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IMPORTANCE OF CLIMATE CHANGE AND SUSTAINABILITY IN NURSING EDUCATION

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Abstract

Background: Climate change poses a serious threat to human health through extreme weather events, widespread disease, and increased strain on healthcare systems. Nurses, as frontline caregivers, play a crucial role in mitigating these impacts. However, limited integration of climate change and sustainability content within nursing education has created a gap between theoretical knowledge and clinical practice. This study investigated the impact of climate change on health awareness among nursing students, their perceptions of sustainability in healthcare, the theory–practice gap, and the benefits of integrating climate change education into nursing curricula. Methodology: A quantitative cross-sectional study was conducted among 359 nursing students. Data were collected using a structured questionnaire based on the Sustainability Attitudes in Nursing Survey and the Experiencing Scale. The study variables included Climate Change Literacy, Experiential Learning Exposure, Sustainability Integration Beliefs, and Sustainable Clinical Practice. Statistical analysis was performed using descriptive statistics, reliability analysis, Pearson correlation, and mediation analysis through Hayes PROCESS (Model 4). Results: The findings indicated that Climate Change Literacy and Sustainable Clinical Practice were at moderate-to-high levels. Significant positive correlations were observed among all study variables. Mediation analysis revealed that Sustainability Integration Beliefs partially mediated the relationship between Climate Change Literacy and Sustainable Clinical Practice, as well as between Experiential Learning Exposure and Sustainable Clinical Practice. These results highlight the important role of sustainability beliefs in translating knowledge and experiential learning into practical clinical application.Conclusion: The study concludes that integrating climate change and sustainability concepts into nursing education, along with enhanced experiential learning opportunities, can strengthen students' capacity to implement sustainable clinical practices. Strengthening sustainability beliefs within educational frameworks is essential to bridging the gap between theoretical understanding and practical application in healthcare settings.

INTRODUCTION

In the 21st century, climate change is becoming a major threat to human health worldwide. It is responsible for extreme weather events that include heavy rains, high temperatures, and violent winds, which have both direct and indirect impacts on people's health (Riaz et al., 2022). This disruption resulted in injuries, illness and loss of life, as well as interruption on health services and supply chain (Riaz et al., 2022). The healthcare industry as a whole has a major impact on climate change due to its high energy consumption, waste generation, and carbon emissions, with hospitals being the biggest contributors (Russo, 2022; Noureen et al., 2022).

Many nursing programs do not provide or include enough education about climate change and environmental sustainability (Shahzad & Amjad, 2022). The most recent research indicates that more than 60% of nursing instructors do not cover the health consequences of global warming or the ways to minimize the environmental footprint of the healthcare sector. The absence of such education results in the new generation of nurses being unready to deal with the climate-related problems in medical environments (Khan, 2020; Shahzad & Amjad, 2022).

There is an urgent need to integrate climate change and sustainability issues into nursing education (Babar et al., 2021). This will involve nursing students in getting the necessary knowledge and skills for giving safe, eco-friendly care, and supporting laws that ensure the health of mankind and nature. If not, the gap between the environmental impact of health care and the part of nurses in dealing with it was come bigger and bigger (Ali & Senturk, 2019; Akbar & Hayat, 2020; Babar et al., 2021; Quader, 2024).

Climate change is a major health threat that is increasing over time and affecting the whole world. It brings about problems like people getting sick due to heat, a rise in the number of people infected with diseases spread by vectors and those caused by water, and respiratory and mental health issues getting worse (Ismail & Ali, 2020; Shahid & Adnan, 2021; Yinusa & Ogoun, 2024). The most affected are the vulnerable groups like children, elders, and the poor. It further strains the healthcare systems, particularly in low and middle-income countries such as Pakistan (Shahid & Adnan, 2021).

Most ecologically dynamic cities were categorized as such based on characteristics such as debris collection, sewage flows, bird holes, debris, and land use (Chitakira & Ngcobo, 2021). The city has undergone some harsh conditions like heat waves that were really extreme, floods in the city, and the return of some diseases such as dengue and chikungunya during the last few years. These happenings are a clear indication that the medical systems and personnel urgently need to be equipped for health issues arising from climate change (Mehdi, 2019; Shahid & Adnan, 2021; Modupe, 2021).

The significance of this research lies in the fact that it is grounded on the perspectives and experiences of healthcare personnel. The results can be beneficial in enhancing nursing education, forming public health programs, and backing policies that reinforce and render the healthcare system more durable and less prone to collapse (Hameed, 2020; Hägg-Martinell, 2025). The research, by tackling this issue, will contribute to the safeguarding of at-risk populations and enhancing the healthcare sector's reactions to climate change in general (Akbar & Hayat, 2020; Khan et al., 2023; Carlo, 2025).

