

Environmental Literacy and Sustainability Awareness among Preschool Children: An Interventional Study

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Abstract

Background: Recently, the world has been facing serious environmental issues, such as rising temperatures, water pollution, Global warming, energy use, ocean acidification, land degradation etc. These challenges have occurred due to human maltreatment of natural resources. Hereafter, meeting the needs of the present without compromising the ability of future generations to meet their own needs is crucial. Hence, sustainable awareness and environmental literacy at early ages are vital.

The aim of this study was to evaluate the effect of nursing intervention on environmental literacy and sustainability awareness among preschool children.

Methodology: A quasi-experimental design was used to conduct the study on 80 preschoolers at 5 governmental nursery schools. Tools of data collection: First tool; included structured questionnaire sheet consists of three parts (demographic characteristics & environmental knowledge of preschool children), second tool: Sustainability attitude of preschool children and third tool: Sustainability practice of preschool children.

Results: The study revealed that pre-intervention none (0%) of children had environmental knowledge, albeit all of them (100%) were knowledgeable post intervention. As to sustainability attitude score, 12.5% held positive attitude pre intervention compared to 87.5% post intervention. Finally, preschool children's overall sustainability practice score was 1.2% pre intervention compared to 98.8% post intervention.

Conclusion: A discernable improvement was prominent in preschoolers' environmental knowledge, attitude and practice after nursing intervention.

Recommendations: Implementation of environmental sustainability programs for preschoolers. As well, sustainability education ought to be directed to parents to guarantee conveying it to new generations.

Keywords: Environmental knowledge, Environmental literacy, preschoolers and Sustainability.

Introduction

Recently, the world has been facing serious environmental issues, including rising temperatures, water pollution, overpopulation, energy use, ocean acidification, land degradation, and deforestation, all of which put human life, wildlife, and the planet at risk. These challenges are occurring now and impact daily lives and future

(Robinson, 2025). These challenges have reached alarming levels, constitute a serious problem for public health **(Gok and Kilic, 2021)**. That occurred as a result of the destruction and unconscious consumption of natural resources due to the rapid development of technology **(Hasturk, 2023)**. According to World Health Organization report (WHO), human-induced climate change is one of the biggest social, environmental and public health challenges in this century. Groups such as children, are particularly vulnerable to the effects resulting from such change. Climate change poses a significant threat to children's health because children have unique metabolism, behavior, physiology and development characteristics **(WHO, 2023)**.

Early childhood (sometimes called the “preschool years”) extends from the end of infancy to about 5 or 6 years. During this period, children become more self-sufficient, develop school-readiness skills (such as learning to follow instructions). The first 5 years of life are critical for the development of cognitive skills and realizing that the world is bigger than their immediate family they start to have more independence, and experiences they have, help growing their personality and beliefs **(Lally and Valentine-French, 2019)**. Children, as the ‘next generation’, can be influential vectors, through whom the environmental message reaches a wider audience, since it is passed on to their relatives **(United Nations, 2021)**. Positive attitude and behaviors acquired about the environment in preschool age are also maintained in the later stages and these attitudes guide the behavior of people **(Erol and ogleman, 2021)**.

Environmental Education (EE) designed for children aims at providing cultural accumulation and giving information about environment, environmental issues, their solutions, and individual responsibilities **(Samur, 2018)**. In addition, environmental education encourages the individual to increase and maintain human–nature interaction over time by developing attitudes, values, knowledge, tendencies and skills to be pro-environmental **(Mastrángelo et al., 2019)**.

