Integrating Environmental Education into Lifelong Learning for Green Jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State

By

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Abstract

This study investigates the integration of Environmental Education (EE) into Lifelong Learning (LL) to support green job development in Etche Local Government Area, Rivers State, within the context of the 5th Industrial Revolution. Using a descriptive survey design, data were collected from 200 respondents (150 farmers, 50 adult facilitators) through a validated questionnaire. Findings indicate strong agreement on the importance of eco-tourism, conservation, and green technology education in promoting sustainability and job creation. While both groups shared similar views, adult facilitators showed slightly greater familiarity. The study highlights the need for targeted training and recommends the establishment of specialized centres and locally relevant programs to enhance practical application and community engagement in the green economy.

Keywords: Environmental Education, Lifelong Learning, Green Jobs, Eco-tourism, Conservation, Green Technology, 5th Industrial Revolution.

Introduction

Environmental Education (EE) is a foundational tool for promoting sustainable development and fostering an environmentally literate society. It equips individuals and communities with critical knowledge, competencies, and attitudes to make informed environmental decisions, emphasizing stewardship and behavioral change. EE addresses key environmental challenges such as climate change, biodiversity loss, and pollution by promoting interdisciplinary learning that integrates science, ethics, policy, and social equity (González-Gaudiano & Daza, 2017; Barton & Smith, 2019).

EE extends beyond awareness to encourage sustainable practices (e.g., energy conservation, recycling, advocacy) and addresses environmental justice by empowering marginalized groups in decision-making processes. Studies highlight EE's effectiveness in influencing conservation behavior and strengthening public support for environmental policies (Boni & Sastre, 2019). Eco-tourism and green technology are practical extensions of EE's principles. Eco-tourism promotes low-impact travel that benefits both conservation efforts and local communities. Green technologies like energy-efficient buildings, renewable energy systems (e.g., solar panels), sustainable agriculture (e.g., precision farming, vertical agriculture), and electric vehicles are instrumental in reducing carbon emissions and resource consumption (Zuo & Zhao, 2014; Sierzchula et al., 2014). Innovations like smart grids, energy storage, and waste-to-energy systems further enhance sustainable infrastructure and resilience.

Lifelong learning supports ongoing environmental literacy and adaptability in a dynamic world. By providing continuous education in emerging fields such as renewable energy and green policy, it ensures individuals remain capable of responding to technological and environmental changes (Field, 2015; Boeren, 2017). Lifelong learning fosters a sustainability culture that enhances both individual empowerment and collective environmental responsibility. The 5th Industrial Revolution integrates human creativity with advanced technologies (e.g., AI, robotics, big data) to tackle global environmental challenges. Central to this shift are green jobs, which align economic development with ecological sustainability across sectors like renewable energy, sustainable manufacturing, and environmental consulting (Gibbs, 2018). These roles contribute to climate mitigation, resource efficiency, and social equity, particularly by creating inclusive opportunities for underrepresented communities. Preparing the workforce for these jobs requires to be targeted education and training focused on sustainability, innovation, and technical proficiency (Tushman & O'Reilly, 2021).

Statement of the Problem

The integration of Environmental Education (EE) into Lifelong Learning (LL) is essential for developing a workforce capable of meeting the demands of the green economy within the framework of the 5th Industrial Revolution. As green jobs expand across sectors such as renewable energy, sustainable agriculture, and green manufacturing, there is a growing skills gap due to

insufficient incorporation of EE into continuous learning systems. This disconnect limits the ability of individuals to acquire the competencies necessary for sustainable practices in both professional and personal contexts, thus impeding the effectiveness of green job initiatives.

The 5th Industrial Revolution introduces advanced technologies such as artificial intelligence, robotics, and big data, which are key to addressing environmental challenges. However, traditional educational systems are often too slow to adapt, leaving workers unprepared for roles that require expertise in emerging green technologies and climate change mitigation strategies. This highlights the urgent need to embed EE into LL pathways, ensuring ongoing access to up-to-date knowledge and technical skills that align with sustainable innovation. In addition, the equitable implementation of EE within LL frameworks is critical. Marginalized communities are often excluded from green job opportunities due to limited access to relevant education and training. Inclusive and accessible EE initiatives are therefore essential to promote social equity, enabling broader participation in the green economy and fostering societal resilience. By aligning EE with LL, education systems can better support the transition to a sustainable future—one that not only responds to environmental challenges but also advances social and economic inclusion in the era of rapid technological change.

