Effect of Climate Change Photovoice Program on Knowledge, Attitude and Daily Life Practices among School-Age Children

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Abstract

Background: Children will be disproportionately impacted by climate change throughout their lives. Photovoice is a particularly useful tool for engaging and working with school-age children through sharing of students' personal knowledge and experiences visually and promotes meaningful dialogue on complex issues like climate change within classroom activities. **Aim:** The aim of the study is to evaluate the effect of climate change photovoice program on knowledge, attitude, and daily life practices among school-age children." **Design**: Quasi-experimental research design was used (pretest–posttest design). **Settings**: The study was conducted in Sayraa shared governmental preparatory school in Markaz Kafr El Dawwar educational directorate affiliated to El-Beheira Governorate. **Subjects**: By using a multistage sampling technique, preparatory school students in the first, second or third grades were selected. **Tools**: Four data collection tools were used to collect the data as follows: *Tool I*: Students' Sociodemographic Characteristics Structured Questionnaire Sheet, *Tool II*: Students' Knowledge Regarding Climate Change Structured Questionnaire Sheet, *Tool III*: Students' Attitudes towards Climate Change Structured Questionnaire Sheet, & *Tool IV*: Students' Reported Daily Life Practices for Climate Change Structured Questionnaire Sheet. **Results**: It was found that there is a statistically significant difference between pre, immediately post and after 3 months among the intervention group regarding knowledge, attitude and daily life practices regarding climate change after the implementation of the photovoice program. It was observed that there was a statistically significant relation between the level of knowledge, attitude and daily life practices among school-age children. There are many factors affecting the satisfactory level of knowledge, attitude and practices such as girl gender, high socioeconomic score and third preparatory level school-age children. **Conclusion**: it can be concluded that climate change photovoice program had a significant effect on school-age children's knowledge, attitude and daily life practices regarding climate change. **Recommendations**: The current study recommended applying a climate change photovoice program by school health nurses to improve awareness of school-age children. It also recommended promoting educational campaigns and intervention programs for various communities in Egypt by school health nurses targeting climate change.

Keywords: Climate change, Photovoice, Knowledge, Attitude, Practices, School-Age Children

Introduction

The rate at which the earth's temperature is changing has caused alarming worry in the hearts of environmental experts. Egypt is among the most vulnerable countries, since it faces numerous risks to its energy, water, and food security, as well as its economic, social, and environmental property (United Nations Development Programme [UNDP], 2020). The poor and vulnerable, especially children, would be most affected by the following three growing climate and development concerns, which, if not managed, could threaten Egypt's development goals. 1) high ambiguity in the timing and amount of water supplies. Around 97% of Egypt's freshwater resources come from the Nile River. The supply of water is now substantially more unpredictable due to climate change. Egypt will cross the line of serious water scarcity in 2033, assuming that population growth and water resource availability remain steady (Abdallah & El-Shennawy, 2020). 2) Coastal regions and highly populated cities are particularly vulnerable to climate change to at least one significant climatic or environmental danger, such as flooding, heat stress, air pollution, desertification, and sea level rise (Elshennawy & Willenbockel, 2021). And 3) Egypt's transition to a low-carbon, environmentally friendly growth route has lagged behind international markets, which could impair its competitiveness. Economic growth and greenhouse gas (GHG) emissions are closely correlated, notwithstanding Egypt's relatively low contribution to global emissions (Breisinger et al., 2019; Abdel Monem & Lewis, 2020). In Egypt, three sectors, energy, transportation, and industry—account for 80% of greenhouse gas emissions, and transportation and industry use 58% of the nation's total energy. Egypt would lose competitiveness in this market unless it adopts a low-carbon development path as preferences in global markets shift to greener and lower-carbon products (Ahram Online, 2021; World Bank, 2021; World Health Organization [WHO], 2021)

The excess heat in the climate system brought on by the atmospheric accumulation of greenhouse gases (GHGs) is what leads to these changes. The main human activities that contribute to these extra GHGs include the combustion of fossil fuels (coal, oil, and natural gas), deforestation (tree cutting), agriculture, and changes in land use. These actions raise the atmospheric concentration of "heat-trapping" greenhouse gases. The observed pattern of climate system changes is consistent with a stronger greenhouse effect. The earth's climate is also impacted by other climatic factors brought on by natural processes, such as variations in the sun's energy and volcanic eruptions. They cannot, however, fully account for the warming that we have seen over the past century (Rooney-Varga et al., 2014; National Centers for Environmental Information [NOAA], 2020; United Nations International Children's Emergency Fund [UNICCEF], 2020; National Aeronautics and Space Administration [NASA], 2021).

The need for a crucial response is likewise becoming more pressing in all facets, elevating climate change and environmental degradation to a position of prominence in public policy. Despite the fact that everyone is affected by the negative consequences of climate change, children—especially those living in underprivileged communities—are more susceptible and less able to adapt than adults, which results in their suffering the greatest losses (United Nations International Children's Emergency Fund [UNICCEF], 2021). Throughout the course of children's lives, climate change will have a disproportionately negative impact on them (Thew et al., 2020; United Nations International Children's Emergency Fund [UNICCEF], 2021). Due to the effects of climate change on children's mental and physical health as well as their overall development, children are among the categories that are most at risk (Frank, 2006; Burke et al., 2018). Children are therefore important participants in the process of developing solutions to climate change. Children are frequently left out of climate change decision-making and action, despite this. Notwithstanding the absence of children, there is a rising global movement of child activists calling for significant climate action, such as the passage of the Green New Deal (Fisher, 2016; Sunrise Movement, 2020). This shows that many children are political actors who engage with climate change, care greatly about the problem, and demand action despite adults' gatekeeping (Hickman et al., 2021; McBride et al., 2021; Biswas & Mattheis, 2022). According to the studies done by Stapleton (2019); Trott (2021); Cutter-Mackenzie and Rousell (2019) and Papenfuss et al. (2019), school-age children may participate meaningfully in efforts to combat climate change by learning how to critically analyse issues from their own points of view and work together to effect change in their communities.