Environmental sustainability refers to individuals' responsibility to harvest natural resources at a lower rate than they can regenerate, while releasing waste no faster than the environment can decompose it **(Melis, 2020)**. On an individual level, it is possible to contribute to climate change prevention by adopting a more sustainable lifestyle, for example, by consuming less energy, recycling more, biking to work instead of using a caretc **(Ivanova et al., 2020)**

School nursing is a unique nursing specialty that benefits from a practice framework that aids school nurses in explaining and accomplishing their role. which has shaped school nursing practice as well as education, leadership, research, and collaboration with stakeholders **(National Association of School Nurses, 2024)**. Nurses, due to their frequent interactions with children and families in various settings, are strategically positioned to lead interventions aimed at mitigating these risks. Their crucial role encompasses health promotion, education by teaching children about personal hygiene (e.g., hand washing, safe play in outdoor spaces), promoting environmental sustainability through recycling and water-saving activities, and collaborating with teachers to incorporate age-appropriate environmental literacy into the curriculum **(Algül and Kılıçarslan , 2024)**.

surveillance, advocacy, and research, not only safeguarding children from immediate health threats but also fostering sustainable practices and environmental literacy that can influence lifelong behaviors **(Butterfield et al., 2019)**.

Aim of the study

This study aimed to Evaluate the effect of nursing intervention on environmental literacy and sustainability awareness among preschool children.

Subjects and Method

Design:

A quasi-experimental design was utilized in the study implementation.

Setting:

Study was conducted in all five nursery schools affiliated to Kafr Sakr city, Sharkia Governorate, Egypt.

Subjects:

The study comprised of 80 governmental nursery school children.

After meeting the following criteria:

- ◆ Both sexes.
- ◆ Age from 5 to less than 6 years.
- ◆ One of their primary care givers acceptance.
- ◆ Free from mental and physical disability or chronic disease.
- ◆ **Sample size :-**

The sample size was calculated by software Epi-info package at level of confidence 95%, margin of error 5% and power of test were 80%, assuming average sustainable built environment education among preschool children is low as wind turbine 25.37 % from 250 (**Ozburak et al., 2018**) preschool children at kafr saqre center, and the least percentage of improvement after the program will be 10% then the sample should include **70** children in addition to **10%** dropout, final sample size will be **80** children.

Tools and techniques of data collection:

Data was collected through the following tools:

Tool I: Structured Interview Questionnaire Sheet

This tool was prepared by the researcher in Arabic language and consisted of following two parts:

Part I: Demographic characteristics and home environment of studied preschool children. Were classified based on **Fahmy et al. (2015)** Such as, age, sex, residence, birth order, parent level of education, monthly family income, availability of clean water, electricity and safe waste disposal.

Part II: Environmental knowledge of preschool children developed by the researcher in the light of the current related literature and guided by other related studies as **Melis (2020)**. It consisted of **15** questions. The researcher communicated children saying, “My beautiful son/girl, we will talk to each other for a while and we will see some pictures. If you know the answer, raise smile face  , and if you don't know, raise sad face  ”. As about definition of environment, environmental resources as persons, air, water, plants, sun, soil and animals, about importance of plants for human kinds, animals, birds, and environment, about the importance of water for living organisms, source of water as rain, seas, rivers, wells, water pollutants, about the importance of air for living organisms, air pollutants as car exhaust, burning waste and use of pesticides,.... etc. and about reusable old things, and instead turning it to new and useful things (hand crafting) as cloths, glasses,etc.

Scoring system:-For the environmental knowledge items the response were scored (1) if correct answer, and (0) for incorrect answer and don't know. For each part the score of items were summed up and converted into percentage. The scores were converted to qualitative variable and the total divided by the corresponding number of items, giving a mean score. These were converted into percentage scores. The child knowledge considered unsatisfactory if percent scores were less 50%, and satisfactory if 50 % or more.

Tool II: Sustainability Attitude of Preschool Children (Appendix II): This tool was developed by the researcher in the light of the current related literature and guided by other related studies as **Ozburak et al. (2021)**. This part composed of 12 closed ended questions (MCQ&true or false) to measures child's outlook towards sustainability, the researcher communicated children saying, “Who the child in the following pictures would you like to act as?. Mark  if you agree with him/her, and  if you disagree.