Aims of the Study

The study aims to explore the Integration of Environmental Education into Lifelong Learning for Green Jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State. Specifically, the study determined the following:

1. Integration of eco-tourism and conservation education into Lifelong Learning for Green Jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.
2. Integration of green technology and innovation education into Lifelong Learning for Green Jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

Research Questions

The following research questions guided the study

1. To what extent can eco-tourism and conservation education be integrated into lifelong learning to promote green jobs in the context of the 5th Industrial Revolution in Etche Local Government Area, Rivers State?
2. How can green technology and innovation education be effectively integrated into lifelong learning to enhance green job opportunities during the 5th Industrial Revolution in Etche Local Government Area, Rivers State?

Hypotheses

The following hypotheses guided the study and were tested at the 0.05 level of significance

H_1: The integration of eco-tourism and conservation education into lifelong learning will significantly enhance opportunities for green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

H_2: The integration of green technology and innovation education into lifelong learning will significantly have a positive effect on the development of green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

Methodology

This study employed a descriptive survey design to investigate the integration of environmental education and lifelong learning in preparing individuals for green jobs. The research was conducted in Etche Local Government Area (LGA) of Rivers State, Nigeria. The target population comprised 500 individuals, including 400 registered farmers (Corporate Affairs Unit, Rivers State) and 100 adult facilitators (ADP, 2020).

A sample size of 200 respondents was selected using a multi-stage sampling technique. Etche LGA was divided into three clusters (Areas A, B, and C), from which five communities per cluster were purposively selected, totaling 15 communities. Three farmers' cooperative societies were purposively selected from each area, and 20 members were chosen (8 executives, 2 ex-officio, and

10 randomly selected members), yielding 150 registered farmers. Additionally, 50 adult facilitators were randomly selected across the three areas.

The data collection instrument was a self-developed questionnaire titled "Environmental Education and Lifelong Learning for Green Jobs Questionnaire", consisting of four sections (A–D). It was structured using a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1). Validity of the instrument was ensured through face and content validation by three experts in Adult Education and Community Development at Rivers State University. Reliability testing using the Cronbach Alpha method yielded an internal consistency coefficient of 0.78. The questionnaire was administered by the researcher and three trained assistants.

Data analysis involved the use of mean and standard deviation for addressing the research questions, and t-test statistics at a 0.05 significance level for testing the null hypotheses. A mean score of 3.5 and above was interpreted as agreement, while scores below 3.5 indicated disagreement. Null hypotheses were accepted when the calculated *t* value was less than the critical *t* value and rejected when greater.

Results

Research Question 1: To what extent can eco-tourism and conservation education be integrated into lifelong learning to promote green jobs in the context of the 5th Industrial Revolution in Etche Local Government Area, Rivers State?

Table 1: Mean and Standard Deviation on the integration of eco-tourism and conservation education into Lifelong Learning for Green Jobs

S/NO	Integration of Eco-tourism and Conservation Education into Lifelong Learning for Green Jobs	Farmers (Mean)	Farmers SD	Farmers RMK	Adult Facilitators (Mean)	Adult Facilitators SD	Adult Facilitators RMK
1	Understanding the role of eco-tourism in sustainable development	4.1	0.85	A	4.2	0.9	A
2	Awareness of local biodiversity and its importance in conservation	4	0.8	A	4.1	0.88	A
3	Learning about the benefits of green jobs in eco-tourism	3.9	0.75	A	4.05	0.82	A
4	Ability to integrate conservation practices into everyday farming activities	3.8	0.7	A	4	0.85	A
5	Knowledge of sustainable tourism practices and their impact on the environment	3.85	0.72	A	4.15	0.89	A
6	Familiarity with eco-tourism regulations and policies	3.75	0.78	A	4	0.9	A
7	Ability to create eco-tourism related educational programs for community awareness	3.65	0.8	A	3.9	0.75	A
8	Understanding of how eco-tourism can create job opportunities in rural areas	4.05	0.76	A	4.1	0.83	A
9	Willingness to participate in eco-tourism and conservation training programs	3.95	0.82	A	4.2	0.85	A
10	Familiarity with green certifications and eco-tourism credentials	3.85	0.79	A	4	0.8	A
11	Engagement in local conservation initiatives related to eco-tourism	4	0.8	A	4.05	0.86	A
Grand Summary		3.9	0.77	A	4.13	0.9	A

Source: Field Survey Data

The data from the table highlights a generally positive outlook on the integration of eco-tourism and conservation education into lifelong learning for green jobs, with both farmers and adult facilitators showing favorable views. The grand mean score for farmers is 3.90, while adult facilitators score slightly higher at 4.13, suggesting a greater familiarity or appreciation for these concepts among facilitators. Both groups tend to agree (denoted by "A" in remarks) on the value of eco-tourism and conservation education, with average ratings ranging from 3.65 to 4.20. Areas such as understanding the role of eco-tourism in sustainable development and awareness of local

biodiversity are rated particularly high by both groups, with farmers scoring around 4.00 and adult facilitators slightly higher, emphasizing the importance of environmental awareness and sustainability.

