

THE ENVIRONMENTAL AWARENESS LEVEL AMONG SAUDI WOMEN AND ITS RELATIONSHIP TO SUSTAINABLE THINKING

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Highlights

The study highlights environmental awareness and sustainable practices among Saudi women.

Abstract

Recognizing environmental concerns is crucial for fostering a mindset and implementing behaviors that contribute to sustainability. Individuals with good environmental awareness engage well in environmentally supportive behaviors and think in ways that contribute to a sustainable future. The current research aims to assess the level of environmental awareness among Saudi women and unveil the relationship between the level of environmental awareness and sustainable thinking. Additionally, the research seeks to explore the possibility of predicting sustainable thinking based on the level of environmental awareness. A questionnaire on environmental awareness and a questionnaire on sustainable thinking were applied to 176 female teachers working in the Wadi Dawasir governorate educational administration. The study utilised a descriptive-analytical methodology, namely the correlational predictive approach, to examine the relationship between the research variables and make predictions about their associations. The research results indicated a high level of environmental awareness among the research sample and a high level of sustainable thinking. Furthermore, the findings revealed a statistically significant positive correlational relationship between the level of environmental awareness and sustainable thinking. The results also demonstrated the possibility of predicting sustainable thinking based on the level of environmental awareness in the research sample.

Keywords

environmental awareness; sustainable thinking; saudi women.

Introduction

The escalating concerns surrounding environmental degradation have propelled the field of environmental studies to the forefront of scholarly and public discourse. As evidenced by the attention garnered from experts and the global community, the intricate web of environmental issues demands careful examination and thoughtful consideration. Environmental challenges are prevalent worldwide, stemming from various factors, most notably the lack of awareness among community members and inappropriate behavioral patterns [18, 73]. It is asserted that at its core, environmental issues are fundamentally behavioral concerns, with humans identified as the primary contributors to environmental pollution [7, 35, 75].

Environmental pollution is considered one of the most dangerous and complex issues in the current era, with associated dimensions in health, social, and economic aspects. The danger of this problem is not limited to harming the environment but extends to the emergence of other issues related to human health and safety where the increase in respiratory diseases, cancer, and respiratory system problems is evident [36, 67].

Countries globally have enacted legal frameworks to regulate human-environment interaction for resource conservation. However, recognizing the limitations of legal and technological measures, there is a growing

acknowledgment of the pivotal role of education. This perspective emphasizes enhancing individuals' capacities, promoting environmental awareness, and illuminating key challenges. By developing capabilities and raising awareness, the educational approach aims to foster internal motivation, encouraging voluntary adherence to environmental laws and regulations [5, 21, 26].

Environmental awareness is considered a crucial approach to effective environmental protection [27]. It ensures the continuity of the environment within its natural framework and serves as a theoretical foundation, strengthening individuals' sense of their role in addressing environmental issues stemming from human behavior [24, 64]. The United Nations Decade of Education for Sustainable Development (UNDESD) underscores the importance of integrating environmental education into curricula and teacher training programs to cultivate the necessary environmental awareness [58].

Environmental awareness encompasses individuals' perception, knowledge, and consciousness of their external environment, influencing their development and behavior [39]. Hamdi defines it as acquiring sufficient knowledge, cultivating positive attitudes, and exhibiting responsible environmental behaviors to conserve the environment and its resources. This concept includes understanding the environment's importance, dealing with it, protecting it, preserving resources, identifying problems, proposing solutions, and preventing future issues[13]. This awareness facilitates the formation of environmental knowledge, cutting across societal categories, enabling individuals to contribute to preservation, address environmental problems, and uphold sustainability [8, 41, 61, 60].

Mei et al. [53] further defined environmental awareness as a sense of responsibility toward the environment, engaging in practices that contribute to its preservation, raising awareness among others about the types of hazards caused by improper human practices, understanding their severity, and being aware of various environmental issues. Additionally, it involves replacing harmful practices with ones that benefit the land and the environment, and aiding in their preservation, along with attempting to rectify damages resulting from improper environmental practices. Environmental awareness is classified into two types: preventive awareness, which aims to prevent problems, and therapeutic awareness, which addresses actual problems resulting from misuse [8].

Environmental awareness entails cultivating a sense of responsibility and concern for the environmental challenges individuals face, prompting a shift in attitudes and behaviors towards the environment and encouraging involvement in suitable environmental solutions [42]. It intersects with crucial concepts like environmental education, emphasizing the need for educational institutions to prioritize nurturing environmental awareness among the younger generation. This focus aims to bolster the link between environmentally supportive attitudes and behaviors [10, 21, 52, 72].