Examples of questions were, When I don't have anything to do, I love watching TV versus Playing in the park,ect. The response answers were ranged from agree to disagree

Scoring system:-Attitude: The responses for positive items were scored 1, and for the negative items were scored 0. The scores of the items were summed up and the total divided by the number of the items, giving a mean score. This was converted into a percentage score.

- The attitude was considered
- **Positive** if the percentage score was 60% or more.
 - **Negative** if the percentage score was less than 60% .

Tool III: Sustainability Practice of Preschool Children (Appendix III): This part developed by the researcher in the light of the current related literature and guided by other related studies as **Kavaz et al. (2021)**. It consisted of 12 questions.

- ❖ **Questions1 to 11** were closed ended, the researcher communicated with children saying, "Now I'm going to ask you about a few things, if you do it, choose  and if you don't, choose  ". Such practices as when you brush your teeth, you turn on the tap whenever necessary or use a cup of water instead?. I know how to grow plant or flower.

Question 12: It was applied to capture the child perception about saving environment (Literacy about sustainability), so the child was given a paper, coloring pencils and crayons to sketch how we can save environment.

➤ **Scoring system:**

Behavior: The positive items reported as "done" were scored "1" and the negative items were scored "0." The scores of the items were summed up and the total divided by the number of the items, giving a mean score, which was converted into a percentage score.

- The practice was considered:
- **Adequate** if the percentage score was 60% or more.
 - **Inadequate** if the percentage score was less than 60%.

Question 12: It was applied to capture the child perception about saving environment (Literacy about sustainability), so the child was given paper, coloring pencils and crayons to sketch how we can save environment.

Validity and reliability of tools:-

The tools were revised by a panel of three experts in the fields of Community Health Nursing, geriatric nursing, and Pediatric Nursing, at Faculty of Nursing, Zagazig University who conducted face and content validity of all items of the study tools. These experts assessed the tools for clarity, relevance, application, and comprehensiveness. There were no recommended modifications. Reliability of knowledge was 0.822, reliability of attitude was 0.945 and the reliability of practice was 0.822.

Pilot study:-

A pilot study was carried out on eight preschoolers representing about 10 % of the total studied sample, to test the feasibility, clarity, comprehensiveness and applicability of the study tools. Also, to estimate the necessary time for completion of the data collection tools sheet. All participants received clear clarification about the study purpose. The children enrolled in the pilot were included in the main study sample as there were no modifications made.

Field of work:-

- Once permission was granted to proceed with the study, the researcher started to prepare a schedule for collecting the data. The fieldwork was carried out within the period of four months, starting from the beginning of October 2024 to the end of January 2025. The researcher allocated two days weekly, Tuesday and Thursday from 9 am to 1 pm.

- With regard to the recruitment of children in the study, due to the high rate of absence in nursery schools, and accordingly, the school used to gather children in one class, regardless of whether they belonged to which educational class.
- Since what was applied to the children was an intervention program, it was necessary to select children who attend nursery school regularly, and accordingly, focus was placed on children who were regularly present in school to ensure completion of the program. Accordingly, the number of students available to implement the program was very limited. So that, an equal number of children were selected from each nursery school, and the children were selected from within the classes randomly and in proportion to the size of the sample and the specifications required for it.

Ethical consideration: -

The study proposal was approved by the Research Ethics Committee (REC) and the Postgraduate Committee of the Faculty of Nursing at Zagazig University in March 2023 (**Code: M.D. Zu. NUR/132/13/2023**). Informed consent was obtained verbally from child's primary care giver after full explanation of the aim and objectives of the study as well as its procedures. They were informed that their involvement in this study was voluntary. Also, they have rights to refuse or withdraw their children at any time of data collection interviews as well as the confidentiality and anonymity of the collected data. They were also assured that any obtained information would be used only for research purposes.