Nowadays, only older age groups (i.e., those through secondary school) are routinely taught climate change education, and it often lacks an action component (Rooney-Varga et al., 2014; Monroe et al., 2019). Conventional pedagogical strategies that promote science-based literacy seldom ever consider students' feelings or encourage them to make plans or take action on their own (Lawson et al., 2019). Distress and negative feelings that start in the classroom and last into adulthood might emerge from an exclusive focus on issues (i.e., teaching facts) without agency-building chances (i.e., action)(Jones & Davison, 2021). Making climate change education "personally relevant and meaningful for school students" is one of the recommendations (Percy-Smith & Burns, 2013; Monroe et al., 2019) – improve their everyday living behaviors related to climate change with a curriculum that sees children as agents of change, and foster their positive outlook through active participation (Cutter-Mackenzie & Rousell, 2019).

The dramatic difference between children's participation with climate change inside and outside of the classroom highlights a need for educational approaches that interact with children on their terms and allow room for children's emotions and significant climate change-related actions. In other words, pedagogical strategies that emphasize "transmitting" information about climate change to passive recipients and fostering climate change literacy miss a potentially game-changing chance to engage school-age children where they are in terms of their understanding, feelings, and motivations. Bottom-up educational strategies are required, which take children's knowledge and activities seriously and embrace a child's perspective by recognizing that adults may learn from children through mutual teaching (Percy-Smith & Burns, 2013; Biswas & Mattheis, 2022).

A promising approach to climate change engagement that invites school-age children to express their thoughts and feelings as well as to lead action on climate change is photovoice (Derr & Simons, 2020; Herrick et al., 2022). *Photovoice* is a creative approach to Participatory Action Research (PAR) and is commonly used in the fields of community development, public health, and education (Wang & Burris, 1997). Participants are encouraged to utilize cameras to visually capture their experiences and their understandings of a particular subject. Also, participants are encouraged to present stories in relation to the images as part of a photovoice program and to make connections between their lives and the larger idea of climate change and ways to approach solutions (Wang & Burris, 1997; Cook & Buck, 2010; Spencer et al., 2019).

The Climate Change Photovoice Program aimed to actively engage the schools' students in climate change-related topics (theoretical sessions), with a focus on solutions (photovoice discussion), in order to empower the students as significant change agents in their families, communities, and schools through local action projects. This interaction was carried out by integrating the three elements of the photovoice program—"Science, Camera, Action" and "Head, Heart, and Hands"—with the transformative sustainability learning (TSL) theory (Sipos et al., 2008). The "Science" portion of the activities that school students participated in to gain information about climate change is called "Head as a cognitive domain. Students used a camera to take pictures of the "Heart as an affective domain" component to make a connection to science-related activities. The "Action" component that students engaged in with their peers to produce action projects in their school is the "Hands as a behavior domain" (Cook, 2015). As a result, the photovoice program's implementation causes a significant change in students' knowledge, practice and attitudes about the upgrade of ecological, social, and economic justice (Sutton-Brown, 2014; Spencer et al., 2019).

The starting point for the photovoice program is a carefully designed research question. "SHOWeD" method, which determines the direction of the outcome. With the aid of this technique, participants have utilized this blending of words and images to describe what they need, what they fear, what they value, what they dream about, and a variety of other thoughts (Sipos et al., 2008; Heras et al., 2016). In addition to having immediate effects on children (such as a sense of agency), photovoice can also have a variety of other effects among families and communities (Wang & Burris, 1997; Cook & Buck, 2010; Sutton-Brown, 2014; Spencer et al., 2019; Trott, 2021).

The use of the photovoice technique has the following benefits: a) It gives people a voice who frequently have little or no opportunity to express their views within their own communities or to change decisions that could have an impact on their life (such as young people). b) Develop the abilities of disadvantaged or disregarded groups and give them authority so they may take charge of their lives and actively participate in helping themselves. the c) Learn more about the (unintended or unexpected) changes brought about by interventions from the perspective of a particular group of stakeholders (Budig et al., 2018).

According to the Centers for Disease Control and Prevention [CDC] (2021), school-age children exhibit traits such as a greater capacity for complicated cognition, the ability to verbally communicate their feelings, and a more developed sense of right and wrong which indicates that this age group is practical and capable of engaging in connected community issues. Few studies have examined how school-age children understand and relate to climate change on their own terms, and how this leads to a dramatic change in knowledge, practices, and attitudes related to improving ecological, social, and economic justice based on these qualities (Gerber, 2012; Centers for Disease Control and Prevention [CDC], 2023). The school nurse uses the "Science, Camera, Action" photovoice program to assist Egyptian school-age children in developing their knowledge, attitudes, and daily life practices addressing climate change and in making links between climate change and their lives (Trott et al., 2020). That is to say, she employs an interactive learning strategy by fusing the arts and sciences through practical activities, introspective conversation, and child neighborhood initiatives (May & Noel, 2020).

Significance of the study

Everyone is suffering from the terrible effects of climate and environmental dangers, but children are more susceptible than adults for a number of reasons. They are less able to tolerate and sustain shocks like floods, droughts, extreme weather, and heat waves because they are physically more sensitive. b) Their physiological vulnerability is greater. Even at lower exposure levels, toxic compounds like lead and other types of pollution have a greater impact on children than on adults. c) Children still have their entire lives ahead of them; any deprivation brought on by environmental and climate change at an early age might lead to a lifetime of missed opportunities. d) They have their whole life ahead of them – any deprivation as a result of climate and environmental degradation at a young age can result in a lifetime of lost opportunity. e) Compared to adults, they are more likely to die from diseases like malaria and dengue that are anticipated to be made worse by climate change. f) Because they are viewed as passive recipients of climate change knowledge rather than active agents in influencing their lived reality, they are frequently excluded from decision-making and action to solve the climate change issue. g) Adults frequently exclude children from decision-making and climate change action because they are underage (and so unable to vote), are thought to need protection from anxiety-related themes, and are susceptible to cultural assumptions that restrict children's participation in society (Jensen & Schnack, 1997; Harris, 2018; United Nations International Children's Emergency Fund [UNICCEF], 2022).