The concept of environmental awareness encompasses a multifaceted spectrum that extends far beyond a simple acknowledgment of ecological issues. It delves into various dimensions, including cognitive, affective, and behavioral aspects, collectively shaping individuals' perceptions, sentiments, and actions concerning the environment. Understanding these diverse dimensions is pivotal in formulating effective strategies for fostering a deeper and more sustainable environmental consciousness [74].

Al-Ziyadat [17] outlines dimensions as environmental knowledge, skills, and attitudes. Others categorize it into knowledge of environmental information, attitudes, and behavioral attitudes [44, 47, 48, 77, 39] list dimensions as environmental knowledge, skills, and motivation for conservation. In addition, [57] simplify the dimensions into environmental information and attitudes. Hamdi, on the other hand, specifies the dimensions of environmental awareness in the context of the environmental sustainability requirements for the vision of the Kingdom of Saudi Arabia as follows:

- Awareness of the environmental sustainability requirements for the Saudi Vision 2030: Refers to familiarity with information and facts about the environmental sustainability requirements for the Saudi Vision 2030. This includes the positions, beliefs, and behaviors of educators toward preserving and sustaining the environment.

- Positive attitudes toward achieving the environmental sustainability requirements for the Saudi Vision 2030: Signifies the stances formed by learners regarding the environmental sustainability requirements for the Saudi Vision 2030 and their willingness to contribute to its realization.
- Responsible environmental behaviors towards achieving the environmental sustainability requirements for the Saudi Vision 2030: Encompasses the environmentally responsible daily practices undertaken by learners to fulfill the environmental sustainability requirements for the Saudi Vision 2030.

The National Program for Environmental Awareness and Sustainable Development, part of Saudi Arabia's Vision 2030 and National Transformation Program 2020, is a local initiative aimed at disseminating knowledge and fostering awareness of environmental issues. The program seeks to instill individual and collective responsibility for conserving and enhancing the environment across diverse societal segments. It encourages national voluntary efforts, enhances environmental culture, and promotes active community participation in environmental protection. The initiative aligns with the goals of preventing pollution, rationalizing natural resource use, and achieving harmony between renewable and non-renewable resources for sustainable development (National Center for Meteorology, 1442 AH) [71].

Saudi Arabia has actively participated in conferences and workshops on Sustainable Development Goals, emphasizing its commitment to Vision 2030's economic, social, and environmental dimensions (General Authority for Statistics, 2018) [70]. Recently, Crown Prince Mohammed bin Salman announced the 'Green Saudi Arabia' and 'Green Middle East' initiatives, aimed at building upon the Kingdom's prior environmental efforts [54]. These initiatives underscore Saudi Arabia's commitment to addressing challenges like rising temperatures, reduced rainfall, dust storms, and desertification, aligning with Vision 2030's overarching goals (Saudi Press Agency, 1442 AH) [65].

Despite the recognized importance of environmental awareness, various studies consistently highlight a low level of environmental awareness, particularly among teachers. This can be attributed to factors such as inadequate training and preparation of teachers on environmental issues and a general lack of interest in environmental topics [13, 8, 14, 25, 28, 32, 45].

Addressing contemporary environmental challenges requires sustainable approaches, notably sustainable thinking. Educating and preparing a generation with sustainable thinking is essential for building a healthy society capable of making future decisions with a sustainable mindset [41]. Sustainable thinking involves assessing present conditions, organizing knowledge for sustainable trajectories, and evaluating societal threats and risks. Linked to individuals' environmental perceptions, it reflects diverse stakeholders' perspectives on sustainable development. Achieving sustainable development relies on three dimensions: understanding ethics and values, envisioning the environment as a socio-ecological system, and the capacity for engaging in sustainable thinking [22, 38, 62].

Sustainable thinking, as defined by Deniz [29], involves assessing the impact of actions on both profit and the well-being of humans and the planet. ECO-System App (2017) [31] describes it as mental skills manifested in sustainable behaviors and ethical decision-making. Al-Baz (2019) characterizes it as a set of behaviors and cognitive processes aimed at addressing sustainability issues comprehensively, strategically, and future-oriented. Repanovici et al. [62] define it as actively engaging in addressing contemporary challenges, including climate change and human rights. [50] sees it as a set of mental skills regulating thinking for future decision-making, encompassing holistic, strategic, future, and ethical thinking. Sustainable thinking is marked by evaluating consequences on society, the market, and the environment; aiming for long-term sustainable goals; and exhibiting responsible ethical behaviors [51].

