting resource inequities.

The findings show that teachers use green skills integration strategies and resources. However, the comparatively low resource availability rating shows that sustainability-focused TLE education needs better access to suitable and consistent teaching resources. This shows that teachers are using sustainability-related strategies. Kolb (1984), Wiek et al. (2019), and Fitriyanto et al. (2021) agree that experiential and project-based learning develop green skills including critical thinking, teamwork, and environmental responsibility.

Resource scarcity remains a problem.

This agrees with OECD (2021), UNESCO (2021), and Safee & Kosnan (2023), who say lack of instructional materials and infrastructure hinders sustainability-focused education. This is crucial to the study. Teacher strategies are fine, but they require better tools and resources to improve.

Table 4 The Level of Student Perceptions of Green Skills Integration

STATEMENT	STANDARD DEVIATION	WEIGHTED MEAN	VERBAL INTERPRETATION
1. My TLE classes include activities that promote environmental awareness.	0.71	3.43	<i>Agree</i>
2. I believe green skills are important for my future career and livelihood.	0.66	3.63	<i>Agree</i>
3. I enjoy learning TLE lessons that involve sustainability practices.	0.65	3.48	<i>Agree</i>
4. I can apply what I learn in TLE to contribute to environmental protection.	0.65	3.59	<i>Agree</i>
5. I feel motivated when sustainability topics are included in TLE.	0.69	3.43	<i>Agree</i>
AVERAGE WEIGHTED MEAN		3.51	<i>Agree</i>

Legend:

SCALE RANGE	VERBAL INTERPRETATION
4.21 – 5.00	Very Highly Ready / Always Used / Strongly Agree
3.41 – 4.20	Highly Ready / Often Used / Agree
2.61 – 3.40	Moderately Ready / Sometimes Used / Neutral
1.81 – 2.60	Slightly Ready / Rarely Used / Disagree
1.00 – 1.80	Not Ready / Never Used / Strongly Disagree

Table 4 shows the standard deviation, weighted mean, and verbal interpretation of students' views on green talents in TLE. The computed weighted mean of 3.51, interpreted as Agree, shows that students generally like green skills in TLE lessons. This implies that students prioritise sustainability themes in their schooling. The indication “I believe green skills are important for my future career and livelihood” had the greatest weighted mean of 3.63 with a standard deviation of 0.66, indicating agreement.

This suggests that students understand how green skills will affect their careers.

The statement “I can apply what I learn in TLE to contribute to environmental protection” had a weighted mean of 3.59 and a standard deviation of 0.65, indicating agreement. This suggests that students see TLE information and skills as useful. “I enjoy learning TLE lessons that involve sustainability practices” had a weighted mean of 3.48 and a standard deviation of 0.65, indicating that students like sustainability lessons. Both “My TLE classes include activities that promote environmental awareness” and “I feel motivated when sustainability topics are included in TLE” had weighted averages of 3.43, with standard deviations of 0.71 and 0.69, respectively, indicating agreement. Environmentally focused activities excite students, according to these studies.

In general, students value green skills integration in TLE and recognize its importance and applicability. However, the moderate mean scores show that student engagement and sustainability practice integration can be improved to maximize learning.

According to UNESCO (2021), World Economic Forum (2020), and ILO (2025), sustainability capabilities are becoming more important in education and work. The high future relevance ranking supports World Economic Forum (2020) and Bone et al. (2023) findings that green skills are essential in global labor markets and rising industries.

Experiential learning promotes understanding when students apply knowledge in real life, according to Kolb (1984) and Saputri & Ediyono (2022). Freire (1970), Pavlova & Chen (2019), and Fitriyanto et al. (2021) recommend participatory and problem-based learning to boost student involvement, however moderate engagement levels indicate more interactive tactics. Since students are excited, teachers should harness this to make lectures more interactive and practical to boost knowledge and interest.