Aim of the study:

To evaluate the effect of climate change photovoice program on knowledge, attitude and daily life practices among school-age children

Hypotheses:

- The school-age children who received the climate change photovoice program will exhibit a satisfactory level of knowledge than those who did not receive it after the program than before.
- The school-age children who received the climate change photovoice program will exhibit a more positive attitude than those who did not received it after the program than before.
- The school-age children who receive the climate change photovoice program will exhibit a satisfactory level of daily life practices than those who did not receive it after the program than before.

Materials and Methods

Materials:

Design:

Quasi-experimental research design was used pretest-posttestt design)

Setting:

The study was conducted in Sayraa shared governmental preparatory school in Markaz Kafr El Dawwar educational directorate affiliated to El-Beheira Governorate.

Subjects:

The target populations for this research were the preparatory school-age students who enrolled in the first, second or third grades in the above-mentioned setting and fulfilled the following eligibility criteria:

- Aged 12-15 years.
- Attended the previously mentioned setting.
- Willing to participate in the study.
- The parent (or guardian) agrees and is committed to participating their children for the full duration of the study.

Sample Size:

By using a multistage sampling technique, the following steps will be carried out to select the study sample: -

1- One out of the 18 educational directorates in El-Beheira Governorate will be selected based on the highest number of shared governmental preparatory schools (78 schools); namely Markaz Kafr El Dawwar educational directorate
2- One shared governmental preparatory school was randomly selected from Markaz Kafr El Dawwar educational directorate; namely Sayraa shared governmental preparatory school
3- From the selected school, the sample size was calculated based on previous studies

and by using Med Calc statistical software. Assuming an alpha of 0.05 and power of study of 90.0%, the beta error was 0.1. A typical advice is to reject the null hypothesis H0 if the corresponding p-value is smaller than 0.05. a minimum sample size required was 120 subjects will be needed for this study.

4- Convenience sampling technique is used to select 120 students who met the inclusion criteria of the study.
5- Divide the total sample size (120 students) into two groups randomly (60 for the intervention group and 60 for the control group).

Data Collection

Tools:

Four tools were used to collect the required data.

Tool I: Students' Sociodemographic Characteristics Structured Questionnaire Sheet:

This tool was developed by the researchers after reviewing the relevant literature (Lam & Trott, 2022). It includes two parts:

- **Part (1): Personal Characteristics of Preparatory School-Age Students:** it included 4 items; age (years), gender, students' preparatory level and if the student participating in voluntary community services activities in their school or not.
- **Part (2): Family Socioeconomic Status (SES):** it included 6 items; father education, mother education, father occupation, mother occupation, crowding index and family income.

Total socioeconomic score:

To calculate the socioeconomic status, the updated and validated tool (Fahmy et al., 2015) was used to identify the social level of the students' families. Each item of different socioeconomic status was replaced by numerical data. Home sanitation and computer or mobile phone domains were excluded because all the study samples already have them. So, the total socioeconomic score was 48 points and it was divided by maximum to get the percentage of the total socioeconomic score and then it was categorized into three levels as follows: low <50%, Moderate 50- <75 % and high ≥75%,

Tool II: Students' Knowledge Regarding Climate Change Structured Questionnaire Sheet:

This tool was developed by the researchers after reviewing the recent literatures (Shi et al., 2015; World Health Organization [WHO], 2015; Bullock et al., 2017; Japan-Caribbean, 2017; United Nations

International Children's Emergency Fund [UNICEF], 2018; World Health Organization [WHO], 2021) to measure students' level of knowledge regarding climate change and its impact on the environment and people. It includes questions under 4 main subtitles such as 1) weather vs climate, 2) what is the climate system and its five major components, 3) what is the atmosphere and its layers and 4) what is the Ecosystem. It also includes questions related to Global Warming (GW under 2 main subtitles such as 1) what is GW, its causes and its role to produces GHGs, 2) how do GHGs differ from other gases (properties) and finally where do GHGs come from (sources) ?. In addition to questions related to Climate Change (CC) under 6 main subtitles such as 1) definition of CC, 2) causes of CC (natural causes and human causes), 3) observed and expected changes, 4) impacts of CC on the environment and people (global and local impacts), 5) reducing GHGs (mitigation) and 6) reducing CC impacts (adaptation).

Knowledge score:

- The students were invited to respond to 65 closed-ended questions; 10 questions were true/false, 20 questions were multiple choices with three possible answers, and 35 questions were about selecting the correct knowledge statement based on a 3-point Likert scale (Yes, No, Don't know). For each question, if the answer to the question is right, it takes 2 points; for the right but not complete answers, 1 point; and for wrong answers, 0 points.
- **Regarding to four knowledge' subtitle:** the number of questions was 16, then the maximum score was 32. While for Global Warming (GW), the number of questions was 17, then the maxim score was 34, finally, the Climate Change (CC) consists of 32 questions and the maximum score was 64. These subtitles were represented in the study result as a means of the right answer.
- **Regarding total knowledge score:** The final score was ranged from 0 to 130 points and divided by the maximum to get the percent of the total knowledge score. If the percent ≥50.0%, it is considered satisfactory level of knowledge while if it was <50.0%, it is considered unsatisfactory level of knowledge.

Tool III: Students' Attitudes towards Climate Change Structured Questionnaire Sheet:

This tool was developed by the researchers after reviewing the recent literature (Shi et al., 2015; World Health Organization [WHO], 2015; Bullock et al., 2017; Japan-Caribbean, 2017; United Nations International Children's Emergency Fund

[UNICEF], 2018; World Health Organization [WHO], 2021) to measure students' attitudes towards climate change and its impact on the environment and people. It includes items that respond to the question "To what extent do you agree or disagree with the following statement?". This tool was divided into three subtitles; a) Students' Attitudes towards Climate Change, b) Potential Solutions for Climate Change Mitigation and c) Potential Solutions for Climate Change adaptation. Regarding **students' attitudes towards climate change** such as "people living in cities pollute more than people living in the countryside", "climate change will reduce the quality of life for future generations" and "climate change does not affect our country". Concerning the **students' attitudes towards potential solutions for climate change mitigation** such as "saving electricity is important because it mitigates climate change", "solar energy is a solution to air pollution" and "poor countries can do little to mitigate climate change". As for **students' attitudes towards potential solutions for climate change adaptation** such as "stopped cutting mangroves and trees", "turned off lights when not in use (energy efficiency)" and "turned off the water when not in use".