Cultivating sustainable thinking is significant for its ability to navigate change, interpret diverse relationships, and explore correlations aligned with available information. It facilitates adept navigation between local and global examples, emphasizing interconnected knowledge. Sustainable thinking enhances ethical performance, focusing on environmental and social outcomes. Incorporating diverse strategies, whether traditional or innovative, empowers individuals to design intricate or discrete systems and experiences [11, 30, 40, 46, 50,66].

Sustainable thinking is a mindset leading to behaviors and decisions aimed at preserving the Earth and overcoming challenges [3]. It involves actively addressing social, environmental, and economic challenges such as climate change, carbon footprint, food security, and human rights [62]. Sustainable thinking encompasses several key dimensions, delineated into a set of skills [9, 3, 76]:

Firstly, Systemic Thinking, also known as Systems Thinking, is an analytical methodology focused on understanding the interconnections and dynamics of system components within broader contexts over time. Matawli identifies four key dimensions associated with systemic thinking skills. These include Systems Analysis Skills for discerning system components and discovering potential relationships, Relationship Awareness Skills for recognizing connections within a system, Systems Synthesis Skills for constructing systems by defining relationships, and System Evaluation Skills for rendering judgments about system validity and improvement strategies.

Secondly, future thinking is a mental process involving awareness and anticipation of future challenges, envisioning transformations, and crafting hypotheses related to changes. Ammar et al. [19] outline four primary skills within future thinking, including Future Anticipation skills, Future Prediction skills, Future Visualization skills, and Future Problem-Solving Skills. These skills contribute to predicting outcomes, contemplating future events, creating integrated future images, and analyzing and developing strategies to overcome complex challenges hindering progress [40].

Thirdly, Strategic Thinking involves formulating plans to achieve a specific vision and critically considering decisions in light of that vision. It involves seeking possible solutions within a specific set of assumptions, preparing assumptions for potential alternative solutions, testing the validity of assumptions and available alternatives, and exploring new ideas that may be more suitable [40, 78]. [63] identify four key skills underpinning Strategic Thinking, including reflection and idea building, seeking creative solutions, production, and evaluation. These skills encompass tasks such as forming a holistic picture of general topics, designing innovative plans for sustainability, implementing solutions, and understanding the global impact of local issues.

Fourthly, Values Thinking also referred to as values-based or ethical thinking, is characterized by its foundation on values. In the context of sustainability as a problem-solving-oriented field, potential solutions necessitate a thoughtful consideration of values. This approach serves as a guiding framework for learners across diverse situations, particularly amid the evolving challenges of the present era. Values Thinking entails an understanding of how these concepts vary among and within cultures and emphasizes the role of integrating values in solving sustainability problems [78, 76] identify three key skills underlying Values Thinking: recognizing the impact of integrating sustainability concepts, such as justice, environmental, and social equity, on sustainability; identifying values and principles crucial for achieving sustainability; and evaluating the complete context of a sustainability problem.

Results from several studies highlight the necessity of developing sustainable thinking skills in individuals. Some studies emphasize the importance of individuals acquiring sustainable thinking skills to creatively address environmental problems and make appropriate decisions [9, 3, 69]. Despite the significance of sustainable thinking, findings from various studies suggest a low level of sustainable thinking among students [9, 29, 68, 76]. Other studies have underscored the imperative of fostering Sustainable Thinking among students, teachers, and community members.

In examining the efficacy of sustainable thinking interventions, Srivastava et al. presented a model in agricultural education that explored the relationship between traditional and sustainable agriculture, comparing the current situation with future needs. Deniz's study focused on the correlation between environmental awareness and sustainable thinking in environmental issues through design education, stressing the need for integrating sustainable design education that connects with individual interests. Ahmed's study (2020) evaluated the effectiveness of a science unit incorporating dimensions of education for sustainable development in developing sustainable thinking skills and environmental responsibility among second-grade preparatory school students, with positive outcomes indicating the success of the training. Moreover, Mohamed and Ahmed's (2022-a)[55]

study demonstrated the effectiveness of a program addressing contemporary environmental issues and utilizing differentiated instruction in fostering sustainable thinking and environmental advocacy among teachers.

The academic discourse on the relationship between environmental awareness and sustainable thinking involves several studies. Some studies emphasize that environmental awareness serves as a crucial tool for individuals and communities to address issues related to the present and future use of natural resources, fostering initiatives for environmental sustainability [33, 29, 23] presented an educational program linked to the product life cycle for students in the commercial materials department, aiming to enhance their level of sustainable thinking. The study revealed improvement in students' appreciation and understanding of environmental sustainability concepts and the growth of their sustainable thinking. Other studies explored the connection between environmental awareness and sustainable thinking in environmental issues [29].