Table 5.1 The Level of Challenges in Green Skills Integration as Perceived by Teachers

STATEMENT	WEIGHTED MEAN	RANK	VERBAL INTERPRETATION
1. I lack training or seminars on how to teach green skills.	2.90	8	<i>Moderately Challenging</i>
2. There are not enough tools, materials, or resources for environmental activities.	3.58	1	<i>Highly Challenging</i>
3. There is not enough time in the TLE curriculum to add green skill lessons.	3.18	4	<i>Moderately Challenging</i>
4. I receive limited support from the school administration for green programs.	3.00	7	<i>Moderately Challenging</i>
5. Students sometimes show low interest in topics related to green skills.	3.15	5	<i>Moderately Challenging</i>
6. There is no available budget for sustainable or environmental projects.	3.41	3	<i>Highly Challenging</i>
7. Some green skill activities require equipment that the school does not have.	3.48	2	<i>Highly Challenging</i>
8. The current TLE curriculum does not give enough focus to sustainability topics.	3.01	6	<i>Moderately Challenging</i>
AVERAGE WEIGHTED MEAN	3.21		Moderately Challenging

Legend:

SCALE RANGE	VERBAL INTERPRETATION
4.21 – 5.00	Very Highly Challenging
3.41 – 4.20	Highly Challenging
2.61 – 3.40	Moderately Challenging
1.81 – 2.60	Slightly Challenging
1.00 – 1.80	Not Challenging

Table 5.1 shows the weighted mean, rank, and verbal interpretation of teachers' green skill integration issues in Technology and Livelihood Education. The computed weighted mean of 3.21, read as Moderately Challenging, shows that teachers have considerable trouble incorporating green skills. This implies that while teachers can incorporate sustainability concepts, various obstacles prevent them from fully implementing green skills in TLE.

The statement “There are not enough tools, materials, or resources for environmental activities” had the highest weighted mean of 3.58 and ranked first as Highly Challenging. This suggests that teachers' biggest challenge is insufficient instructional resources. The statement “Some green skill activities require equipment that the school does not have” ranked second with a weighted mean of 3.48, also Highly Challenging. This highlights the problem of limited facilities and equipment in sustainability-related operations. Lack of budget for sustainable or environmental projects was a third-ranked Highly Challenging issue with a weighted mean of 3.41.

This underlines financial restrictions as another major barrier to green skill integration.

Several indicators were Moderately Challenging. These include limited time in the TLE curriculum to teach green skills (WM = 3.18, Rank 4), low student interest in green topics (WM = 3.15, Rank 5), insufficient sustainability focus (WM = 3.01, Rank 6), and limited administrative support. These data show that curricular and institutional factors moderately affect instructors' green skill integration. “I lack training or seminars on how to teach green skills” had the lowest weighted mean of 2.90 and placed eighth, still Moderately Challenging. This suggests that training is less important than resources, equipment, and funding.

The results show that teachers have considerable difficulty incorporating green skills, with resource constraints such materials, equipment, and budget being the most problems. Addressing these issues may improve green

skills integration in TLE training and sustainability. Teachers had moderate problems (WM = 3.21) with materials, equipment, and funding.

UNESCO (2021), OECD (2020), and Green VET4SDG (n.d.) all cite resource constraints as a fundamental obstacle to environmental and vocational education changes. According to DepEd sustainability studies and UNESCO frameworks, Republic Act No. 9512 policy implementation gaps exist. Teachers can teach green skills, but they need support to do so. Better teaching requires money, supplies, and spaces from schools and the government.

Table 5.2 The Level of Challenges in Green Skills Integration as Perceived by Students

STATEMENT	WEIGHTED MEAN	RANK	VERBAL INTERPRETATION
1. We do not have enough materials for environmental projects or activities.	2.64	2	<i>Moderately Challenging</i>
2. I need more explanation from my teacher to understand green skills.	2.00	7	<i>Slightly Challenging</i>
3. Some topics about the environment are difficult for me to understand.	1.98	8	<i>Challenging Slightly</i>
4. There is not enough time in class to finish green-related activities.	2.41	3	<i>Challenging Slightly</i>
5. My classmates are not very interested in green projects.	2.39	4	<i>Challenging Slightly</i>
6. We rarely do hands-on environmental activities in TLE.	2.36	5	<i>Challenging Slightly</i>
7. Our school lacks facilities or space for green activities (e.g., garden area).	2.71	1	<i>Moderately Challenging</i>
8. Sometimes the instructions for environmental activities are unclear.	2.23	6	<i>Challenging Slightly</i>
AVERAGE WEIGHTED MEAN	2.34		<i>Slightly Challenging</i>