This inquiry mainly aimed at discovering:

- The climatic variation influence on health consciousness of nursing students and their knowledge about it.
- The perception of nursing students towards sustainability in the field of healthcare.
- The division between nursing students' theoretical knowledge and application of sustainability practices in the clinic.
- The impact of introducing climate change issues into nursing education.

This paper is composed of six major chapters. In Chapter 1, the study is presented, with a discussion on the background, problem statement, significance, research gap, objectives, research questions, and operational definitions. Chapter 2 covers the literature review of climate change, sustainability in nursing education, and experiential learning, and it also introduces the theoretical framework. Chapter 3 explains the research methodology, covering the research design, population and sample, sampling method, data collection tools, ethical aspects, and data analysis plan. In Chapter 4, the results of the study are presented through descriptive statistics, and the reliability, correlation, regression, and mediation analyses are also provided. The discussion of the findings in Chapter 5 is connected to previous research, and implications for nursing education and practice are also pointed out. Finally, in Chapter 6, the study is summed up with practical recommendations, constraints, and suggestions for future research, and then references and appendices are provided.

LITERATURE REVIEW

The Social Cognitive Theory (SCT), developed by Albert Bandura, is the principal theoretical framework that this literature review employs to illuminate the significance of sustainability and climate change issues in the context of nursing practice. The Social Cognitive Theory asserts that the three-way interaction of the cognitive, affective, and environmental factors is the main mechanism of the learning and the behaviour of people (Bandura, 1986). Among the main concepts to The Social Cognitive Theory are self-efficacy, outcome expectancies, behavioural capability, self-regulation, and observational learning (modelling). The concepts employed in nursing practice, particularly the learning of nurses and educating them about climate change and sustainability, have a direct impact on the behavioural aspect of nursing. This behavioural aspect is the application of knowledge to consistent and observable clinical behaviour. Among the concepts introduced by Bandura, self-efficacy or the belief that one can take the required actions to deal with the situation effectively is the most crucial (Ufaq, 2019; Modibbo & Inuwa, 2020; Noureen et al., 2022; Marc & Roussel, 2024).

The higher climate change literacy encompassing science, health impacts, and mitigation measures has been linked to the nursing profession and education practicing sustainability, and these beliefs being more pronounced. Recent studies reveal that nursing students with higher climate awareness are those who, to a larger extent, support the principles of sustainability in the professional identity they gain (Raja & Iqbal, 2019; Atta et al., 2024; Aronsson et al., 2025).

In this model, the independent variables climate change literacy and experiential learning exposure impact the dependent variable, sustainable clinical practice, through the sustainability integration belief. Climate change literacy raises awareness of the environmental health effects and the necessity for sustainable practices (Muhammad & Yan, 2019; Rehman & Malik, 2020; Marc et al., 2025) in healthcare. Experiential learning further develops this knowledge by letting people put in practice the concepts of sustainability in actual clinical settings. These factors together produce a strong belief in the necessity of sustainability in clinical care. This belief drives the healthcare workers to practice the use of resources efficiently and proper waste management, which are up to the eco-friendly standards. Hence, the strengthening of climate change literacy and experiential learning indirectly, but powerfully, support the movement towards sustainable clinical practice through the changing of attitudes and beliefs about sustainability.

H1: Climate change literacy is directly associated with sustainability integration belief among nursing students

It is justifiable to assert that climate literacy is a direct factor that strengthens the beliefs in the merging of sustainability and that the association between them also serves to point out the significance of practical experiences, suggesting that

the use of experiential learning as a teaching method might even more convince the students to endorse the idea of sustainability being part of the practice. Experiential learning practices such as clinical simulations, project-based assignments, and reflective practices have been found to be related to positively the students' change in attitudes and beliefs about sustainability. The research shows that students in the nursing program who have taken part in activities concerning the connection between climate and health have reported a stronger conviction in the sustainability of their church (Douglas et al., 2024; Álvarez-Nieto et al., 2024).

H2: Experiential learning exposure is directly associated with sustainability integration belief

It is possible to create an impact on the belief in sustainability integration through experiential learning; thus, students was more confident and motivated to practice these sustainability principles, which in turn will lead the shift in their beliefs towards more effective and ecologically responsible clinical practice. In case the nursing profession is going to be educated in a way to be sustainable, it was the students and nurses who will support the idea of waste segregation as the right way to handle wastes, energy conservation, low-carbon making of decisions, and educating the patients through sustainable clinical activities (İlaslan & Şahin Orak, 2024; Álvarez-Nieto et al., 2024).