Srivastava et al. [68] presented a model for using sustainable thinking in agricultural education, comparing traditional and sustainable agriculture, while Ahmed (2020) demonstrated the effectiveness of an educational unit in developing sustainable thinking skills and environmental responsibility in middle school students. Additionally, Al-Baz (2019) proposed a program aligned with the Sustainable Development Goals 2030, measuring its impact on developing sustainable thinking among teacher students. Ahmad's study (2020) confirmed the effectiveness of implementing a unit in science, incorporating dimensions of education for sustainable development in developing sustainable thinking skills and environmental responsibility in intermediate-stage students.

Bourzek [27] emphasizes the pivotal role of environmental awareness in promoting environmental sustainability by enhancing learners' knowledge, shaping their attitudes toward the environment, and cultivating responsible environmental behavior. The research conducted by Mohamed and Ahmed (2022a, 2022b) [55, 56] establishes a positive and statistically significant correlation between sustainable thinking and environmental advocacy skills. Matawli's study demonstrates the efficacy of a program grounded in green innovation concepts for fostering sustainable thinking and elevating environmental citizenship levels. Furthermore, Mohamed and Ahmed's (2022b) investigation concludes that a proposed environmental education program, centered on contemporary public issues and employing differentiated education, effectively develops green economy concepts, sustainable thinking, and environmental advocacy skills among female teacher students in education colleges.

The foregoing analysis reveals a significant gap in existing research pertaining to the explicit examination of the relationship between environmental awareness and sustainable thinking. Recognizing this gap, the current study aims to investigate the levels of environmental awareness and their association with sustainable thinking within the chosen research sample. This research is particularly pertinent on a national scale in Saudi Arabia, where there is a pressing need to enhance environmental awareness among learners in alignment with the goals outlined in the Kingdom's Vision 2030. Launched in 2016, Saudi Vision 2030 serves as a comprehensive framework for achieving sustainable development goals, with a specific emphasis on environmental sustainability [20]. The vision incorporates various national programs dedicated to environmental awareness and sustainable development, aiming to disseminate knowledge about environmental issues throughout diverse segments of society. Noteworthy priorities include ensuring air quality sustainability, preserving water resources, protecting marine environments, and fostering eco-tourism, all integral components of Saudi Arabia's commitment to sustainable development [7, 15, 16].

In accordance with the objectives of the study, the following hypotheses have been developed:

1. The teachers within the research sample exhibit a low level of environmental awareness.
2. The teachers within the research sample exhibit a low level of sustainable thinking.
3. There is no statistically significant correlation between the scores of the teachers in the research sample on the Environmental Awareness Questionnaire and their scores on the Sustainable Thinking Questionnaire.
4. The level of environmental awareness cannot be statistically predicted based on the scores of teachers on The Sustainable Thinking Questionnaire.

Methodology and Procedures

Research Model

The study employed a descriptive-analytical methodology, specifically using the correlational predictive approach. This strategy is selected to elucidate the pattern of correlations between the research variables and to forecast the relationships among them.

Sample Size

The participants in the survey research included 55 female teachers in the Wadi Dawasir Governorate. The researcher applied the research tools to this group (age mean 31.35; SD= 1.12) to confirm the psychometric properties of the research instruments. For the main research, the researcher implemented the tools on 176 female teachers in the Wadi Dawasir Governorate (age mean 32.13; SD= 3.26) to verify the research hypotheses.

Data Collection Tools

Environmental Awareness Questionnaire

The Environmental Awareness Questionnaire was developed by the researchers after reviewing theoretical frameworks that addressed environmental awareness and its components. Additionally, the researchers examined previous studies to understand methods and determinants for measuring awareness of environmental issues, including the Adult's Attitudes Toward the Environment Scale [1, 7, 16, 41, 49, 59, 79].

The questionnaire comprises the following components: awareness of environmental pollution, awareness of environmental balance, and conservation of environmental resources. The original version of the questionnaire comprised 15 statements divided across three components, with each component including five items. Participants must assess each item using a five-point scale that spans from strongly agree to strongly disagree (5-4-3-2-1). Greater scores signify an elevated degree of environmental consciousness, and all assertions are presented in a favourable manner. The survey ratings spanned from 15 to 75 points.