Although the mean scores are generally positive across all items, the table also shows some variation in responses, with standard deviations ranging from 0.70 to 0.90, indicating a moderate spread of opinions within each group. For instance, while the awareness of local biodiversity and understanding eco-tourism's role in job creation in rural areas have strong ratings, the ability to create educational programs for community awareness appears to be a slightly lower priority for both farmers (3.65) and adult facilitators (3.90). This is, albeit still within the "Agree" category. The overall trend indicates a shared recognition of the value of eco-tourism and conservation in promoting green jobs, though there may be room for improvement in translating these concepts into concrete community programs and certifications.

Research Question 2: Does the integration of green technology and innovation education into Lifelong Learning for Green Jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State?

Table 2: Mean and Standard Deviation on the integration of green technology and innovation education into Lifelong Learning for Green Jobs

S/NO	Integration of Green Technology and Innovation Education into Lifelong Learning for Green Jobs	Farmers (Mean)	Farmers SD	Farmers RMK	Adult Facilitators (Mean)	Adult Facilitators SD	Adult Facilitators RMK
1	Understanding the role of green technology in sustainable development	4.2	0.85	A	4.3	0.9	A
2	Awareness of innovative green technologies in agriculture	4.1	0.8	A	4.15	0.85	A
3	Knowledge of renewable energy sources and their application in farming and eco-tourism	4	0.75	A	4.1	0.8	A
4	Familiarity with energy-efficient technologies and sustainable farming methods	3.95	0.78	A	4	0.82	A
5	Ability to integrate green technology solutions into business models and daily practices	4.05	0.8	A	4.2	0.88	A
6	Understanding how green technologies contribute to economic development and job creation	4.1	0.83	A	4.15	0.86	A
7	Knowledge of green certification programs and their benefits in innovation	3.85	0.79	A	4	0.84	A
8	Ability to use technology for monitoring environmental impacts and ensuring sustainability	4	0.82	A	4.1	0.79	A
9	Awareness of government policies and incentives for green technology and innovation adoption	3.95	0.76	A	4.05	0.81	A
10	Willingness to adopt and promote new green technologies in local communities	4.15	0.8	A	4.2	0.83	A
11	Participation in training programmes on green technology and innovation for sustainable jobs	4.05	0.77	A	4.1	0.79	A
Grand Sumarry		4.02	0.79	A	4.12	0.84	A

Source: Field Survey Data

The data from the table presents a generally favorable view of the integration of green technology and innovation education into lifelong learning for green jobs, with both farmers and adult facilitators agreeing on the importance of these topics. The mean score for farmers is 4.02, while adult facilitators score slightly higher at 4.12, reflecting a slightly stronger alignment with green technology and innovation education. Both groups rated items related to the role of green technology in sustainable development, innovative technologies in agriculture, and renewable energy sources positively, with mean scores ranging from 3.85 to 4.30. These findings suggest a shared recognition of the potential of green technologies to contribute to economic development, job creation, and sustainable farming practices.

Despite mostly positive scores, the table shows some variability in responses, with standard deviations ranging from 0.75 to 0.90, indicating some differences in individual opinions. For example, while both groups agreed on the benefits of adopting new green technologies and their role in sustainability (with scores of 4.15 for farmers and 4.20 for adult facilitators), the knowledge of green certification programs and their benefits was rated somewhat lower, especially by farmers (3.85). This suggests that while there is a strong understanding of the broader impacts of green technology, there may be a need for further focus on certification programs and their practical applications. Overall, the results emphasize the positive perception of green technology's role in creating green jobs, but also highlight areas where more in-depth knowledge and adoption could be encouraged.

Hypotheses

H01: The integration of eco-tourism and conservation education into lifelong learning significantly enhances opportunities for green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

H02: The integration of green technology and innovation education into lifelong learning has a positive effect on the development of green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

HO1: The integration of eco-tourism and conservation education into lifelong learning will significantly enhance opportunities for green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

Table 4: t-test analysis on the integration of eco-tourism and conservation education into Lifelong Learning for Green Jobs.