Legend:

SCALE RANGE	VERBAL INTERPRETATION
4.21 – 5.00	Very Highly Challenging
3.41 – 4.20	Highly Challenging
2.61 – 3.40	Moderately Challenging
1.81 – 2.60	Slightly Challenging
1.00 – 1.80	Not Challenging

Table 5.2 shows the weighted mean, rank, and verbal interpretation of students' perceptions of green skill integration issues in Technology and Livelihood Education. The computed weighted mean of 2.34, read as Slightly Challenging, shows that TLE students have few problems integrating green skills. This implies that students can implement sustainability-related activities, albeit some areas need development. Among the identified challenges, the statement “Our school lacks facilities or space for green activities (e.g., garden area)” obtained the highest weighted mean of 2.71 and rated first, interpreted as Moderately Challenging. This suggests that students' main concerns in green skills activities are facilities and space. Next is “We do not have enough materials for environmental projects or activities,” which placed second and was Moderately Challenging with a weighted mean of 2.64. This shows that insufficient materials hinder environmental project implementation.

However, certain signs were considered slightly difficult. These include time limits in green-related activities (WM = 2.41, Rank 3), student disinterest (WM = 2.39, Rank 4), restricted hands-on environmental activities (WM = 2.36, Rank 5), and confusing directions (WM = 2.23, Rank 6). These data suggest that respondents do not consider such problems substantial impediments. Both “I need more explanation from my teacher to understand green skills” (WM = 2.00, Rank 7) and “Some topics about the environment are difficult for me to understand” (WM = 1.98, Rank 8) had the lowest weighted averages, indicating Slightly Challenging.

This suggests students don't find green skills topics challenging. The results show that pupils have little problems integrating green skills. Facilities and material availability issues are particularly pressing. Addressing these difficulties may improve green skills integration in TLE and student learning. This finding is congruent with Piaget's cognitive theory and confirmed by Kolb (1984) and Mahapatra & Ravichandran (2023), which imply that learners understand concepts better when learning is concrete and experienced.

However, insufficient hands-on exposure shows a lack of experiential learning opportunities, which UNESCO (2021), Saputri & Ediyono (2022), and Pavlova & Chen (2019) recommend for sustainable competency

development. To study effectively and enjoyably, students need more practical activities and better facilities like gardens and project supplies.

Table 6.1 The Relationship between Perceptions of Students of Green Skills Integration and Teachers’ Readiness

Variables	R-value	Interpretation	p-value	Decision
Students’ Perceptions and Teachers’ Readiness	0.029	Very Weak Positive Correlation	> 0.05	Do Not Reject H ₀

Table 6.1 presents the results of the Pearson product-moment correlation analysis examining the relationship between students’ perceptions of green skills integration and teachers’ readiness in Technology and Livelihood Education (TLE).

The computed Pearson R-value of 0.029 indicates a very weak positive correlation between the two variables. This suggests that there is almost no linear relationship between teachers’ readiness and students’ perceptions of green skills integration. In other words, variations in teachers’ readiness are not significantly associated with changes in how students perceive the integration of green skills.

Furthermore, the obtained p-value is greater than 0.05, indicating that the relationship is not statistically significant at the 0.05 level of significance. Based on this result, the null hypothesis (H₀) is not rejected. This means that there is insufficient evidence to conclude that a significant relationship exists between teachers’ readiness and students’ perceptions.

The absence of a significant relationship between teacher readiness and student perceptions suggests that readiness alone may not be sufficient to influence students' views regarding green skills integration. It is possible that students form perceptions based on direct classroom experiences, peer interactions, school culture, or personal environmental awareness rather than teachers' self-reported readiness. Furthermore, social desirability bias may have influenced teacher responses, resulting in higher self-ratings that may not fully reflect actual classroom implementation.

The findings suggest that teachers' readiness to integrate green skills may not translate to students' classroom experiences. Teaching tactics, resources, student participation, and learning environment may influence students' perceptions of green skills integration more.

The results show that teachers' preparation alone does not predict students' perspectives, suggesting that many elements must be considered to improve green skills integration in TLE. Results reveal no correlation between instructor preparedness and student impression. This contradicts OECD (2020), which claims teacher ability directly affects student results. It supports Mutohari et al. (2023), who suggest that preparation does not ensure learning success. This supports systems theory in education (UNESCO, 2021; Cedefop, 2022), which considers learning as a product of institutional, teacher, and learner variables.