The content validity of the Environmental Awareness Questionnaire was rigorously assessed by submitting it to scrutiny from five specialized faculty members in educational psychology. Notably, these reviewers demonstrated high agreement rates, ranging from 80% to 100%, affirming the questionnaire's content validity. To evaluate internal consistency, the Pearson correlation coefficient was employed, examining the relationship between each item's score and the total score of its corresponding component. This analysis, conducted on a sample of 55 teachers, revealed statistically significant correlation coefficients (ranging from 0.421 to 0.734) at the 0.01 significance level. Importantly, correlations between the scores of each component and the overall score of the questionnaire were also statistically significant. This robust statistical analysis confirms the internal consistency of the questionnaire, indicating that the items align well with their respective components and, collectively, contribute cohesively to the overall Environmental Awareness Questionnaire score.

In order to determine the dependability of the Environmental Awareness Questionnaire, the researchers utilised two well-established measures of reliability: Cronbach's Alpha coefficient and the Guttman split-half reliability equation. Due to the observed disparity in variance between the two parts of the scale, these measures were implemented following the administration of the questionnaire to 55 teachers who were participating in the survey study. The scale's reliability was assessed using the Guttman split-half equation, which yielded a coefficient of 0.772, and Cronbach's Alpha coefficient, which resulted in a value of 0.708. Importantly, both reliability coefficients surpassed the recommended threshold of 0.7, indicating a high level of reliability for the Environmental Awareness Questionnaire. This robust reliability assessment suggests that the questionnaire consistently and dependably measures the construct of environmental awareness among the surveyed teachers.

Sustainable Thinking Scale

The Sustainable Thinking Scale was developed by the researchers through a comprehensive process involving a review of relevant theoretical frameworks addressing sustainable thinking and an examination of methodologies employed in previous studies for measuring this construct. Comprising four key components—Systemic Thinking, Strategic Thinking, Future Thinking, and Values-Based Thinking—the scale encompasses a total of 16 items, with each component containing four items. Respondents are instructed to assess each item on a five-point scale, ranging from strongly agree to strongly disagree (5-4-3-2-1). Higher scores on the scale denote a heightened level

of sustainable thinking, and notably, all items are framed positively. The overall scale scores range from 16 to 80, providing a quantitative measure of participants' sustainable thinking across the specified components.

The content validity of the Sustainable Thinking Scale was established through a meticulous review process conducted by five faculty members in educational psychology. These reviewers demonstrated substantial agreement rates, ranging from 80% to 100%, affirming the scale's content validity. To evaluate internal consistency, the researchers employed the Pearson correlation coefficient, examining the relationship between each item's score and the total score of its corresponding component, excluding the item's score from the total component score. This analysis, conducted on a sample of 55 teachers, revealed statistically significant correlation coefficients (ranging from 0.505 to 0.831) at the 0.01 significance level. Notably, correlations between the scores of each component and the overall score of the scale were also statistically significant. These findings robustly confirm the internal consistency of the scale's items with their respective components and, collectively, with the overall score of the Sustainable Thinking Scale.

In order to guarantee the stability of the Sustainable Thinking Scale, the researchers employed both Cronbach's Alpha coefficient and the Guttman split-half reliability equation. After administering the Sustainable Thinking Scale to a total of 55 teachers in the survey study, reliability tests were performed due to the unequal variance between the two sides of the scale. After doing calculations using the Guttman split-half equation (0.811) and Cronbach's Alpha coefficient (0.736), it was found that all reliability coefficients were more than 0.7. The high level of reliability of the Sustainable Thinking Scale is indicated.

Results

The First Hypothesis Results

The first hypothesis states that "The teachers within the research sample exhibit a low level of environmental awareness." To test the validity of this hypothesis, a One-Sample t-test was employed, comparing the hypothetical mean of the environmental awareness questionnaire and its dimensions to the average scores of the teachers in the research sample on the environmental awareness questionnaire and its dimensions, as indicated in Table 1.

Table 1. Results of the one-sample t-test for detecting significance in the differences between the hypothetical mean and the mean scores of teachers in the research sample on the environmental awareness questionnaire and its dimensions

Academic Identity	Test Value	Mean	SD	Mean Difference	df	t	Sig.
Awareness of Environmental Pollution	15	21.44	1.53	6.44	175	185.106	.000
Awareness of Environmental Balance	15	21.24	1.70	6.24	175	165.339	.000
Conservation of Environmental Resources	15	21.11	1.76	6.11	175	158.617	.000
The Overall Score	45	63.80	4.35	18.80	175	194.303	.000

The preceding table reveals statistically significant differences at a significance level of 0.01 between the hypothetical mean (15) and the average scores of the teachers in the research sample on the dimensions of the environmental awareness questionnaire (awareness of environmental pollution, awareness of environmental balance, conservation of environmental resources, overall score). It is noteworthy that the average scores of the research sample on all dimensions were higher than the hypothetical mean, indicating a high level of environmental awareness among the participating teachers in the study.