Statistical analysis: -

The SPSS 20.0 statistical package was used for data management and statistical analysis. Descriptive statistics as frequencies and percentages were used for categorical variables and means and standard deviations and medians for quantitative ones. Gutmann-split half coefficient analysis was used to test the reliability of the scales. Categorical variables were compared using chi-square tests. Quantitative continuous data were compared using the non-parametric Mann-Whitney. Spearman rank correlation analysis was applied to assess the inter-relationships among quantitative and ranked variables. To identify the independent predictors of the knowledge, attitude, and practice scores, multiple linear regression analysis was used. Statistical significance was considered at p-value <0.05.

Results

Regarding socio-demographic characteristics of preschool children reveals that, 70% of the studied children aged 5-<6 years with Mean age 5.8 ± 0.4 . Also, 60.0 % of them were females, 87.5% lived in urban areas, concerning parents' education, 43.8% of mothers had university education compared to 27.5% of fathers. Regarding parents' work, 70% of mothers worked while 23.7% of fathers were farmers, and 23.7% of them worked as professionals. Moreover, 33.8% of parents had sufficient income.

Considering home environmental conditions of the studied preschool children, 92.5 % had sewage system, 87.5% had toilets and 86.3% had clean water supply, also only 18.8% had waste disposal. Concerning total home environmental condition, 83.7% had poor conditions. On other hand, 55% had computers. The crowding index was 27.5% (more than two per one room).

In term of hearing about concepts of environment among studied preschool children, pollutants, waste management, plantation, health behavior and total knowledge score, **Table 1** illustrates that there were statistically significant difference between children's knowledge pre- post intervention in all sub items and totally ($p=0.001$), all studied preschool children had satisfactory level of total knowledge score post intervention compared to none of them pre intervention with a statistically significant difference ($p<0.05$).

Regarding health behavior about environment among studied preschool children, plantation, recycling resource conversation, safe waste disposal and total attitude, **Table 2** indicates that strong significant difference between children's attitude pre- post intervention in all sub items and totally ($p=0.001$), total environmental attitude among preschool children pre/post intervention. The post test results reveals that 87.5% of preschool children held positive attitude toward environment compared to only 12.5% who held negative attitude with a statistically significant difference ($p<0.05$).

As for practices relating to environment power conservation among studied preschool children (water conservation, decreasing pollution, environmental protection, recycling and safe waste disposal), **Table 3** demonstrates strong significant difference between children practice pre- post intervention in all sub items and totally ($p=0.001$). The table also reveals that 98.8% of preschool children had adequate practice post intervention compared to 1.2% who had inadequate practices with a statistically significant difference ($p<0.05$).

Table 4 refers to statically significant positive correlation between children's attitude and their knowledge. Furthermore, statically significant positive correlation was also observed between children's practice and their overall knowledge, awareness and attitude ($p=0.001$).

Table 5 refers to statically significant positive correlation between children's attitude and their knowledge and awareness. Furthermore, statically significant positive correlation was also observed between children's practice and their overall knowledge, awareness and attitude ($p=0.001$).

Table 6 points to statically significant positive correlation between child's knowledge, attitude and practice and their age ($p=0.01$). Moreover, a statically significant positive correlation is also observed between child practice and their father education ($p=0.01$).

Table 7 indicates that, intervention is statistically significant independent positive predictor of children's knowledge score at $p<0.001$. The model explains 98% of the variation in this score as the value of r -square indicates.

Discussion

The United Nations Children's Fund (UNICEF) reported that around 1 billion children, nearly half of the world's 2.2 billion children, now face extreme risks to their ability to survive, grow, and thrive due to the triple planetary crisis of climate change, environmental pollution, and biodiversity loss. This situation has put virtually every child in the world at risk (UNICEF, 2024). In this context, many note that protecting and restoring the global environment will require transformative changes in human production and consumption-related behaviors, reflecting on individual choices as well as larger-scale, culturally mediated collective action (Ardoin & Bowers, 2020).