Table 6.2 The Relationship between Perceptions of Students of Green Skills Integration and Teaching Strategies and Resources

Variables	R-value	Interpretation	p-value	Decision
Students’ Perceptions and Teaching Strategies and Resources	-0.055	Very Weak Negative Correlation	> 0.05	Do Not Reject H ₀

Table 6.2 presents the results of the Pearson product-moment correlation analysis examining the relationship between students’ perceptions of green skills integration and the teaching strategies and resources used in Technology and Livelihood Education (TLE).

The computed Pearson R-value of -0.055 indicates a very weak negative correlation between the two variables. This suggests that there is essentially no meaningful linear relationship between the teaching strategies and resources employed by teachers and the students’ perceptions of green skills integration. The negative sign implies an inverse relationship; however, given the extremely low magnitude, this relationship is negligible.

Moreover, the obtained p-value is greater than 0.05, indicating that the relationship is not statistically significant at the 0.05 level of significance. Therefore, the null hypothesis (H_0) is not rejected. This means that there is insufficient evidence to establish a significant relationship between teaching strategies and resources and students’ perceptions of green skills integration.

The lack of a significant relationship between teaching strategies and student perceptions may indicate that the frequency of strategy use does not necessarily guarantee meaningful student engagement. Students may value the quality, relevance, and authenticity of sustainability activities more than their mere presence in classroom instruction.

The findings suggest that the use of instructional strategies and resources does not significantly affect how students view green abilities in TLE. This suggests that students' personal interests, learning experiences, school atmosphere, and participation may shape their perspectives more.

The results show that instructional methodologies and materials alone do not strongly influence students' perceptions of green skills integration, indicating the need for a more comprehensive approach to sustainability education. This implies that instructor preparedness does not impact student perception. Engagement, environment, and feedback affect student learning, according to Hattie (2018). Consistent with systems theory in education, where numerous factors affect learning results, instructors are vital but need a holistic approach.

Table 6.3 The Relationship between Teachers’ Readiness and Teaching Strategies and Resources

Variables	R-value	Interpretation	p-value	Decision
Teachers’ Readiness and Teaching Strategies and Resources	0.659	Strong Positive Correlation	< 0.001	Reject H_0

Table 6.3 presents the results of the Pearson product-moment correlation analysis examining the relationship between teachers’ readiness and the teaching strategies and resources used in Technology and Livelihood Education (TLE).

The computed Pearson R-value of 0.659 indicates a strong positive correlation between the two variables. This suggests that as teachers’ readiness increases, the use of effective teaching strategies and resources for integrating green skills also tends to increase. In other words, teachers who are more prepared and knowledgeable about green skills are more likely to employ appropriate instructional strategies and utilize relevant resources in their teaching.

Furthermore, the obtained p-value is less than 0.001, indicating that the relationship is statistically significant at the 0.05 level of significance. Based on this result, the null hypothesis (H_0) is rejected. This means that there is sufficient evidence to conclude that a significant relationship exists between teachers’ readiness and their use of teaching strategies and resources.

The findings imply that teachers' readiness plays a crucial role in shaping their instructional practices. As teachers become more equipped with knowledge, skills, and confidence in integrating green skills, they are more likely to implement varied and effective teaching approaches and maximize available resources.

Overall, the results show that professional development, training, and support for teachers can increase the quality and frequency of instructional strategies and resource use, boosting green skills in TLE. Several Philippine studies support this study's conclusions. Professional development and instructional support greatly increase TLE teachers' utilization of teaching strategies and resources, according to Dioquino and Abellana (2022). Excelise and Marapao (2025) found that teacher preparedness and professional development boost instructional performance and strategy implementation.

Alcaide and Blancia (2024) also noted that TLE-competent teachers can create better instructional materials and teach better. Also, Caspe and Sarrosa (2025) found that teacher preparedness affects curricular implementation and instruction. These studies confirm that instructors' preparation positively correlates with their utilization of instructional strategies and resources in TLE ($r = 0.659, p < 0.001$).