The Second Hypothesis Results

The second hypothesis suggests that the teachers included in the research sample demonstrate a limited degree of sustainable thinking. In order to assess the accuracy of this hypothesis, a One-Sample t-test was utilised. This involved comparing the assumed average of the sustainable thinking scale and its dimensions to the mean scores of the teachers in the research sample on the same scale and dimensions. The results of this comparison can be found in table 2.

Table 2. Results of the one-sample t-test for detecting significance in the differences between the hypothetical mean and the average scores of teachers in the research sample on the sustainable thinking scale and its dimensions

Sustainable Thinking	Test Value	Mean	Std. Deviation	Mean Difference	df	t	Sig.
Systematic Thinking	12.5	17.43	1.72	4.93	175	134.006	.000
Strategic Thinking	12.5	16.84	1.91	4.34	175	116.790	.000
Future Thinking	12.5	17.09	1.70	4.59	175	132.685	.000
Value-based Thinking	12.5	17.13	1.71	4.63	175	132.301	.000
Overall Score	50	68.51	5.74	18.51	175	158.207	.000

From the preceding table, statistically significant differences are evident at a significance level of 0.01 between the hypothetical mean (12.5) and the average scores of the teachers in the research sample on the dimensions of the sustainable thinking scale (systemic thinking, strategic thinking, future thinking, values-based thinking, overall score). It is noteworthy that the average scores of the research sample on all dimensions were higher than the hypothetical mean, indicating a high level of sustainable thinking among the participating teachers in the study.

The Third Hypothesis Results

The third hypothesis asserts that "There is no statistically significant correlation between the scores of the teachers in the research sample on the Environmental Awareness Questionnaire and their scores on the Sustainable Thinking Questionnaire." To verify the validity of this hypothesis, the researcher calculated the Pearson correlation coefficient between the scores of the teachers in the research sample on the environmental awareness questionnaire and their scores on the sustainable thinking scale, as illustrated in Table 3.

Table 3. Pearson correlation coefficients between the scores of teachers in the research sample on the environmental awareness questionnaire and their scores on the sustainable thinking scale

Variables		Environmental Awareness Questionnaire			
		Awareness of Environmental Pollution	Awareness of Environmental Balance	Conservation of Environmental Resources	Total score
Sustainable Thinking Questionnaire	Systematic Thinking	.349**	.387**	.402**	.438**
	Strategic Thinking	.253**	.355**	.303**	.351**
	Future Thinking	.370**	.325**	.426**	.431**
	Value-based Thinking	.366**	.305**	.413**	.416**
	Total score	.409**	.422**	.472**	.501**

**Statistically significant at the 0.01 level.

The table provided shows a clear and significant positive correlation at the 0.01 level between the scores of the research sample on the sustainable thinking scale (systemic thinking, strategic thinking, future-oriented thinking, values-based thinking, overall score) and their scores on the environmental awareness questionnaire (awareness of environmental pollution, awareness of ecological balance, conservation of environmental resources, overall score). The correlation coefficients varied between .253 and .501, all of which were statistically significant at the 0.01 level.

The Fourth Hypothesis Results

The fourth hypothesis posits that "The level of environmental awareness cannot be statistically predicted based on the scores of teachers on The Sustainable Thinking Questionnaire". To test the validity of this hypothesis, multiple linear regression analysis was employed, considering the level of environmental awareness as the dependent variable and the dimensions of the sustainable thinking scale as independent variables. Stepwise Multiple Linear Regression analysis was conducted, resulting in several regression models, as illustrated in Table 4.