H3: Sustainability integration belief is directly associated with more effective sustainable clinical practice

The beliefs mentioned turn out to be a strong predictor of the actual sustainable practice. This means that once students see sustainability as being part of their professional identity, they are more likely to apply theory in the form of practical clinical actions. This situation leads to the idea that such beliefs could play a key role in deciding the impact of climate-related knowledge on the sustainability of practices. The proponents of climate change education refer to this very research work as a pointer in their favor: being knowledgeable is not sufficient for people to act sustainably unless they have a substantial belief that sustainability is a must-integrated area (Dog an, 2025; Atta et al., 2024).

H4: Sustainability integration belief mediates the relationship between climate literacy and sustainable clinical practice

In this context, the belief in sustainability integration acts as a mediator in the process of climate literacy impacting eco-friendly clinical practice, thus pointing out the pivotal role of attitudinal routes in the transfer of knowledge from lightening to action. Push on this, the very attitudinal mechanism could also be the same through which experiential learning has an impact on the sustainable behavior of students, which means that the latter is mostly determined by the former in terms of the beliefs it reinforces. Experiential education has been proven by empirical studies to have a strong impact on the sustainability beliefs and therefore the habits of the learners in the long run (Douglas et al., 2024; Aronsson et al., 2025).

H5: Sustainability integration belief mediates the relationship between experiential learning exposure and sustainable clinical practice

One of the aspects through which experiential education has a supportive effect on the belief that sustainability is leading in this is by linking the behavior change closely with the learning experience and connecting it indirectly to the emergence of wider routes of effects. Additionally, just as the belief in sustainability integration, climate change literacy may be a key factor influencing the longevity of clinical practices by affecting the latter and revealing another indirect mechanism through which the effects reach the clinical practice changes. Climate literacy is not affecting the behavior of the medical community simply but it is rather changing their attitude and beliefs in the long run thus making it a major component to the sustainable clinical practice through the medium of the sustainability integration belief (Tiitta et al., 2024; Abualruz et al., 2024).

H6: Climate change literacy is indirectly associated with sustainable clinical practice

The core factor in literacy to practice influence, thus the connection to the indirect effect of experiential learning is made, is not knowledge but rather beliefs. Likewise, experiential learning can also affect the sustainable clinical practice through the reinforcement of these beliefs that are seen as another indirect route from learning experiences to behavioral outcomes. It is similar with the influence of experiential learning exposure on sustainability in clinical practice: the influence is mainly indirect and is, therefore, reinforced by one's belief in sustainability combination (Hägg-Martinell et al., 2025; Douglas et al., 2024).

H7: Experiential learning exposure is indirectly associated with sustainable clinical practice

Gradually, through changing students' mindsets through immersion and reflection, experiential learning paves the way for sustainability in clinical practice, thus closing the conceptual loop of the model. Recent research has highlighted the importance of incorporating climate change and sustainability into nursing education and practice. Methods to augment climate literacy, sustainability beliefs, and pro-environmental behaviors categorized by Giwaymel (2025), Tiitta et al. (2024), al, et al. (2024), and Douglas et al. (2024), are such as competency-based curricula, simulations, blended learning, and experiential projects. The Social Cognitive Theory explains the influence of knowledge, observational learning, and mastery experiences on the adoption of sustainable practices in the healthcare sector (Bandura, 1997; Egele et al., 2025). Moreover, sustainability integration perception is mediating the impact of climate literacy and experiential learning on sustainable clinical behavior (Dog an, 2025; Hägg-Martinell et al., 2025). Even though climate change early warning systems and other global frameworks regarding sustainability in healthcare point to a proactive approach, the South Asian countries are still having a hard time adapting due to lack of resources and non-existent laws that would support them (Baig et al., 2024; Shah, 2024).