Attitude score:

- The students were invited to respond to 53 questions on a 3-point Likert scale (agree, uncertain and disagree). For each question, if the answer to the question is "agree", this means "positive attitude" and it takes 2 points and if the answer to the question is "disagree or uncertain", this means "negative attitude" and it takes 0 points.

- **Regarding to three attitude's subtitle:** *For Attitudes towards Climate Change,* the number of questions was 18, then the maximum score was 36. While for *Attitudes towards Potential Solutions for Climate Change Mitigation,* the number of questions was 14, then the maxim score was 28, and finally, the *Attitudes towards Potential Solutions for Climate Change adaptation* consists of 21 questions and the maximum score was 42. These subtitles were represented in the study result as a mean of the positive attitude.
- **Regarding to total attitude score:** The final score ranged from 0 to 106 points and was divided by the maximum to get the percent of the total attitude score. If the percent was ≥50.0%, it is considered "a positive attitude" while if it was <50.0%, it is considered "a negative attitude".

Tool IV: Students' Reported Daily Life Practices for Climate Change Structured Questionnaire Sheet:

This tool was developed by the researchers after reviewing the recent literatures (Shi et al., 2015; World Health Organization [WHO], 2015; Bullock et al., 2017; Japan-Caribbean, 2017; United Nations International Children's Emergency Fund [UNICEF], 2018; World Health Organization [WHO], 2021) to measure reported indoor and outdoor daily life practices for climate change. It includes items that respond to the question "how often do you practice the following indoor activities?". This tool was divided into two subtitles; a) **Students' Indoor Daily Life Practices for Climate Change** such as "limit using of air conditioning in summer", "use rechargeable batteries", "avoid products in plastic packaging", "generate as little food waste as possible", "minimum use of papers" and "segregating the wet & dry household waste". b) **Students' Outdoor Daily Life Practices for Climate Change** such as "use stairs instead of elevators", "use cloth/cartoon bags in shopping, not plastic ones", "participating in tree plantation drives" and "participating in cleanliness drives".

Practices score:

The students were invited to respond to 33 questions on a 3-point Likert scale (regularly, sometimes and rarely). For each question, if the answer to the question is right practice, it takes 2 points; for right practice but not complete one, it takes 1 point; and for wrong practice and don't know answer, it takes 0 points.

- **Regarding two practices' subtitle:** *For Indoor Daily Life Practices,* the number of questions was 18, then the maximum score was 36. While *for Outdoor Daily Life Practices,* the number of questions was 15, then the maxim score was 30. these subtitles were represented in the study result as a means of the right practices.
- **Regarding to total practices' scores:** The final score ranged from 0 to 66 points and was divided by maximum to get the percent of total practice scores. If the percent was ≥50.0%, it is considered satisfactory level of practice while if it was <50.0%, it is considered unsatisfactory level of practice.

Method

The study was carried out in three phases as follows:

I. Preparation Phase:

1- An **official letter** from the Faculty of Nursing, Damanhour University was directed to the Directorate of Education in El-Beheira Governorate to obtain their permission to collect data from the selected school which is

"**Sayraa shared governmental preparatory school**". The **principal of "Sayraa school"** was met by the researchers to clarify the purpose of the study and to gain their cooperation.

2- **Development of tools I, II III and IV** was done by the researchers after reviewing of the literature and translating it into Arabic.

3- **Content validity** of tools I, II III and IV were tested and revised by 5 experts in the related fields of community health nursing and pediatric nursing and necessary modifications were done accordingly.

4- **Stability, and reliability of the tools II, III and IV** were measured by use of Cronbach's Alpha to test internal consistency. The Cronbach's alpha for the three tools were 0.825%, 0.799% and 0.807% respectively. **(Table 1)**

Table (1): Stability and reliability of the Tools II, III and IV used in the study.

Item	Reliability Cronbach's alpha	Stability person correlation coefficient
Knowledge	0.825	0.808
Attitude	0.799	0.762
Practice	0.807	0.793

5- **Pilot study for tools I, II, III and IV** was carried out on 12 students, who were excluded from the main study's subjects, to test the feasibility and the applicability of the tools.

6- **Climate Change Photovoice Program Preparation:** the researchers prepared the objectives, content, classroom activities, educational materials used and study settings for theoretical and photovoice sessions.

7- **Assessment (Pre-Test)** was done to the preparatory students by distributed a questioner included tools **I, II, III and IV.** They lasted about 30–45 minutes. The questioner was collected and revised by the researchers for missing data.

II. Implementation Phase of Climate Change Photovoice Program: (Table 2)

- The researchers divided the intervention group (60 students) randomly into 6 groups (10 students/group)
- Each student engaged in 9 sessions and 1 collaborative action project as follows: 1 introductory session, 4 hands-on activities (theoretical sessions), 4 photovoice sessions, and 1 action project (photo gallery in their school).
- *The first introductory session* aimed to establish the relationship by breaking the ice with the students which gives the opportunity for the

students to know each other and asking them about their program expectations and needs, explain to them objectives of the program and instructions about the climate change photovoice program.

- These *instructions* were discussed with the students as follows:

  ▪ Orient them about time, activities and active participations in each session.

  ▪ On Sunday, all groups attend for **theoretical sessions** (4 sessions /4 weeks).

  ▪ On Monday, each student takes pictures of anything he/she want that relates to the programs' activity, there are no right or wrong photographs. There is no limit to the number of photos he/she takes, but make sure to pick 1 or 2 favorites to send to 1st researcher via WhatsApp to print at least one day before the photovoice session.

  ▪ On Tuesday/ Wednesday/Thursday, each one of the two groups was allocated by the researchers in one day of them. Each group attended **photovoice sessions** paralleled with theoretical sessions in the same week (4 sessions /4 weeks).

  ▪ All sessions (theoretical or photovoice) were conducted for one hour after the school day for 6 weeks.