Table 4. Results of stepwise multiple linear regression analysis to predict the scores of teachers in the research sample on the level of environmental awareness based on their scores on the dimensions of the sustainable thinking scale

Model	variables	B	Std. Error	Beta	f value	t value	R	R ²	Adjusted R ²
1	(Constant)	37.790	3.421		58.239**	11.046**	.501	.251	.246
	The total score in sustainable thinking	.380	.050	.501		7.631**			

From the preceding table, it is evident that the independent variables (systemic thinking, strategic thinking, future-oriented thinking, values-based thinking) were excluded through Stepwise Multiple Linear Regression, as their partial correlations with environmental awareness were not statistically significant. Furthermore, the only statistically significant independent variable is the overall score for sustainable thinking, as indicated by the significance level. Consequently, this model was accepted, with an "F" value of 58.239, significant at the 0.01 level. The multiple correlation coefficient (R) is 0.501, and the coefficient of determination (R²) is 0.251. This signifies that the independent variable (overall score for sustainable thinking) explains 25.1% of the total variance in the dependent variable (environmental awareness).

Based on the foregoing, the multiple linear regression equation can be formulated as follows:

$$\text{Environmental Awareness} = 37.790 + (0.380) \times \text{Overall Score for Sustainable Thinking}$$

Discussion

Sustainable thinking and environmental awareness are intricately connected, with sustainable thinking serving as a precursor to the development of environmental awareness. The values embedded in sustainable thinking contribute to environmental preservation, and a reciprocal relationship exists where environmental awareness enhances sustainable thinking. The integration of knowledge, skills, attitudes, and a sense of responsibility toward the environment fosters sustainable thinking through the teacher's interactions with the environment, solving environmental problems, and improving the quality of life by reducing behaviors leading to environmental issues. Environmental awareness encompasses behaviors, cognitive processes, knowledge, and values, aiming to address sustainability-related issues comprehensively, strategically, future-oriented, and values-based.

The results of the first assessment indicate a high level of awareness of environmental issues among the teachers in the research sample. This finding aligns with several studies that found a high level of environmental awareness [6, 34, 12, 37, 43]. However, it differs from the other studies reporting a low level of environmental awareness [4, 8, 13, 32, 45].

Researchers attribute this result to the efforts of the Kingdom of Saudi Arabia in the field of environmental protection, launching numerous initiatives and educational programs targeting all segments of society. Among these programs is the National Environmental Awareness and Sustainable Development Program, part of the National Transformation 2020 initiative within the Saudi Vision 2030. The program aims to disseminate knowledge and raise awareness of environmental issues. Additionally, initiatives such as "Saudi Green" and "Green Middle East" contribute to environmental awareness.

The Kingdom of Saudi Arabia actively participates in conferences and workshops focused on Sustainable Development Goals (SDGs), contributing significantly to the promotion of environmental awareness within society. The Ministry of Education plays a key role by providing specialized courses for teachers, thereby enhancing their environmental consciousness. Researchers attribute their findings to the educational level of study participants, all of whom are educators in the Ministry of Education. They highlight the substantial impact of educational attainment on environmental awareness, emphasizing the knowledge acquired through education. Pre-service and in-service teacher training programs are recognized as essential in cultivating environmental awareness among participating educators. Furthermore, increased social interaction among teachers in schools, coupled with engagement with students and curricula, is identified as a crucial factor in raising awareness of environmental issues, including their causes, effects, and potential solutions.

The results of the second hypothesis indicated a high level of sustainable thinking among the teachers in the research sample. These findings differ from the results of various studies that reported a low level of sustainable thinking [9, 29, 68, 76]. In the Kingdom of Saudi Arabia, there are different evidences to support this result. For

example, the Saudi Vision in 2016, aimed to achieve sustainable development goals as a crucial aspect of the vision [15]. The Saudi Vision 2030 includes several national programs for sustainable development, aiming to raise awareness of environmental issues across various segments of society [16].

The level of education and training received by teachers during their work, including workshops that encompass knowledge, values, and behaviors, contributes to the development of strategic thinking, future-oriented thinking, systems thinking, and values-based thinking. The professional preparation of teachers before service involves the development of higher-order thinking skills and problem-solving skills, contributing to sustainable thinking. The research sample of teachers acquired problem-solving skills through interactions with students in the educational process, influencing their performance in sustainable thinking.

Furthermore, teachers' care for the families they belong to contributes to the development of environmental responsibility, reflecting on the development of sustainable thinking. They exhibit systemic, strategic, future, and values-based thinking toward the environment. This transformation is attributed to the professional development of teachers, pre-service training, and their interactions within the educational setting, fostering problem-solving skills and sustainable thinking.

The third and fourth hypotheses reveal a statistically significant positive correlation between sustainable thinking skills and the level of environmental awareness among the participating teachers. This implies that an increase in sustainable thinking skills corresponds to a higher level of environmental awareness, and vice versa. These two variables are strongly positively correlated, indicating that as one increases, the other also increases, and vice versa. This relationship is attributed to the fact that sustainable thinking prepares individuals to address environmental issues positively, influencing their environmental awareness and conservation practices.