Recognizing these environmental problems is the first step toward solving them. Everyone can play a role by making small changes in lifestyle or supporting large-scale solutions (Bryson, 2024). Hence, the present study aimed to evaluate the effect of nursing intervention on environmental literacy and sustainability awareness among preschool children.

Part I: Demographic characteristics and home environment of studied preschool children

Pertaining to children's age, the current study findings showed that the mean age of the children was 5.8 ± 0.4 years and more than half of the sample were females, and more than two-thirds belonged to urban areas. This finding is consistent with the results of several studies conducted in Turkey, which reported that more than half of preschool children were females (Çabuk and İsal, 2023; Duran, 2021; Güvenir and Türkmen, 2024). Similarly, Melis et al. (2020) in Norway demonstrated that half of the studied preschool children were females.

As to mothers' education and work, the current study findings revealed that nearly half of mothers had university education, and more than half were working. This result might be attributed to Egypt's government focus in recent decades on educating women and empowering them to work effectively in society. On the same line, a study conducted by Biber et al. (2022) in Turkey showed that more than three-quarters of mothers had university education, and more than half of mothers were working.

Regarding fathers' education and work, the results of the current study revealed that about one-third of fathers had only primary education. More than one-quarter of fathers were farmers, and more than one-quarter had professional jobs. This relatively small percent can be attributed to individual factors that may be played a role in hindering those fathers from completing their education and hence limited opportunity to catch a job. This

finding disagree with **Çabuk and İsal (2023)** in Turkey, who revealed that more than half of fathers were undergraduates and that more than half had private jobs.

Considering family income, the results of the current study showed that about one-third of families had sufficient income. This might be attributed to low educational level of fathers, who are the economic foundation and support of family, which reduces the chances of good jobs and thus a high salary or income. This finding contrast with **Halmatovand Ata (2017)** In India, who demonstrated that more than half of parents received only a minimum salary.

Considering child residence, the findings of current study reported that the majority of children lived in urban areas. This finding is consistent with the results of **Simsar (2021)** in Turkey, who reported that more than half of preschool children lived in urban areas.

In terms of home sanitation, the findings of the current study clarified that the majority of homes had a sewage system. However, less than a quarter of the sample reported the presence of waste management. This finding may be explained by limited awareness about proper waste management or unavailability of waste collection system. This finding is in agreement with **Singh and Sharma (2023)** In India, where the study results clarified that the majority of the population are unable to discard waste properly because of the unavailability of dust bins nearby. On the same stream, these findings agreed with **Adekanmbi Peter (2022)**. In Nigeria, who stated that solid wastes are indiscriminately disposed of outside community by the roadside, public area, incessant burning of refuse. In contrary, **Abdullah et al. (2017)** in Malaysia reported that residents disposed of their waste multiple times weekly as designed by the waste-collecting establishment.

Part II: Environmental knowledge of preschool children

In terms of knowledge of the studied children about the environment pre- and post-intervention, the current findings illustrated that there was a statistically significant relation between pre- and post-intervention environmental knowledge among children in the study sample. (**Table 1**). This result might be attributed to lack or misunderstanding of parents about preschool children abilities in understanding such complex issues.

Similarly, **Barrierl et al. (2022)** In the United States clarified that participants gained and retained knowledge about the environment a composite of understandings (e.g., how materials cycle and energy flows), knowledge about environmentally friendly behavior options (e.g., how to save water and energy), and general strategies for nature preservation (e.g., how consumer choices affect carbon emissions or waste accumulation).

In the same vein, **Rashad et al. (2021)** found that there was a statistically significant difference between the average scores of the experimental group on the pre- and post-application of the Environmental Knowledge test, in favor of the post application. On the same line, **Zjalic et al. (2024)** in Italy concluded that the preliminary analysis showed an average increase of 19% in correct responses to knowledge questions.