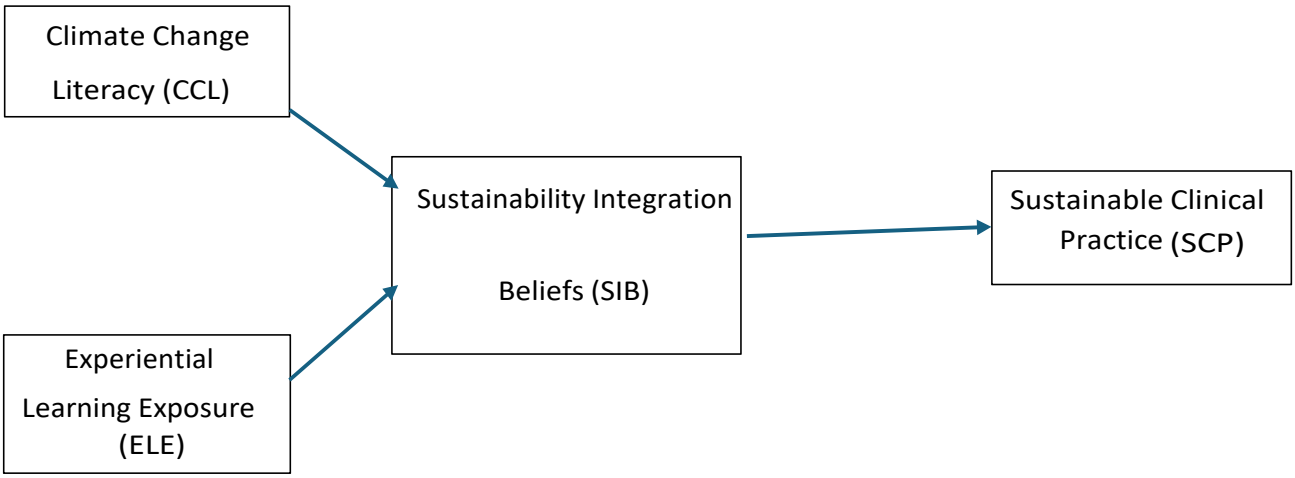


Fig. 1: Theoretical Framework

The integration of climate change within most health or environmental education reflects the growing recognition of the pressing roles it plays in status of health among various health issues, thereby the worth of integrating climate-change in health promotion (Babar et al., 2021). Recent research indicates that while nursing students are conscious of climate change and regard sustainability as a vital duty, still a considerable number have difficulty in establishing a relationship between these notions and the realities of nursing practice (Babar et al., 2021).

Moreover, one more restriction in the literature is the fact that the majority of studies have been

carried out in high-income areas like Sweden and Spain, where the level of resources and the quality of the health care systems are not the same as in the more vulnerable regions. According to the findings from Pakistan, health care workers are aware of the increasing health hazards created by climate change but they are not trained formally, do not get the support of the institution, and thus cannot integrate their teaching with the climate issues (Yasmeen et al., 2022). This emphasizes the immediate requirement of additional studies to study the way nursing education could be modified in the scope of resource-poor and climate-affected areas. Course design that not only creates awareness but also imparts practical skills for promoting sustainable healthcare in different global locations would be a solution to this serious gap (Saeed et al., 2023).

METHODOLOGY

This investigation embraced a realist ontology, recognizing the existence of reality beyond individual perception, and applied an objectivist epistemology to make sure the produced knowledge was empirical and quantifiable (Crotty, 1998; Ramirez & Clarke, 2024). In congruence with the positivist paradigm, the study was carried out in an organized manner to test hypotheses and aimed at obtaining findings that could be applied through structured instruments (Creswell, 2014). A deductive mono-method quantitative approach with a cross-sectional design was adopted to assess the interrelations among climate change literacy, experiential learning, personal beliefs, and sustainable clinical practices among nursing students through the use of questionnaires (Saunders et al., 2019; Bryman, 2016). Data collection occurred at Jinnah Hospital and Gulab Devi Hospital, which had been selected for their convenient location and relevant clinical exposure, thus making the findings more applicable to the context (Ahmed & Sultana, 2024). The use of G*Power 3.1 led to a determination of 377 as the least sample size needed for obtaining statistical power, and using convenience sampling the team managed to recruit participants in an efficient manner within the limitations of time (Sekaran & Bougie, 2019; Rahman et al., 2025). The individual nursing student was considered as the unit of sampling, this approach enabled the researchers to assess in detail personal perceptions, attitudes, and practices concerning sustainability adoption in clinical settings (Bryman, 2016).

Measures and Instruments

The data were collected through a structured questionnaire which was based on validated scales, notably the Sustainability Attitudes in Nursing Scale-2 (SANS-2) and the Clinical Learning Experience Scale (López-Medina et al., 2024; Hägg-Martinell et al., 2025). The questionnaire measured four constructs; Climate Change Literacy (CCL), Experiential Learning Exposure (ELE), Sustainability Integration Beliefs (SIB), and Sustainable Clinical Practice (SCP). A 5-point Likert scale was applied to the response options so as to facilitate standardization, reliability, and comparability of the results.

Data Collection Methods

The data was collected through Google Forms, which are considered the most appropriate method owing to their efficiency, accuracy, and confidentiality (Park & Chen, 2024). Survey consent was shown up on the screen for the respondents to see before they take the survey (Iqbal et al., 2025). The online method enables contacting students of various universities (Rahman et al., 2025). The approach is like convenience sampling and cross-sectional study design (Khan & Abdullah, 2024).