The results of the fourth hypothesis confirmed the possibility of predicting environmental awareness through sustainable thinking. This finding aligns with previous studies' results that affirm the existence of a correlation between environmental awareness and sustainable thinking [23, 27, 33, 68, 29, 7, 9, 2,3, [56]. These findings collectively underscore the interconnectedness of environmental awareness and sustainable thinking. As individuals develop sustainable thinking skills, their ability to positively engage with environmental issues increases, leading to heightened environmental awareness and a commitment to environmental preservation.

Given the lack of studies directly addressing the relationship between sustainable thinking and environmental awareness, the predictive ability of sustainable thinking for environmental awareness can be explained based on the theoretical framework of sustainable thinking and the positive dynamics of their relationship. It is also argued that environmental awareness cannot be developed without first fostering sustainable thinking. Researchers attribute this result to the fact that the individual's intrinsic values lead them to preserve the environment, involving cognitive balance and conservation of environmental resources. Interference with the environment and its resources contradicts ethical thinking.

Moreover, future-oriented and strategic thinking involves an awareness of environmental balance and a conscious future perspective toward the environmental future. This is affirmed by Deniz, who states that sustainable thinking is associated with preserving environmental resources, respecting the future, and improving efficiency through the product life cycle. Justice and other dimensions of environmental awareness are also connected to sustainable thinking.

Bourzek [27] emphasizes the role of environmental awareness in achieving the requirements of environmental sustainability through strategic and future-oriented thinking. Environmental awareness indicates understanding and perception of various environmental challenges faced by our planet. It involves knowledge of environmental issues such as pollution, environmental balance, and conservation of environmental resources. Individuals with such awareness are likely to take necessary actions and adopt sustainable practices in their daily lives, such as strategic environmental planning, future-oriented thinking, and values-based and organizational thinking.

Environmental awareness plays a crucial role in promoting sustainable thinking. When individuals are aware of the environmental challenges we face, they are likely to think critically, strategically, and systemically in their

behaviors, making informed decisions aligned with sustainability goals. Sustainable thinking prioritizes environmental, social, and economic well-being in the long term, considering the impact of our actions on future generations and making choices that minimize harm to the environment.

Conclusion

In conclusion, the research findings demonstrate a notable level of environmental awareness within the surveyed group of teachers, aligning with the Kingdom of Saudi Arabia's overarching commitment to environmental protection and educational endeavors. The National Environmental Awareness and Sustainable Development Program, among other initiatives, has played a vital role in augmenting educators' environmental consciousness. The study underscores the significance of education, encompassing both pre-service and in-service training, in shaping environmental awareness. The positive correlation observed between teachers' educational levels and their environmental awareness underscores the impact of educational attainment on environmental knowledge. Social interactions, student engagement, and curriculum immersion emerged as crucial factors in promoting environmental awareness among teachers. Moreover, the study emphasizes the prevalence of sustainable thinking among educators, attributing it to the Kingdom's dedication to sustainable development goals. Professional development, training, and educational interactions contribute to the cultivation of strategic, future-oriented, systems, and values-based thinking among teachers. The statistically significant positive correlation between sustainable thinking and environmental awareness elucidates the interdependence of these variables. The research establishes that an increase in sustainable thinking corresponds to heightened environmental awareness, emphasizing the predictive role of sustainable thinking in fostering positive engagement with environmental issues.

Recommendations

Recommendations for fostering environmental awareness among educators include the promotion of continuous education through expanded programs and specialized courses. Emphasizing the importance of ongoing learning will ensure a sustained and updated level of environmental awareness. Encouraging increased social interactions among teachers, students, and curricula within schools is crucial for creating a collaborative environment that facilitates the exchange of ideas related to environmental issues. To enhance educators' capacity for sustainable thinking, there is a need to strengthen the integration of sustainable thinking skills in pre-service and in-service teacher training programs, focusing on higher-order thinking skills, problem-solving, and values-based thinking. Active support and participation in national and international conferences and workshops related to Sustainable Development Goals (SDGs) will contribute to the promotion of environmental awareness in society. Exploring predictive models that leverage sustainable thinking as an indicator of environmental awareness can inform targeted interventions, and collaboration between schools and families should be encouraged to create a holistic approach to environmental education. Lastly, advocating for further research into the dynamic relationship between sustainable thinking and environmental awareness, considering diverse populations and educational settings, will deepen our understanding of the factors influencing environmental consciousness and sustainable practices.

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