Limitations of the Study

Several limitations should be considered when interpreting the findings of this study. First, the study utilized a cross-sectional design, limiting the ability to establish causal relationships among variables. Second, the data relied primarily on self-reported responses, which may be influenced by social desirability bias.

Third, the student sample was heavily represented by Grade 10 learners, while Home Economics dominated teacher specialization, potentially limiting the generalizability of the findings. Fourth, the study did not include qualitative data such as interviews or focus group discussions that could have provided deeper explanations for participant perceptions.

Finally, the study focused only on selected public secondary schools in Caloocan City and may not fully represent other educational contexts.

Proposed Framework and Program to Enhance Green Skills Integration in TLE Title: Green Skills Enhancement Program (GSEP) for TLE



Figure 3: Green Skills Enhancement Program (GSEP) for TLE

The framework presents the Green Skills Enhancement Program (GSEP) as a structured process that moves from inputs to impact, showing how the program improves the integration of green skills in Technology and Livelihood Education (TLE).

1. Inputs

The first part of the framework represents the resources needed to implement the program. These include:

- Teacher training – to improve teachers’ knowledge and skills in sustainability
- Curriculum development – to embed green skills into TLE lessons
- School programs – to support environmental initiatives

These inputs are essential because they serve as the foundation of the entire program. Without them, effective implementation cannot take place.

2. Activities

The second stage shows the specific actions or interventions carried out using the inputs. These include:

- Conducting workshops aligned with Republic Act No. 9512
- Implementing experiential learning projects such as recycling and gardening
- Launching green school initiatives

These activities are guided by constructivist and experiential learning principles, where students learn by doing and actively participating.

3. Outputs

Outputs refer to the immediate results of the activities. These are short-term and measurable, such as:

- Teachers becoming trained and more competent
- Development of enhanced lesson plans
- Implementation of school-based environmental activities

These outputs indicate that the program is being successfully implemented at the classroom and school level.

4. Outcomes

Outcomes represent the changes or improvements that happen after the outputs. These include:

- Increased knowledge of green skills among students
- Higher student engagement and participation

At this stage, the program begins to influence student learning and behavior, which is the main goal of instruction.

5. Impact

The final stage is the long-term effect of the program. These include:

- Sustainable practices being consistently applied in TLE
- Development of environmentally responsible schools and learners

This aligns with the goals of Department of Education and national policies on environmental education, where students become responsible citizens who care for the environment.

Rationale

The findings of the study revealed that while teachers are moderately ready and already implementing green skills in TLE, challenges such as lack of resources, insufficient training, and limited institutional support hinder effective integration. Additionally, students show positive but moderate engagement, indicating the need for enhanced instructional approaches.

Thus, this program aims to strengthen the integration of green skills by addressing gaps in training, resources, and student engagement.

Objectives

1. To enhance teachers' competence in integrating green skills in TLE.
2. To provide sufficient resources and materials for sustainability-related activities.
3. To increase student engagement and participation in environmental practices.
4. To promote a sustainable and environmentally responsible school culture.

Program Components

1. Teacher Training and Capacity Building

- Conduct seminars and workshops on green skills integration
- Invite environmental education experts
- Provide teaching guides and lesson exemplars

2. Development of Instructional Materials

- Creation of localized modules on sustainability
- Use of low-cost and recycled materials for teaching aids
- Integration of digital resources (videos, simulations)

3. School-Based Green Projects

- Establish school gardens
- Implement waste segregation and recycling programs
- Conduct eco-friendly product-making activities in TLE

4. Student Engagement Activities

- Project-based learning (e.g., eco-products, upcycling projects)
- Environmental campaigns and awareness drives
- Competitions (poster-making, innovation challenges)

5. Resource and Facility Enhancement

- Allocate budget for tools and materials
- Develop designated spaces for green activities (e.g., garden areas)
- Partner with local government and organizations for support

Implementation Plan

Table 7: Implementation Plan of Green Skills Enhancement Program (GSEP) for TLE

Phase	Activities	Time Frame	Persons Involved	Expected Outcomes / Success Indicators
Phase 1	Planning and Orientation	Month 1	School Head, Teachers	100% of teachers oriented; approved action plan
Phase 2	Training	Months 2-3	Teachers, Experts	At least 80% of teachers trained; materials developed
Phase 3	Implementation	Months 4-8	Teachers, Students	Increase in student engagement (e.g., participation rate); integration observed in lesson plans
Phase 4	Evaluation	Months 9-10	School Admin	Evaluation report completed; improvement plan created