- *The 4 theoretical sessions cover 4 different topics as follows: the first session is about Basic Concepts of the Environment, the second session about Global Warming (GW), the third session is about Climate Change (CC) and the last theoretical session is about indoor and outdoor daily life practices.*

- *The 4 photovoice sessions* highlighted 4 different topics discussed in the theoretical session of the same week. For example, following "Weaving the Web," students were asked to find evidence of ecosystems in their own lives; thought about how people, plants, and animals depend on one another for survival in their own life.

- The *first photovoice session* focused on how children were connecting to scientific educational activities explaining ecosystems and differentiating between weather and climate. *The second session* focused on children's connections to the greenhouse effect and Earth's changing climate. *The third and fourth sessions* focused on children's thoughts and feelings about climate action, specifically 'Sustainable Solutions' for energy (i.e., individual indoor and outdoor practices).

- *During photovoice session,* the researchers asked the students to share what they took a picture of. Some students who forgot to take pictures, drew pictures relating to the topic activities. Each student was asked to give a title and caption for their favorite printed photographs. Then the researchers used the "SHOWeD" method to guide photovoice discussions, which helps students reflect on their

photographs to tell a story and make connections between their lives and the larger idea of climate change and ways to approach solutions.

- *The SHOWeD questions* include: (a) "What do you **S**ee here?", (b) "What is **H**appening here?", (c) "How does this relate to **O**ur lives?", (d) "**W**hy does this situation, concern, or strength **e**xist?", and (e) What can we **D**o about it?"

- At the end of the program, the *photo Gallery* was conducted by the intervention group in their school as a collaborative action project to disseminate climate change-related knowledge and practices among school members.

- **Different teaching and learning methods** were used during the theoretical or photovoice sessions such as gaming, role-play, brainstorming, peer feedback, and competition between participants.

- **Material used** such as PowerPoint Presentation.

- **Data was collected** in accessible classrooms in the selected school, during the academic year (2021-2022) over a period of 6 weeks (starting from beginning of the October 2021 to the 2nd week of November 2021).

III. Evaluation phase:

The evaluation of the effectiveness of the climate change photovoice on knowledge, attitude and reported daily life Practices of preparatory school-age students was done immediately **(Post-test 1)** after the implementation of the program using the same tools of pre-test (Tool II, III and IV) and after 3 months for follow up **(Post-test 2).**

Ethical considerations:

Ethical approval to conduct the current study was obtained from the ethical committee of the Nursing Faculty, Damanhour University. The researchers received oral assent from students and written consent from their parents to participate in the study. Participation was totally voluntary, and no incentives were provided to the participants. Participants' privacy and confidentiality of the collected data were maintained throughout the study.

Statistical analysis

The Data were fed to the computer using IBM SPSS software package version 24.0. Quantitative data were described using mean and standard deviation for normally distributed data. For normally distributed data, comparisons between more than two populations were analyzed F-test (ANOVA) to be used. Comparison between different groups regarding categorical variables was tested using the Chi-square test. Regression analysis enables the identification and characterization of relationships among multiple factors. Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level.

Table 2. Schedule of Climate Change Photovoice Program Implementation and Data Collection Points

Week	Data collection Points	Component of SCA Program	Topic (For intervention Group)
1 (1st week of October, 2021)	• Pre-Test for Intervention and Control Group	N/A*	- The researchers *divided* **the intervention group** (60 students) randomly for 6 groups (10 students/group) - ***The first introductory session*** (*breaking the ice* activities with the students, explain the *program's expectations, objectives* and *instructions* about the climate change photovoice program.
2 (2nd week of October, 2021)		S ♣	**Theoretical Session #1** • **Basic Concepts of the Environment**
		C ▲	**Photovoice Session with FGD #1** 10 students 10 students
		C ▼	**Photovoice Session #1** 10 students 10 students
		C ►	**Photovoice Session #1** 10 students 10 students
3 (3rd week of October, 2021)		S ♣	**Theoretical Session #2** • **Part (2): Global Warming (GW)**
		C ▲	**Photovoice Session with FGD #2**
		C ▼	**Photovoice Session #2**
		C ►	**Photovoice Session #2**
4 (4th week of October, 2021)		S ♣	**Theoretical Session #3** • **Part (3): Climate Change (CC)**
		C ▲	**Photovoice Session #3**
		C ▼	**Photovoice Session with FGD #3**
		C ►	**Photovoice Session #3**
5 (1st week of November, 2021)		S ♣	**Theoretical Session #4** • **Daily life practices affecting climate change (Indoor and outdoor)**
		C ▲	**Photovoice Session #4**
		C ▼	**Photovoice Session #4**
		C ►	**Photovoice Session with FGD #4**
6 (2nd week of November, 2021)	• Immediate Post-Test for Intervention and Control Group	A	• **Action Project (Photo Gallery) 60 Students** • Closing the program
7 (3rd week of February, 2022)	• 3 Months Post-Test for Intervention and Control Group		

*: N/A: Not Applicable

S: Science: theoretical session (cognitive domain); C: Camera: Photovoice process (affective domain); A : Action: Collaborative action project (behavior domain).

♣ : Every Sunday the intervention groups (60 students) were received theoretical session (S) in the main Lecture Hall in the school .

▲: Every Tuesday the Group (1 and 2) were received photovoice session (C) in separate classroom at the same time (10 Students/ Session).

▼: Every Wednesday the Group (3 and 4) were received photovoice session (C) in separate classroom at the same time (10 Students/ Session).

►: Every Thursday the Group (5 and 6) were received Photovoice Session (C) in separate classroom at the same time (10 Students/ Session).

1st Researcher was responsible for delivering of theoretical session for all intervention group (60 students) for one hour after the school day.

& : 2nd and 3rd Researchers were responsible for delivering of photovoice Session, each researcher for one group (10 Students) in separate classroom at the same time for one hour after the school day.