Data Analysis

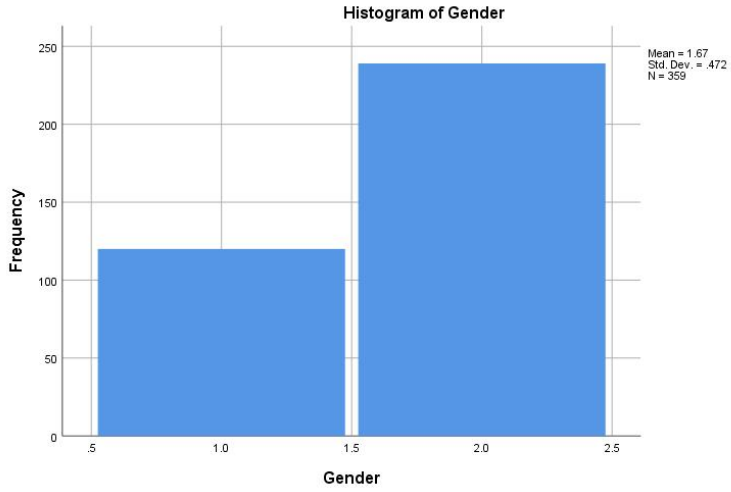
SPSS (version 26) was the software that served to process the data gathered so that the research aims could be met. Mean values, standard deviations, frequencies, and percentages were calculated as part of the descriptive statistics for demographic variables and study constructs (CCL_Total, EL_Total, SIB_Total, SCP_Total). Reliability of the scales was determined through Cronbach's alpha. Pearson correlation was applied to explore the relationships between the variables and multiple regression

analyses were performed to test the predictive relationships. Mediation analysis was carried out with the use of Hayes' PROCESS macro (Model 4) to identify the indirect effects of Climate Change Literacy (CCL) and Experiential Learning (EL) on Sustainable Clinical Practice (SCP) through Sustainability Integration Beliefs (SIB).

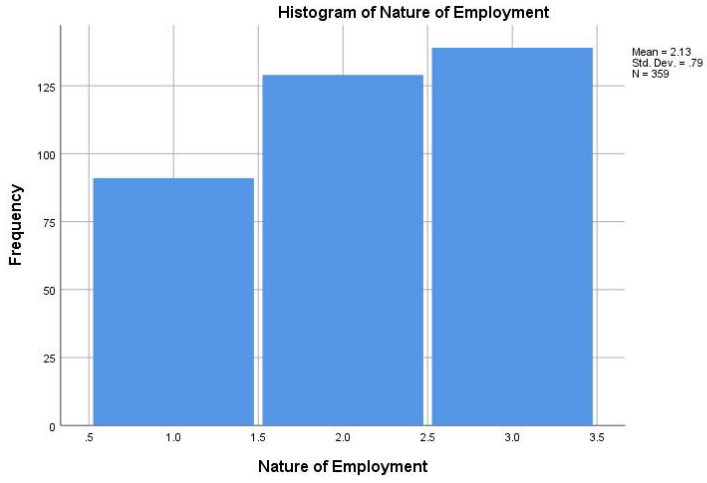
RESULTS

This chapter showcases the findings of the research which looked into climate change literacy (CCL), experiential learning (EL), sustainability integration belief (SIB), and sustainable clinical practice (SCP) in the nursing student population. The results comprise demographic profile, reliability of the measuring instruments, descriptive statistics, correlations, and regression analyses, alongside mediation effects.

The demographic information of the participants is summarized below. A total of 359 nursing students participated in the study.