Expected Outcomes

- Improved teacher readiness and competence in green skills integration
- Increased availability of instructional resources
- Higher student engagement and participation
- Enhanced environmental awareness and practices among students

Evaluation Measures

- Pre-test and post-test on teacher readiness
- Student feedback surveys
- Observation of classroom practices
- Assessment of student outputs and projects

Implications of the Proposed Framework and Program

The proposed Green Skills Enhancement Program (GSEP) presents several important implications for educational practice, policy, and future research, particularly in strengthening the integration of green skills in Technology and Livelihood Education (TLE).

1. **Implications for Teaching and Learning.** The framework shows that we need to move away from old-fashioned teaching that focuses on just delivering content and instead embrace methods that are more hands-on and centered around the learners. By incorporating practical activities like recycling, gardening, and project-based learning, teachers can help students improve their critical thinking, problem-solving abilities, and understanding of environmental issues. This means that successfully bringing green skills into learning needs both sharing knowledge and getting students involved in real-life situations.

2. **Implications for Teacher Development.** The results and suggested program highlight how crucial it is to keep learning and growing in your job. Teachers require ongoing training, support, and access to teaching materials

to successfully include sustainability ideas in TLE. This means that schools and education leaders need to focus on programs that help teachers feel sure and skilled in teaching green skills.

3. Implications for Curriculum Development. The GSEP highlights the importance of including green skills in the curriculum instead of viewing them as separate or extra subjects. This means that those who create and plan the curriculum need to take another look at and improve the current TLE skills to make sure they match up with sustainability goals and national rules about teaching environmental education.

4. Implications for School Administration and Policy. The program shows how important it is to have support from institutions, like providing resources, building infrastructure, and strengthening policies. School leaders are urged to set up eco-friendly programs, budget for supplies and facilities, and team up with local government and organizations. This means that making green skills part of education is something everyone needs to work on, not just teachers in the classroom.

5. Implications for Student Development. By getting more involved in environmental activities, students are expected to learn and also develop good attitudes and habits that support sustainability. This means that adding green skills helps create people who care about the environment and can use sustainable practices in their everyday lives and future jobs.

6. Implications for Community and Stakeholder Involvement. The framework highlights how important it is to work together with outside groups, like local government, non-profits, and people in the community. This means that making school and community connections stronger can help get more resources and give students real-life situations to learn from.

7. Implications for Future Research. The suggested framework lays the groundwork for more research on how well green skills programs work in various situations. Future researchers might look into how GSEP affects things over time, whether it can be expanded, and if it can be used in other subjects. This means that we need to keep checking and studying to make sustainability education programs better

8. Prior to full-scale implementation, the Green Skills Enhancement Program (GSEP) shall undergo pilot testing in one participating school for one academic year. The effectiveness of the program shall be evaluated using pre-test and post-test measures of teacher readiness, classroom observations, student engagement surveys, and assessment of sustainability-related projects. Feedback from teachers, students, school administrators, and external stakeholders shall be collected to refine the program before wider implementation.

Summary

This part presents the summary of the findings, conclusions, and recommendations on the assessment of green skills integration in Technology and Livelihood Education.

Based on the data gathered, the following findings were obtained:

1. Profile of Respondents. The majority of TLE teachers were women, making up about 84% of the group. They were experienced and had the right qualifications, with over half of them holding a master's degree. Most of their focus (52 or 65.00%) and teaching role (56 or 70.00%) were in Home Economics. At the same time, most of the students who answered the survey were girls, making up 60.31% of the total, and the majority were in Grade 10, which accounted for 62.50%. Grade 7 had 35.00% of the respondents, while Grade 8 and Grade 9 had very few, with only 1.88% and 0.63% respectively.

2. Teachers' Readiness in Integrating Green Skills. Teachers were seen to be somewhat prepared (AWM = 3.39) to include green skills in their teaching. They demonstrated a good understanding of basic sustainability ideas (WM = 3.70) and a readiness to try out new approaches (WM = 3.65), along with a belief in their ability to incorporate green skills (WM = 3.50) and support students (WM = 3.46). But not many people took part in the training and seminars (WM = 2.61), which made them less prepared overall.