Results

Table (3) shows the sociodemographic characteristics of the school-age students among both the intervention and control groups, it revealed that the mean age of the intervention group was 13.1±1.7, while the mean age of the control group was 13.5±1.5. Regarding gender, 68.3 % of the intervention group and 63.3% of the control group were girls. Concerning students' preparatory level, the first preparatory level was prevalent among the intervention and control groups by 43.3% and 50% respectively. Related to the fathers' educational level, it was found that 30% of the intervention group and 33.3% of the control group had basic education (primary and preparatory), while the mothers' educational level was 40% in the intervention group and 41.7% in the control group. As regard to the fathers' occupation, it was found that 35% of the intervention group and 33.3% of the control group were skilled workers, while housewives were prevailing among mothers at 41.7% and 36.7 respectively. The mean crowding index was 2.5±0.8 in the intervention group while it was 2.6±0.92 in the control group. Concerning family income, it was found that 43.3% of the intervention group and 46.7% of the control group reported insufficient family income. Regarding to participating in voluntary community services activities in their school, it was reported that 86.7% of the intervention group and 90% of the control group did not participate in any activities. Regarding the total socioeconomic score, it was found that 48.3% of the intervention group and 51.7% of the control group reported low socioeconomic scores. Finally, there was no statistically significant differences between the two groups regarding all Sociodemographic characteristics.

Table (4) Represents effect of the climate change Photovoice program on Knowledge, Attitude and Daily Life Practices among both intervention and control groups. It was found that there is a statistically significant difference between pre, immediately post and after 3 months among the intervention group regarding knowledge, attitude and daily life practices. On the other hand, there was no statistical difference between pre, immediately post and after 3 months among the control group.

Table (5) Represents the relation between the **level of** knowledge, attitude and daily life practice **among <u>intervention group immediately</u> after implementation of the program.** It was observed that there was statistically significant relation between level of knowledge, attitude and daily life practice among intervention group immediately after implementation of the program (X^2 = 34.4, p= 0.0001 and X^2= 32.1, p=0.0001) respectively.

Table (6) Demonstrates the different factors affecting satisfactory level of knowledge, attitude and daily life practice among intervention group immediately after implementation of the climate change Photovoice program. It was observed that, there was a statistically significant relation between level of knowledge, girl gender, students' third preparatory level and high socioeconomic score at p = 0.037, p=0.001 and p=0.001 respectively. Regarding to factors affecting students' attitude, it was found that there was a statistically significant relation between level of attitude, girl gender and high socioeconomic score at p = 0.011 and p=0.005 respectively. Concerning the factors affecting students' daily life practices, it was noticed that there was a statistically significant relation between level of daily life practices, girl gender and high socioeconomic score at p = 0.019 and p=0.048 respectively.

Table (3): Sociodemographic characteristics of the school-age students among both intervention and control group.

Students' Sociodemographic Characteristics	Intervention Group (n= 60)		Control Group (n= 60)		Total	X² P value
	No	%	No	%		
1. Age (years)						
● 12-	27	45.0	29	48.3	56	0.487
● 13-	20	33.3	21	35.0	41	0.77
● 14 and more	13	21.7	10	16.7	23	
Min – Max Mean ± SD	12-16 13.1±1.7		12-16 13.5±1.5			
2. Gender						
● Boy	19	31.7	22	36.7	41	0.33
● Girl	41	68.3	38	63.3	79	0.563
3. Students' Preparatory Level						0.56
● First level	26	43.3	30	50.0	56	0.827
● Second level	22	36.7	20	33.3	42	
● Third level	12	20.0	10	16.7	22	
4. Father educational level						
● Illiterate/read &write	12	20.0	7	11.7	19	1.59
● Basic education (primary, preparatory)	18	30.0	20	33.3	38	0.661
● Secondary	17	28.3	18	30.0	35	
● University or higher	13	21.7	15	25.0	28	
5. Mother educational level						
● Illiterate/read &write	9	15.0	7	11.7	16	0.443
● Basic education (Primary, preparatory)	14	23.3	16	26.7	30	0.931
● Secondary	13	21.7	12	20.0	25	
● University or higher	24	40.0	25	41.7	49	
6. Father occupation						
● Retired	6	10.0	5	8.3	11	0.240
● Unskilled	18	30.0	18	30.0	36	0.970
● Skilled worker	21	35.0	20	33.3	41	
● Professional	15	25.0	17	28.3	32	
7. Mother occupation						
● Housewife	25	41.7	22	36.7	47	1.83
● Unskilled	13	21.7	10	16.7	23	0.660
● Skilled worker	17	28.3	19	31.7	36	
● Professional	5	8.3	9	15.0	14	
8. Crowding index						
● 1	16	26.7	12	20.0	28	0.778
● 2	21	35.0	22	36.7	43	0.677
● ≥3	23	38.3	26	43.3	49	
Min – Max Mean ± SD	1-4 2.5±0.8		1-5 2.6±0.92			
9. Family income						
● Sufficient & save	13	21.7	9	15.0	22	0.89
● Sufficient	21	35.0	23	38.3	44	0.640
● Insufficient	26	43.3	28	46.7	54	
10. Participating in voluntary community services activities in their school						0.323 0.569
● Yes	8	13.3	6	10.0	14	
● No	52	86.7	54	90.0	106	
Total socioeconomic score						
Low	29	48.3	31	51.7	60	0.148
Moderate	22	36.7	21	35.0	43	0.928
High	9	15.0	8	13.3	17	

P was calculated by using Chi square test

Table (4): Effect of the climate change Photovoice program on Knowledge, Attitude and Daily Life Practices among both intervention and control groups