The findings are also consistent with **Lai (2018)**, who found that students' marks in the environmental education measurement were higher in the post-test compared to the pre-test. Similar results were reported by **Kao and Lin (2016)**, and **Yang (2016)**, **Chang (2017)**, and **Demirbas (2017)** confirming that environmental interventions can significantly enhance knowledge levels. However, these findings disagreed with **Gaylord (2021)** in Turkey, whose results from the knowledge section indicated that participants in the intervention group did not demonstrate significantly greater knowledge from pre- to post-test.

Part IV: Sustainability Attitudes of Preschool Children

In terms of environmental attitude among study children before and after the intervention, the findings of the current study revealed a highly significant improvement in children's attitude post-intervention (**Table 2**). This indicates that structured environmental education programs can foster more positive orientations toward sustainability among preschool children.

Similarly, **Güvenir and Türkmen (2024)** in Turkey reported a significant difference between pre-test and post-test scores of environmental attitudes in the experimental group, favoring the post-test results. These

findings suggest that early childhood educational interventions play a crucial role in developing environmentally responsible attitudes.

In the same line, **Buldur and Ömeroğlu (2018)** in Turkey reported that preschool children's attitudes toward the environment were generally high, further emphasizing the role of age-appropriate educational strategies in nurturing sustainable thinking and behaviors among young learners. Similarly, the present findings contradicted those of **AbuZaid (2022)** In Egypt, who emphasized the effectiveness of literary media activities in shaping children's environmental awareness and personality development. The success of the program in his study was evident in the observed behavioral changes among kindergarten children.

The findings of the current study were in line with **Borg et al. (2019)** In Sweden, who concluded that children developed knowledge about the environmental impact of different modes of transportation. Approximately half of the children **recognized** that traveling by car was harmful to the environment due to gas emissions, while bus travel and cycling were considered more environmentally friendly alternatives. In the same context. Moreover, **Sieg and Dreesmann (2021)** In Germany reported a significant increase in pro-environmental intentions among children after educational interventions.

These findings also resonate with **Hartley et al. (2015)** In England, who demonstrated that children became significantly more environmentally **concerned** and reported an increase in pro-environmental behaviors (such as recycling and proper litter disposal) following participation in the program.

Part V: Sustainability Practices of Preschool Children

Regarding environmental practices among study children before and after the intervention, the current study finding indicated a strong and statistically significant improvement in children's sustainable practices (**Table 3**). This result might be attributed to the diverse educational methods used in the intervention outdoor activities and continuous contact between the researcher and parents and school teachers. This suggests that the applied environmental program effectively translated awareness and attitudes into practical behaviors.

Observations following program implementation highlighted noticeable behavioral changes among the children. They were seen actively participating in sustainable practices such as collecting garbage in designated bins, separating recyclable waste, turning off water taps after use utilizing both sides of notebook paper when writing or drawing, and switching off lights when leaving classrooms. Additionally, when asked questions about environmental protection, many children creatively expressed their understanding by drawing methods of preserving the environment, reflecting the program's success in instilling sustainable habits.

Similarity, study conducted by **Aydın and Tezi (2018)** In Turkey, found that outdoor and nature-based education supported children's acquisition of environmentally friendly behaviors. As well, the findings of these results supported by **Lampreda (2019)** In United States, who noted changing in behaviors of children in kindergarten as picking up trash around the school, turning off the water while washing their hands, and even using both sides of their paper while drawing. Quickly children began to practice and became more conscious of their environmental impact.

Part VI: Relations, Correlations, and Predictors among the Studied Variables

Considering the relation between child practice pre intervention, the current study points to significant positive correlation between child practice pre intervention (**Table 4**). This may be due to a baseline connection exists from early childhood, or may be due to, kindergarten teachers' efforts in manipulating environmental issues in advance.