3. **Teaching Strategies and Resources Used in TLE.** The teaching strategies and resources were rated as frequently used, with an average score of 4.05. Teachers often motivated students to use sustainability ideas in their projects and included environmental topics in their lessons. They also used hands-on learning projects and teaching materials. But, having enough teaching resources (WM = 3.73) was a bit lower, showing that resources aren't always available consistently.

4. **Students' Perceptions of Green Skills Integration.** Students mostly felt that green skills are important, relevant, and useful for their future, with an average score of 3.51. They really thought that having green skills is important for future jobs (WM = 3.63) and that they could use these skills to help protect the environment (WM = 3.59). Students liked the lessons about sustainability (average score = 3.48) and felt motivated (average score = 3.43), but there is still room to boost their engagement levels.

5. **Challenges in Green Skills Integration.** Teachers faced some challenges (average score = 3.21), with the biggest problems being not enough materials (score = 3.58), not enough equipment (score = 3.48), and a tight budget (score = 3.41). Other worries were having not enough time (WM = 3.18) and how interested the students were (WM = 3.15). Students faced some minor issues (AWM = 2.34), mostly due to not having enough facilities (WM = 2.71) and materials (WM = 2.64), rather than struggling to grasp the ideas of green skills (WM = 1.98–2.00).

6. **Relationship between Variables.** The study found no significant relationship between teachers' readiness and students' perceptions ($r = 0.029$, $p > 0.05$), as well as between teaching strategies/resources and students' perceptions ($r = -0.055$, $p > 0.05$). This shows that just because teachers are well-prepared and use good methods, it doesn't mean that students will necessarily feel more positive about their experience. There was a clear connection found between how ready teachers are and the teaching methods they use ($r = 0.659$, $p < 0.05$). This means that teachers who feel more prepared tend to use better teaching strategies.

These results indicate that teachers' readiness and instructional practices alone do not significantly influence students' perceptions of green skills integration.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

1. Teachers possess adequate foundational knowledge and positive attitudes toward green skills; however, their readiness remains at a moderate level due to insufficient training and professional development opportunities.
2. The integration of green skills in TLE is already evident through the frequent use of appropriate teaching strategies and activities that promote sustainability.
3. Students recognize the importance and relevance of green skills in their education and future careers, indicating a generally positive perception toward sustainability integration.
4. Resource-related constraints—including lack of materials, equipment, facilities, and budget—are the primary barriers to the effective implementation of green skills in TLE.
5. Teachers' readiness and teaching strategies are not strong predictors of students' perceptions, suggesting that other factors such as learning environment, student engagement, and institutional support may have greater influence.
6. There is a need for stronger institutional and curricular support to fully integrate green skills into TLE and maximize its impact on student learning.

RECOMMENDATIONS

In light of the findings and conclusions, the following recommendations are proposed:

For Teachers

1. Participate in continuous professional development programs focusing on sustainability and green skills integration.
2. Utilize more innovative, interactive, and hands-on teaching strategies to enhance student engagement.
3. Integrate green skills consistently across various TLE topics and not limit them to specific lessons.

For School Administrators

1. Provide adequate instructional materials, tools, and facilities to support environmental and sustainability-related activities.
2. Allocate sufficient budget for green projects and school-based environmental programs.
3. Encourage and support teachers in attending seminars, training, and workshops related to green skills.

For Curriculum Developers and DepEd

1. Strengthen the integration of green skills in the TLE curriculum by embedding sustainability concepts across competencies.
2. Provide clear guidelines, modules, and instructional materials that support green skills education.
3. Ensure proper implementation of environmental education policies and monitor their effectiveness in schools.
5. DepEd may develop professional training programs focusing on green skills integration in TLE subjects

For Students

1. Actively participate in sustainability-related activities and apply learned concepts in real-life situations.
2. Develop environmental responsibility through simple practices such as waste segregation and energy conservation.

For Future Researchers

1. Explore other variables that may influence students' perceptions, such as teaching styles, school climate, and parental support.
2. Include a more balanced distribution of respondents across grade levels.
3. Develop and test intervention programs to improve green skills integration in TLE.

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