Item	Intervention Group			ANOVA	P	Control Group			ANOVA	P
	Pre	Post (immediate)	Post (3month)			Pre	Post (immediate)	Post (3month)		
Knowledge										
● *Basic concepts of the Environment (max.32)*	12.6±5.7	21.6±5.68	19.9±6.2	16.85	0.0026*	13.21±5.1	15.11±5.12	15.03±4.82	0.789	0.395
● *Global warming (GW) (max.34)*	14.2±7.9	28.2±5.33	22.1±4.1	15.2	0.0012*	14.6±6.7	14.8±5.8	14.6±5.0	0.611	0.411
● *Climate change (CC) (max.64)*	22.9±8.11	49.7±12.3	43.2±8.79	18.9	0.001*	23.6±9.3	24.1±8.7	24.3±7.11	0.401	0.526
Total score ● **Satisfactory** ● **Unsatisfactory**	8 (13.3) 52 (86.7)	49 (81.7%) 11 (18.3%)	43 (71.7%) 17 (28.3%)	14.2	0.001*#	9 (15.0) 51 (85.0)	10 (16.7) 50 (83.3)	10 (16.7) 50 (83.3)	0.322	0.971
Attitude										
● *Attitudes of the studies student about climate change (max.36)*	15.1±3.89	28.2±7.1	26.8±8.11	8.22	0.007*	14.81±3.71	14.8±4.1	15.0±5.0	0.841	0.385
● *Attitudes of studied student about potential solutions for mitigating climate change.(max.27)*	12.11±4.1	20.6±4.89	20.1±5.2	9.74	0.003*	12.0±4.31	11.95±3.9	12.11±4.0	0.3641	0.632
● *Attitudes that determine social action (max.42)*	18.5±7.01	32.8±10.3	30.8±11.0	6.98	0.006*	18.0±6.6	19.7±6.58	17.9±6.01	0.2411	0.742
Total score ● **Positive** ● **Negative**	11 (18.3) 49 (81.7)	46 (76.7%) 14 (23.3%)	43 (71.7%) 17 (28.3%)	7.97	0.002*#	10 (16.7) 50 (83.3)	11 (18.3) 49 (81.7)	10 (16.7) 50 (83.3)	0.279	0.899
Daily Life Practices										
● *Indoor activities (max.36)*	12.01±4.01	27.3±4.8	23.9±7.0	12.2	0.0019*	12.7±4.16	12.01±4.1	12.2±4.1	0.421	0.585
● *Outdoor activities (max.30)*	11.7±4.3	25.2±5.11	22.8±5.9	11.3	0.0024*	11.5±4.1	11.3±4.0	12.1±3.01	0.601	0.415
Total score ● **Satisfactory** ● **Unsatisfactory**	7 (11.7) 53 (88.3)	48 (80.0%) 12 (20.0%)	46 (76.7%) 14 (23.3%)	9.58	0.0053*#	8 (13.3) 52 (86.7)	8 (13.3) 52 (86.7)	9 (15.0) 51 (85.0)	0.109	0.918

* P < 0.05 (significant)

P was calculated by using ANOVA test, while for categorized statistic

p was calculated by chi square test.

Table (5): Relation between the level of knowledge, attitude and daily life practice among intervention Group immediately after implementation of the program.

	Level of Knowledge				X^2 P value
	Satisfactory "n=41"		Unsatisfactory "n=19"		
	No.	%	No.	%	
Attitude					
Positive (n=46)	45	91.8	1	9.1	34.4
Negative (n=14)	4	8.2	10	90.9	0.0001*
Daily life Practice					
Satisfactory (n=48)	46	93.9	2	18.2	32.1
Unsatisfactory (n=12)	3	6.1	9	81.8	0.0001*

P was calculated by using X^2

Table (6): Factors affecting satisfactory level of knowledge, attitude and daily life practice among intervention group immediately after implementation of the program.

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
I. Knowledge					
(Constant)	1.532	0.31		4.821	0.001*
Age (14 and more)	0.027	0.063	0.071	0.476	0.621
Gender (girl)	0.321	0.141	0.282	2.24	0.037*
Students' preparatory level (3rd year)	0.037	0.042	0.143	3.31	0.001*
Total socioeconomic score (high)	0.018	0.031	0.109	4.07	0.001*
Participating in voluntary community services activities in their school	0.069	0.087	0.125	1.43	0.099
II. Attitude					
(Constant)	2.502	0.585		4.274	0.001*
Age (14 and more)	0.058	0.107	0.079	0.54	0.591
Gender (girl)	0.226	0.237	0.129	2.33	0.011*
Students' preparatory level (3rd year)	0.122	0.072	0.258	0.955	0.344
Total socioeconomic score (high)	0.018	0.053	0.047	2.68	0.005*
Participating in voluntary community services activities in their school (yes)	0.145	0.149	0.056	1.01	0.211
III. Daily life practice					
(Constant)	1.544	0.758		2.038	0.047*
Age (14 and more)	0.072	0.144	0.072	0.502	0.618
Gender (girl)	0.061	0.319	0.03	2.02	0.019*
Students' preparatory level (3rd year)	0.202	0.093	0.311	0.252	0.351
Total socioeconomic score (high)	0.044	0.072	0.085	1.98	0.048*
participating in voluntary community services activities in their school (yes)	0.106	0.201	0.075	0.526	0.601

P was calculated by using multiple logistic regression analysis.

Discussion

Children are important participants in attempts to combat climate change, yet they are excluded from decision making and action to manage the issue. Children are more frequently viewed in the literature of climate change as passive recipients of knowledge than as active agents in defining their lived reality. Therefore, there are few studies that discover how children understand and engage in climate change on their own terms. Using the participatory action research approach of photovoice, it is possible to analyze children's viewpoints and encourage critical thought and action (Trott et al., 2020).

The current study investigated how photovoice program assisted school-age children in making links between their lives and the more general concept of climate change. This is achieved by using a quasi-experimental research design that compare between intervention and control group to evaluate the effect of the program on their knowledge, attitudes, and daily life practices. The intervention group of school-age children of the present study amounted 60, aged 12 to 16 years, 68.3 % of them were girls, 43.3% were in the first preparatory level, and 48.3% of them reported low socioeconomic score.

The climate change awareness program proved to be a significant on the nursing students' total knowledge level (Abdallah & Wagdy Farag, 2022). Thus, such awareness is necessary to guide, empower and motivate students to make appropriate behaviors toward their surrounding environment (Rahman et al., 2014). The findings of the *current study* represented that the photovoice program had a significant effect on school-age children's knowledge regarding climate change among intervention group. The present study was in line with study conducted in by Hissa (2016) who reported that photovoice as a community-based participatory research methodology empowers participants to increase their understandings of a particular issue through the use of visual images regarding climate change adaptation. Also, the present study agreed with Trott (2019) study who reported that following the photovoice climate change education program, participants demonstrated increased knowledge of the scientific and social dimensions of the causes and consequences of climate change, as well as its solutions through human action. In addition to the agreement of the present study with Lam and Trott (2021) who stated that a common way children gained knowledge about climate change through photovoice was by seeing connections between SCA's climate change educational content and the world around them.