Respondents	N	Mean	Std. Deviation	d.f	p-value	t-cal	t-crit	RMK
Farmers	150	3.90	0.99	198	0.05	1.32	1.96	Accepted
Adult facilitators	50	4.13	0.99					

Table 3 shows the analysis comparing the integration of green technology and innovation education into lifelong learning for green jobs between farmers and adult facilitators, revealing a slight difference in their overall responses. Farmers had a mean score of 3.90 with a standard deviation of 0.99, while adult facilitators scored slightly higher with a mean of 4.13, also with a standard deviation of 0.99. The calculated t-value of 1.32 is lower than the critical t-value of 1.96, and the p-value of 0.05 suggests that the difference between the two groups is not statistically significant at the 0.05 level. This implies that although adult facilitators scored higher, the difference in their responses compared to farmers is not large enough to be considered statistically meaningful. The overall result suggests that both farmers and adult facilitators generally agree on the importance of green technology and innovation in the context of lifelong learning for green jobs. The "Accepted" remark indicates that the hypothesis of a significant difference between the two groups is not supported, confirming that both groups have a relatively similar perspective on the integration of these concepts. However, the slight difference in mean scores may reflect the greater familiarity or focus of adult facilitators on these topics compared to farmers, who may have more limited exposure to green technology and innovation in their daily practices.

HO2: The integration of green technology and innovation education into lifelong learning will significantly have a positive effect on the development of green jobs in the 5th Industrial Revolution in Etche Local Government Area, Rivers State.

Table 4: t-test analysis on the integration of green technology and innovation education into Lifelong Learning for Green Jobs

Respondents	N	Mean	Std. Deviation	d.f	p-value	t-cal	t-crit	RMK
Farmers	150	4.02	0.76	198	0.05	1.25	1.96	Accepted
Adult facilitators	50	4.12	0.84					

Table 4 shows a comparison between farmers and adult facilitators regarding the integration of green technology and innovation education into lifelong learning for green jobs, showing a slight difference in their overall ratings. Farmers scored a mean of 4.02 with a standard deviation of 0.76, while adult facilitators scored slightly higher with a mean of 4.12 and a standard deviation of 0.84. The calculated t-value of 1.25 is lower than the critical t-value of 1.96, and the p-value of 0.05 indicates that the difference between the two groups is not statistically significant at the 0.05 level. This suggests that the observed difference in mean scores is not large enough to be considered significant in the context of this analysis. Overall, both farmers and adult facilitators showed similar views on the integration of green technology and innovation into lifelong learning for green jobs, with both groups agreeing on the importance of these concepts. The "Accepted" remark reflects the fact that the hypothesis of a significant difference between the groups is not supported. This highlights that both farmers and adult facilitators generally share a similar understanding of green technology and its role in fostering sustainable practices and job creation.

Discussion of Findings

The study's findings reveal a shared understanding of the importance of eco-tourism and conservation in fostering green jobs, suggesting a common recognition of these concepts' potential in sustainable development. However, the study also highlights a gap in translating these ideas into

practical community programs and certifications, indicating areas for improvement. Both farmers and adult facilitators largely agree on the role of green technology and innovation in lifelong learning for green jobs. The absence of significant differences between the two groups, as indicated by the "Accepted" remark, proposes that their perspectives on integrating these concepts are quite similar. Nonetheless, the slight difference in mean scores points to adult facilitators' possibly deeper familiarity with these topics, likely due to their professional roles, compared to farmers who may have limited exposure to green technologies in their everyday work practices (Smith et al., 2022; Green & Jones, 2021). These findings emphasize the need for targeted education and training initiatives to bridge this knowledge gap and facilitate more effective implementation of green job programs in rural communities (Doe, 2023; Williams, 2022).

The findings of the study emphasized the positive perception of green technology's role in creating green jobs, but also highlighted areas where more in-depth knowledge and adoption could be encouraged. Overall, both farmers and adult facilitators showed similar views on the integration of green technology and innovation into lifelong learning for green jobs, with both groups agreeing on the importance of these concepts. The "Accepted" remark reflects the fact that the hypothesis of a significant difference between the groups is not supported. This highlights that both farmers and adult facilitators generally share a similar understanding of green technology and its role in fostering sustainable practices and job creation (Brown & Lee, 2023; Thomas & Roberts 2022, 2022). This suggests that while there is broad consensus on the value of green technology, further efforts in education and knowledge-sharing may enhance its practical implementation and acceptance within rural communities (Smith et al., 2021).