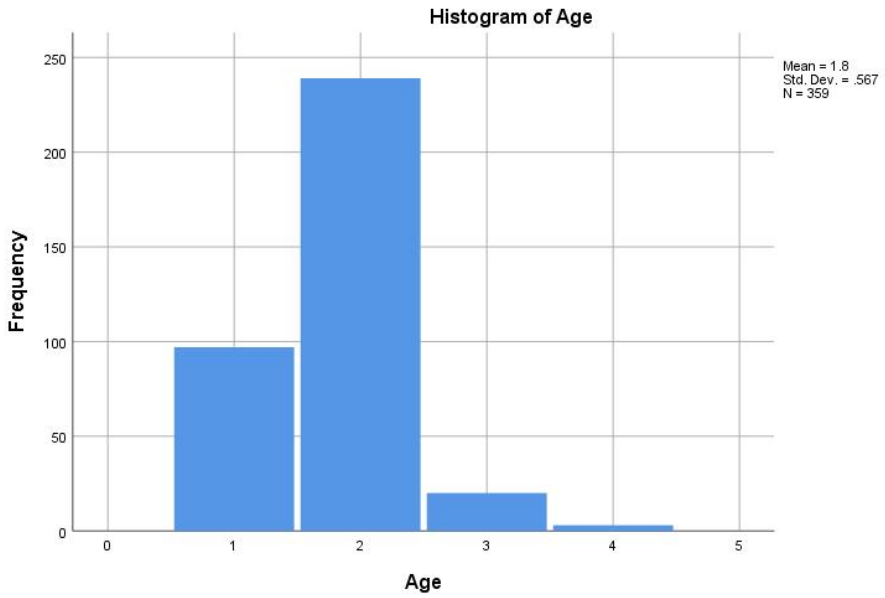


Gender: Out of 359 participants, 120 (33.4%) were male and 239 (66.6%) were female, indicating a higher proportion of female participants in the study.



Nature of Employment: Regarding employment type, 91 participants (25.3%) were contractual, 129 (35.9%) were permanent, and 139 (38.7%) were categorized as "Other".

Age and Length of Service



The participants' age ranged from 1 to 4 (M = 1.80, SD = 0.567), The length of service ranged from 1 to 4 years (M = 2.22, SD = 0.911).

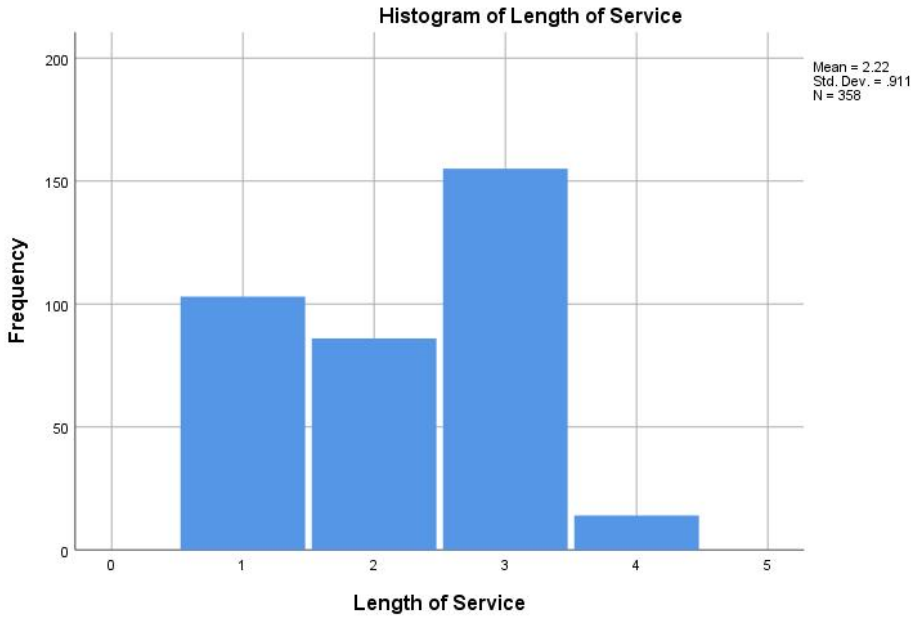


Table 1: *Reliability Statistics of Study Instruments*

Scale	Items	Cronbach's Alpha
Climate Change Literacy (CCL)	8	0.969
Experiential Learning (EL)	7	0.964
Sustainability Integration Belief (SIB)	8	0.972
Sustainable Clinical Practice (SCP)	10	0.979

The internal consistency of the study instruments was evaluated with the help of Cronbach's Alpha. The scales showed very high reliability, as the values were all above 0.9, which means that the instruments were very consistent in measuring the respective constructs. This means that the items within each scale can be trusted to assess the underlying variables of climate change literacy, experiential learning, sustainability integration belief, and sustainable clinical practice.

Table 2: *Descriptive Statistics of Study Variables (N = 204)*

Variable	Min	Max	Mean	SD	Skewness	Kurtosis
CCL_Total	1.00	5.00	3.961	1.012	-1.839	2.236
EL_Total	1.00	5.00	3.834	0.963	-1.821	2.338
SIB_Total	1.00	5.00	3.971	1.015	-1.850	2.251
SCP_Total	1.00	5.00	3.976	1.013	-1.876	2.294

The descriptive statistics engaged the participation of the subjects to show a picture of their climate literacy, experiential learning, sustainability integration and sustainable clinical practices, which all turned out to be at relatively high levels. The negative skewness of the distributions for all the variables proves that most of the participants had the highest scores, indicating strong involvement and good views about sustainability in their clinical training. The kurtosis values were between 2.2–2.3, which means that the distributions were of moderate peak.