Climate change education helps young people comprehend and address the impact of climate change, encourages changes in their attitudes and helps them adapt to the climate change-related trends (Karami et al., 2017). The school age students should be exposed to the dangers of climate change early enough to help them develop positive attitude towards their environment and reduce the dangers associated with climate change (Njoku, 2016). The present study revealed that climate change photovoice program improve the school age students' attitude toward climate change. This result was in accordance with the study of Trott (2019) who reported that following the photovoice program, school age children left the program with an increased sense of respect for nature, an enhanced sense of environmental responsibility, and a greater sense of urgency towards the need for climate change, which denotes more positive attitude toward it. The result of the present study contradicted the result of Figueiredo and Perkins (2013) who suggested that scientific knowledge-based approaches have been largely ineffectual in altering the attitudes and behavior of children and young people towards climate change.

Photovoice helped children to learn about, care about, and take action on climate change (Lam & Trott, 2022). Children reported engaging in a variety of climate-protective actions to reduce their energy use and waste, with some children becoming more physically active as they left behind electronics to play outdoors (Trott, 2021). The result of the present study found that there is a significant effect of climate change photovoice program on the daily life practices of school age children regarding indoor and outdoor activities. This results supported by the result of the Trott (2019) study, who concluded that participants reported increased engagement in personal pro-environmental behaviors in climate change after implementation of SCA program. Also, the current study was in line with the study of Sprague et al. (2021) who observed that students associated the environment with social interactions as well as outdoor experiences with peers and family members and the photovoice intervention improved youths' social and familial functioning. Improvement in knowledge, attitude and daily life practices of school age children after the implementation of climate change photovoice program in the present study can be justified as the program was built on their interest and enjoyment regarding CC, which help them in modifying their behaviors towards environmental activities and enhancing their cooperation and teamwork.

In an Egyptian study of climate change-related knowledge and attitude, the participants reported the need to get information in a different way that could help in changing their attitude positively toward the issue of climate change

mitigation. The results of the present study represents a statistically significant relation between knowledge level, attitude and daily life practice of school age children. Satisfactory level of knowledge was associated with positive attitude regarding climate change, and satisfactory level of daily life practice. These findings agreed with study of Abdallah and Wagdy Farag (2022) who proved a positive correlation between the post-test total students' knowledge score level, total daily life practices, and perception. Furthermore, study done by Rahman et al. (2020)found that high level of climate change knowledge, and positive attitudes were significantly associated with high level of climate change adaptation or mitigation practices of the participants. Also, the finding of the current study came in the same line of Reddy et al. (2022) who concluded that the participants with adequate knowledge about climate change were observed to have more eco-friendly practices compared to participants with inadequate knowledge. On the contrary, these results disagreed with the study of Adio-Moses and Aladejana (2015)who revealed that awareness of global warming is poor and most people are indifferent in their attitude towards global warming. The significant relation between knowledge level, attitude and daily life practice of school age children in the present study can attributed to students' enjoyment, integration, and creativity in capturing photography from the surrounding environment based on implementation of the program and applying it on their lives.

The current study elaborated the different factors affecting satisfactory level of knowledge, attitude and daily life practices among school age children after the implementation of the climate change photovoice program. It was found that girl gender, 3rd preparatory level, and high socioeconomic score were factors affecting students' level of knowledge. These findings were similarly to a study done by Stevenson et al. (2014) who found that females demonstrated higher levels of climate change awareness and risk perception. While opposing with a study conducted by Rahman et al. (2014) who indicated that both males and females respondents had knowledge and awareness of the climate changes. These findings of the present study can be attributed to the students' age in which older students have the vision to acquire more knowledge than younger students. In addition, girl students are more curious to learn about information and get higher grades than boys.

Regarding the factors affecting the students' attitude, there was a statistically significant relation between girl gender, high socioeconomic score, and students' attitude. This finding is congruent with a study conducted by Dhenge et al. (2022) who found that female respondents had a favorable environmental attitude when compared with male

respondents. Also, the present finding supported by the study of Grandin et al. (2022) who reported that the pro-environmentalism was positively and significantly associated with the - Socioeconomic status of the participants.

Concerning factors affecting the daily life practices. It was found that girl gender with high socioeconomic scores were the main factors affecting school students' practice regarding climate change. This result is consistent with Stevenson et al. (2018) who stated that a low socioeconomic state was related to smaller gains in knowledge, concern, and behavior regarding climate change among adolescents. Also, the finding agreed by Wang et al. (2022) in their study which revealed that females children having air conditioners or heating systems at home were positively associated with adaptive behavior regarding climate change. On the contrary with a study conducted by Grandin et al. (2022) who mentioned that there is no significant mediated relationship was found between socioeconomic status of the participants and their pro-environmental behavior. The present findings can be justified as girl students in this study had better level of commitment, achievement regarding the requirements of the program. In addition to the high level of socioeconomic status of the family, which help mastering good-mannered and acceptable behavior such as having air conditioners or heating systems.

Conclusion:

Based on the finding of the present study, it can be concluded that climate change photovoice program had a significant effect on school age children knowledge, attitude and daily life practices regarding climate change. There was a statistically significant difference between both the intervention and control group pre and post the program. Girl gender, high socioeconomic score and third preparatory level of students are different factors affecting satisfactory level of knowledge, attitude, and daily life practices among school age children concerning climate change.

Recommendations:

Based on the findings of the current study the following recommendations are suggested:

- Climate change education should be included as a topic into the school curricula.

- Applying climate change photovoice program by school health nurse to improve awareness of the school age children.

- Promote educational campaigns and intervention programs focusing on climate change adaptation, mitigation and effective prevention strategies among various communities in Egypt by school health nurse.

- Mass media education & communication programs should be disseminated focused on accurate & culturally sensitive information about climate change photovoice program.

- A guideline book of climate change knowledge should be disseminated to all school age children and university students by ministry of education and ministry of health and population to increase their awareness.

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