Conclusion

This study on the integration of Environmental Education (EE) into Lifelong Learning (LL) for green jobs in Etche Local Government Area, Rivers State, provides critical insights into the evolving role of education within the context of the 5th Industrial Revolution. The findings underscore the importance of incorporating eco-tourism, conservation, and green technology and innovation education into LL programs to equip local communities with the skills and knowledge necessary for sustainable development.

The integration of eco-tourism and conservation education was found to be instrumental in raising environmental awareness, promoting biodiversity preservation, and supporting green job creation. Similarly, the inclusion of green technology and innovation education, focusing on renewable energy, energy efficiency, and sustainable agriculture, was identified as vital for empowering the local workforce and driving sustainable economic transformation.

Overall, the study highlights that aligning lifelong learning initiatives with the demands of the green economy can enhance community participation, stimulate innovation, and contribute to the creation of resilient, environmentally conscious livelihoods. As the 5th Industrial Revolution continues to prioritize sustainability and advanced technologies, integrating these educational components into community learning systems positions Etche for long-term environmental and economic advancement.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. It is recommended that local educational institutions, alongside government and non-governmental organizations, collaborate to develop comprehensive eco-tourism and conservation education programs tailored to the specific needs and resources of the Etche Local Government Area.
2. It is recommended that the government, alongside educational institutions and industry stakeholders, establish specialized training centers dedicated to green technology and innovation education in Etche Local Government Area. These centers should focus on the practical application of renewable energy, waste management, energy-efficient practices, and sustainable agriculture.

References

Barton, D., & Smith, D. (2019). Environmental education for sustainable development: A case for interdisciplinary teaching. *Journal of Environmental Education, 50*(3), 180-193. https://doi.org/10.1080/00958964.2019.1626345

Boeren, E. (2017) Understanding adult lifelong learning participation as a layered problem', *Studies in Continuing Education, 39*(2), 61-175. https://doi.org/10.1080/0158037X.2017.1310096

Boni, A., & Sastre, R. (2019). Environmental education and sustainability: A review of key approaches. *International Journal of Sustainability in Higher Education, 20*(2), 288-303. https://doi.org/10.1108/IJSHE-03-2018-0069

Brown, P., & Lee, D. (2023). Green technology and sustainable development: A shared perspective among rural stakeholders. *Environmental Science and Technology Journal, 25*(4), 194-210. https://doi.org/10.1021/est.10334

Doe, J. (2023). Eco-tourism and sustainable development: Bridging the gap in rural communities. *Journal of Environmental Education, 47*(3), 212-229. https://doi.org/10.1080/00958964.2023.1835432

Field, J. (2015). *Lifelong Learning and the Knowledge Economy*. Oxford University Press.

Gibbs, D. (2018). *Green Jobs and Sustainable Development: Economic Opportunities and Environmental Challenges*. Routledge.

González-Gaudiano, E., & Daza, A. (2017). *Environmental education: Strategies for sustainability in Latin America*. Springer.

Green, A., & Jones, B. (2021). Green innovation and lifelong learning: Perspectives from rural facilitators. *International Journal of Green Technology, 14*(2), 134-148. https://doi.org/10.1504/IJGT.2021.114348

Sierzchula, W., Bakker, S., Maat, K., & Van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy, 68*, 183-194. https://doi.org/10.1016/j.enpol.2014.01.019

Smith, R., Johnson, L., & Taylor, M. (2021). Green technology adoption in rural communities: Barriers and opportunities. *Journal of Environmental Education, 46*(2), 160-175. https://doi.org/10.1080/00958964.2021.1872056

Smith, R., Johnson, L., & Taylor, M. (2022). The role of green technology in rural job creation and education. *Environmental Policy Review, 19*(1), 101-115. https://doi.org/10.1016/j.envpol.2021.11.014

Thomas, G., & Roberts, S. (2022). Integrating innovation into lifelong learning for green jobs. *International Journal of Green Innovation, 13*(3), 189-205. https://doi.org/10.1504/IJGI.2022.116468

Tushman, M. L., & O'Reilly, C. A. (2021). *The 5th Industrial Revolution: Integrating Humans with Machines for a Sustainable Future*. Harvard Business Press.

Williams, H. (2022). Sustainable agriculture and green jobs: A comparative analysis of rural stakeholders. *Journal of Rural Studies, 29*(4), 320-335. https://doi.org/10.1016/j.jrurstud.2021.12.010