Table 3: *Correlation Matrix of Study Variables (N = 359)*

No.	Variable	1	2	3	4
1	Climate Change Literacy (CCL)	1.00			
2	Experiential Learning (EL)	0.960**	1.00		
3	Sustainability Integration Belief (SIB)	0.988**	0.960**	1.00	
4	Sustainable Clinical Practice (SCP)	0.971**	0.976**	0.974**	1.00

The Pearson correlation analysis showed very strong positive relationships among all the variables involved in the study. This means that the higher the climate literacy and experiential learning exposure, the stronger the sustainability beliefs and practices. To be more precise, the CCL had extremely strong correlations with both SIB ($r = 0.988$) and SCP ($r = 0.971$), while the EL also showed very strong correlation with SIB ($r = 0.960$) and SCP ($r = 0.976$). The data points towards the conclusion that both theoretical knowledge and practical learning experiences are associated with the development of sustainable behaviors in clinical practice.

The results of the simple linear regression analyses were as follows:

- H1 (CCL → SIB): Climate change literacy was a strong predictor of sustainability integration belief ($\beta = 0.988$, $p < 0.001$), and variance of 97.5% was accounted for.
- H2 (EL → SIB): Experiential learning was a strong predictor of sustainability integration belief ($\beta = 0.960$, $p < 0.001$), and variance of 92.2% was accounted for.
- H3 (SIB → SCP): Sustainability integration belief was a strong predictor of sustainable clinical practice ($\beta = 0.974$, $p < 0.001$), and variance of 94.9% was accounted for.

The findings thus suggest that both cognition and practical learning are the major factors which students' sustainability beliefs grow, and those beliefs have a strong influence on the clinical practice they adopt.

The sustainability integration beliefs (SIB) were confirmed to be a partial mediator by mediation analyses using Hayes' PROCESS macro (Model 4):

- H4 and H6 (CCL → SIB → SCP): The direct effect of CCL on SCP was reduced to $\beta = 0.383$ ($p < 0.001$) when SIB was considered, and

there was a significant indirect effect via SIB (β = 0.590, 95% CI [0.386, 0.819]). This means that the climate literacy of the students enhances the sustainable practices in the clinic to some extent through the reinforcement of sustainability beliefs.

- H5 and H7 (EL → SIB → SCP): The direct effect of EL on SCP was reduced to β = 0.524 ($p < 0.001$), while there was a significant indirect effect via SIB (β = 0.475, 95% CI [0.388, 0.565]). This indicates that the experiential learning not only directly contributes to the sustainability in the clinical practices but also does so through the sustainability beliefs.

The key takeaway from the study is that theoretical understanding and hands-on experience play a major role in the development of sustainability-oriented practices in nursing.

The results show that educational background about climate change and learning by doing to a larger extent create an environment for the integration of sustainability beliefs that will consequently lead to the practice of clinical sustainability. The mediation analyses indicate that one of the main reasons for the impact of literacy and experiential learning on clinical practice is the formation of sustainability beliefs, thus pointing out their significant role in the sustainability promotion of nursing students.

DISCUSSION

The current research looked into the connections that exist between the various aspects of climate change literacy, experiential learning, sustainability integration beliefs, and sustainable clinical practice among nursing students. To sum up, the results show that climate change literacy and experiential learning are linked to each other in a significant way; moreover, the former is believed to do so positively with sustainable clinical practice through the latter. All-in-all, it is the students with the best knowledge on climate change and the ones involved with experiential learning activities that are most likely to grasp the sustainability concepts and apply them in their clinical practices. This has been proved in the past by showing that the practices in nursing that were oriented towards sustainability were affected by both knowledge and learning experiences (Babar et al., 2021; Yasmeen et al., 2022).

Considered together with existing studies the new findings show a wide agreement. In previous researches it was claimed that being theoretically aware of environmental and climate issues does not lead automatically to sustainable healthcare practices unless it is supported by experiential and practice-based learning strategies (Babar et al., 2021; Yasmeen et al., 2022). The present research recognizes the mediating role of sustainability integration beliefs which has been previously discussed by theorists in relation to professional behavior as a major process through which knowledge and experience interact (Hägg-Martinell, 2025). The implication is that experiential learning promotes the establishment of belief which later determines the taking of sustainable clinical actions.