The findings of current study are supported by **Whitburn et al. (2023)**. In New Zealand, who concluded that environmental education was associated and an increase in support for conservation. In the same line **Melis et al.(2020)**. In Norway, stated that upon completing kindergarten, many children had gained an early understanding of environmental sustainability. Garbage disposal, deforestation, and air pollution from vehicles.

The finding of the present study revealed statistically significant positive correlations between children's attitudes and their knowledge. Moreover, significant positive correlations were also found between

children's practices and their overall knowledge, and attitudes (**Table 5**). This result may be due to the effective impact of the environmental program provided by the researcher, which in turn led to improving environmental knowledge, which is the basic nucleus that led to enhancing environmental awareness among preschool children, which led to improving their environmental attitudes and consequently, they adopted pro-environmental behaviors. This is in addition to the role played by the state through the media regarding environmental issues, or the rise in the educational level of mothers.

In line with these results, **Biber et al. (2021)**. In Turkey reported a high positive correlation ($r = .87$) between environmental attitude sub-dimensions, emphasizing the close relationship between the two constructs.

Regarding the effect of demographic variables on knowledge, attitudes, and practices, the current study showed a statistically significant positive correlation between children's overall attitudes and their age (**Table 6**). This may be due to the higher age, the higher grade point average (GPA), the higher the (Environmental Knowledge)EK of the children. This finding is consistent with **Cabuk and Haktanir (2012)**. In Turkey, who found that preschoolers' environmental pro-environmental practices increased with age. Similarly, **Liu and Green (2024)**. In China demonstrated that children's pro-environmental behaviors were influenced by social agents, with variations based on gender and age.

The finding is also consistent with **Gaylord (2021)**. In Turkey, who concluded that overall pre-test knowledge was significantly associated with age ($r = .46$, $p = .03$), indicating that older children had greater baseline knowledge than younger ones.

These findings are further supported by **Mockovčáková and Barrable (2024)**. In Scotland, who suggested that parental demographic variables such as educational level could influence children's development. **Iwaniec and Curdt-Christiansen (2020)**. In China highlighted that parental education, particularly maternal education, plays a substantial role in shaping children's behavior and environmental practices.

Regarding the multiple linear regression for the knowledge score, the current study demonstrated that the intervention was a statistically significant independent positive predictor of children's knowledge scores ($p < 0.001$). (**Table 7**). These findings are consistent with those reported by **Isenaj et al. (2025)** In Kosovo, who found that knowledge scores were significantly influenced by the intervention. Their results revealed a strong positive effect ($OR = 26.83$, 95% CI [22.12, 32.54], $p < 0.001$), indicating that the intervention substantially improved knowledge outcomes post-intervention.

Conclusion

Initially, the majority of children's home environment was ranked as poor. Furthermore, before intervention all children held unsatisfactory environmental knowledge, negative sustainable attitude towards environment and inadequate sustainable practices. Albeit, post intervention discernable improvement was prominent in preschoolers' environmental knowledge, attitude and practice. Therefore, the existing study commends the implementation of an environmental sustainability programs for preschool children.

Recommendation

Based on the results of this study, the following recommendations were suggested; Implementation of an environmental sustainability programs for preschool children to enhance their environmental literacy. Sustainability education ought to be directed to parents to guarantee conveying it to new generations. Replicate the study in other settings and on larger sample to permit for generalization.

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Table 1: Environmental knowledge of studied preschool children pre-post intervention. (n=80)

Satisfactory (50%+) Environmental knowledge:	Time				X ² test	p-value
	Pre		Post			
	No.	%	No.	%		
Heard about environment	1	1.3	80	100.0	156.05	<0.001*
Pollutants	0	0.0	80	100.0	160.00	<0.001*
Waste management	2	2.5	80	100.0	152.20	<0.001*
Plantation	3	3.8	80	100.0	148.43	<0.001*
Health behavior	30	37.5	79	98.8	69.11	<0.001*
Total knowledge:						
Satisfactory	0	0.0	80	100.0		
Unsatisfactory	80	100.0	0	0.0	160.00	<0.001*