The outcomes also showed that climate change literacy directly and positively influenced sustainable clinical practice, though this connection was partially mediated by sustainability integration beliefs. This indicates that knowing must first be taken as a belief before it can be frequent and seamless practice in the hard and demanding clinical environments. Research prior to this has made similar conclusions where personal values and professional beliefs were pointed out as the primary motivational drivers of eco-friendly healthcare practices (McCauley et al., 2024).

Experiential learning had both direct and indirect influences on sustainable clinical practice and pointed out the necessity of active learning methods in nursing education. The application of simulation-based activities, scenario-based teaching, and reflective group discussions was found to be beneficial in developing the skills of critical thinking, decision-making, and problem-solving which are all tied to sustainable healthcare delivery (López-Medina et al., 2022). This conclusion is in line with earlier research which pointed out that experiential learning not only draws students in more but also

makes them more competent and already prepared to use sustainability principles in actual healthcare settings (Aronsson et al., 2025).

These discoveries have an enormous impact on nursing education especially in low- and middle-income countries where the health impacts of climate change are heavy and health care resources are scarce. It has been established by various studies that sustainability-focused and experiential learning approaches can be effectively integrated into nursing curricula to prepare students to tackle climate-related health problems while simultaneously encouraging good environmental practices (Shahid & Adnan, 2021; Khan et al., 2023). Scenario-based and reflective learning techniques are considered to be the most effective ways of closing the gap between theory and practice since they allow the students to use the concept of sustainability in different clinical situations.

Notwithstanding these contributions, the study's limitations should nevertheless be recognized. The emphasis on nursing students makes it impossible to extrapolate the results to other health professional groups. Moreover, the cross-sectional design hinders the drawing of causal inferences regarding the observed relationships. Such methodological drawbacks have also been identified in sustainability education research, which has been relying on self-reports and thus likely exposing itself to the problem of response bias and, consequently, to the limitation of the accuracy of the reported practices (McCauley et al., 2024).

Longitudinal designs should be applied in future research to monitor how and when the climate change literacy, experiential learning, and sustainability integration beliefs are changing and influencing long-term clinical practice. A broader approach to research that considers not only the practicing nurses but also the organizational and institutional factors might give a better understanding of the sustainability integration in healthcare systems. The implications of the study are that, through a combination of knowledge, experiential learning, and belief formation, nursing students will be trained to have sustainable practices and be the environmentally responsible nursing workforce that is able to meet current and future needs in health care related to climate change (Hägg-Martinell, 2025).

CONCLUSION

This research indicated that Climate Change Literacy (CCL) and Experiential Learning (EL) significantly increase Sustainability Integration Beliefs (SIB). In addition, their mutual relationship is a strong predictor of Sustainable Clinical Practice (SCP) among nursing students. Knowledge is not enough; besides the internalized beliefs, the "active" practical application through experiential learning has to be at the core to "translate" sustainably into clinical behaviors. The findings emphasize the need to consider the simultaneous integration of climate change education, belief development, and hands-on learning into nursing curricula. By doing so, future nurses can be well-prepared to provide environment-friendly care, be part of sustainable healthcare systems, and tackle climate-related health issues. Nursing students' sustainability ethics can be built by creating an atmosphere where literacy skills, experiential learning, and sustainability beliefs coexist. Thus, nursing students will be able to adopt contemporary clinical settings' sustainable practices. Thus, nursing students will be able to adopt contemporary clinical settings' sustainable practices. The present study has to acknowledge the presence of several limitations along with the enlightening findings. To begin with, the sample only included nursing students from one geographical area, which may limit the applicability of the outcomes to other locations or institutions. Next, the cross-sectional design does not permit the deducing of causality between the variables Climate Change Literacy, Experiential Learning, Sustainability Integration Beliefs, and Sustainable Clinical Practice. Besides, the study results were based on self-reported measures, which are always at risk of being influenced by social acceptability. Finally, it is true

that validated instruments were employed in the study, but still, the specific cultural and contextual factors of the study population may have affected their responses.

Future research should go beyond a single institution and region to make the results applicable to a wider population. Longitudinal studies or experiments could be used to shed light on causality and the gradual effect of specific educational interventions. Nursing education as a whole should include not just the scientific theories of climate change and sustainability, but also the practical side of it through experiential learning. Besides that, the educators should come up with ways to implant beliefs and motivation for sustainable practices in clinical settings among the students. The application of qualitative methods could also highlight how nursing students view the issues of sustainability in the clinic – the barriers and the facilitators – and thus give a socioeconomic insight into their world. These insights should be taken into consideration by policy makers and curriculum developers in the rollout of programs that are based on evidence and that equip nurses with the skills needed for climate-responsive healthcare delivery.

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