(*) Statistically significant at $p < 0.05$

Table 2: Sustainability attitude among studied preschool children pre-post intervention. (n=80)

Positive (60%+) attitude toward:	Time				X ² test	p-value
	Pre		Post			
	No.	%	No.	%		
Health behaviors	5	6.3	69	86.3	102.98	<0.001*
Plantation	1	1.3	76	95.0	140.82	<0.001*
Recycling	0	0.0	63	78.8	103.92	<0.001*
Resource conservation	9	11.3	68	85.0	87.15	<0.001*
Safe waste disposal	0	0.0	80	100.0	160.00	<0.001*
Total attitude:						
Positive	0	0.0	70	87.5		
Negative	80	100.0	10	12.5	124.44	<0.001*

(*) Statistically significant at $p < 0.05$

Table 3: Sustainability practices among studied preschool children pre-post intervention. (n=80)

Adequate (60%+) practices:	Time				X ² test	p-value
	Pre		Post			
	No.	%	No.	%		
Power conservation	5	6.3	65	81.3	91.43	<0.001*
Water conservation	2	2.5	80	100.0	152.20	<0.001*
Decreasing pollution	0	0.0	79	98.8	156.05	<0.001*
Environmental protection	4	5.0	69	86.3	106.44	<0.001*
Recycling	5	6.3	60	75.0	78.38	<0.001*
Safe waste disposal	1	1.3	79	98.8	152.10	<0.001*
Total practice:						
Adequate	0	0.0	79	98.8		
Inadequate	80	100.0	1	1.3	156.05	<0.001*

(*) Statistically significant at $p < 0.05$

Table 4: Correlation matrix of preschool children's knowledge, awareness, attitude, and practice scores throughout the intervention (n=80)

Scores	Spearman's rank correlation coefficient		
	Knowledge	Attitude	Practice
Pre-intervention:			
Knowledge	1.000		
Attitude	-0.066	1.000	
Practice	0.157	0.195	1.000
Post-intervention			
Knowledge	1.000		
Attitude	0.372**	1.000	
Practice	0.388**	0.617**	1.000

(*) Statistically significant at $p < 0.05$

(**) Statistically significant at $p < 0.01$

Table 5: Correlation matrix of preschool children's overall knowledge, attitude, and practice scores (n=80)

Scores	Spearman's rank correlation coefficient		
	Knowledge	Attitude	Practice
Overall:			
Knowledge	1.000		
Attitude	0.801**	1.000	
Practice	0.83**	0.861**	1.000

(**) Statistically significant at $p < 0.01$

Table 6: Correlation between preschool children's knowledge, attitude, and practice scores and their characteristics throughout intervention(n=80)

Characteristics	Spearman's rank correlation coefficient		
	Knowledge	Attitude	Practice
Pre-intervention:			
Age	-0.053	0.132	-0.144
Father education	0.027	-0.122	-0.097
Mother education	-0.11	-0.101	-0.122
Home environment	0.108	-0.041	-0.189
Income	-0.101	-0.116	-0.144
Crowing index	-0.022	-0.09	-0.013
Post-intervention			
Age	0.156	.598**	.619**
Father education	0.048	.124	.278*
Mother education	0.014	.129	.194
Home intervention	0.183	-.031	.158
Income	0.036	-.025	.081
Crowing index	0.005	-.012	.099

(*) Statistically significant at $p < 0.05$

(**) Statistically significant at $p < 0.01$

Table 7: Best fitting multiple linear regression model for the knowledge score (n=80)

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	-68.59	1.521		45.106	<0.001	-71.59	-65.58
Intervention	83.05	0.962	0.99	86.356	<0.001	81.15	84.95

r-square=0.98

Model ANOVA: $F=7457.21$, $p < 0.001$

Variables entered and excluded: age, gender, parents' education and job, residence, income, crowding index, home environment