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Leveraging Digital Technology Such as Films to Promote Environmental Awareness and Sustainable Practices among Interior Design Students^{*}

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Abstract:

In response to the escalating environmental issues locally and globally, it has become necessary to leverage digital technology, such as environmental films and comics, as powerful educational tools to promote environmental awareness, modify student behaviors, and build sound environmental practices. This research aims to evaluate the effectiveness of an educational approach that integrates films to improve students' environmental awareness and behavior. The study was conducted within the course "Environmental Control Systems", with the participation of a group of 22 female students in the Interior Design Program at King Abdulaziz University for the year 2024, using a quasi-experimental approach with pre- and post-assessments to measure shifts in environmental awareness among participants. In addition, personal interviews were conducted to gather deeper insights into the effects of the strategy on student behavior. The results of the study showed that the educational approach significantly enhanced students' perception and behavior towards environmental issues, allowing them to abandon harmful environmental habits and adopt sustainable practices, which should be reflected in their future design endeavors. The importance of this research lies in enhancing knowledge and expanding perspectives on integrating educational strategies with digital technology to enable students to make sustainable choices that preserve the environment.

Keywords: Digital technology; Education strategies; Environmental awareness; Environmental perception; Environmental sustainability; Interior design.

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1- Introduction:

Recent studies show a growing global trend towards enhancing environmental awareness among students of different age groups and geographical regions, through innovative and effective educational strategies. Despite the differences in geographical locations and curricula, there are common threads between these studies in focusing on the importance of environmental education and its role in changing individuals' behaviors towards the environment. Studies in Kuwait and Spainhave shown that environmental education has a significant positive impact on students' environmental behaviors according to (Al-Hashem, 2016) and (Jurado et al, 2019). In Kuwait, the educational program contributed to raising environmental awareness among primary school students, while the study in Spain showed that the glass recycling program helped spread the culture of recycling among students, their families, and the community.

The study in Saudi Arabia shows the use of the TRIZ theory as an innovative educational strategy to promote creative thinking and solve environmental problems as (Al Farhan, 2019) presented. This is in line with the recommendations of other studies that indicated the need to use modern and diverse teaching methods to promote environmental awareness. Moreover, the importance of diversifying educational strategies has been explained in the study by (Al Hashem, 2016). Additionally, Imran et al, 2024 focused on the impact of environmental education after the 2022 floods in Pakistan and this study highlighted the importance of integrating environmental education in addressing local environmental challenges. This result is similar to other studies in Kuwait, Saudi Arabia, and Spain that all emphasized the importance of enhancing environmental knowledge at different educational levels to address increasing environmental challenges. All studies confirmed that environmental education is not limited to enhancing knowledge only, but also contributes to changing behaviors and forming positive values towards the environment. Through educational programs in Kuwait and Spain, innovative teaching strategies such as TRIZ in Saudi Arabia, and lessons learned from the Pakistani experience after the floods, it is clear that environmental education is a powerful tool for guiding students towards more sustainable practices and a sense of environmental responsibility.

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A study conducted on female interior design students showed that they had a moderate level of interest and positive attitudes towards environmental sustainability (Bettaieb, 2019). However, a gap was found between their understanding of sustainable practices and their actual application in design projects, emphasizing the need for greater focus on the practical application of sustainability concepts in education. Another study focused on interior designers confirmed that there is a clear gap between environmental awareness and practical application, despite the available knowledge by (Mohsen and Matarna, 2023).

1-1 Research objective:

This study aims to evaluate the effectiveness of an educational strategy that integrates environmental films in deepening environmental awareness among female interior design students. It aims to measure the impact of this strategy on modifying negative environmental behaviors and adopting sustainable behaviors. Furthermore, it seeks to explore the role of digital technology in teaching environmental issues and encouraging positive behaviors among female students.

1-2 Significance of the research

The importance of this study lies in enriching knowledge about the effectiveness of integrated education strategies with technology in raising environmental awareness from mere knowledge to perception and then application. The research provides insights on how to improve educational curricula using digital tools, such as environmental films/ visual storytelling, to encourage sustainable behaviors among students. It contributes to preparing a generation of designers who integrate the principles of environmental sustainability into their future designs, which reflects positively on the environment.

1-3 Research field:

This research is related to the field of environmental education integrated with digital technology and aims to enhance environmental awareness with perception and modify negative behaviors through digital media such as environmental films, with a focus on interior design students.

1-4 Research methodology:

The study followed the quasi-experimental approach with pre- and

post-measurement to measure the change in the level of environmental behaviors and awareness among female students. The methodology enabled the measurement of the proposed strategy on promoting sustainable environmental behaviours.

1-5 Previous studies:

A study in the State of Kuwait aimed to raise awareness of environmental behaviors among primary school students by preparing an educational program and then measuring its effectiveness in promoting these positive environmental behaviors by (Al-Hashem, 2016). The program consisted of six units covering topics: air, water, food, plants, animals, and sounds. These topics were presented through activities appropriate for the primary education stage and the sample was 98 students. The results showed that environmental education programs have a positive impact on primary school students, which is a crucial stage in shaping environmental knowledge and behaviors. It recommended preparing a strategic plan to integrate environmental education within the general education system and strengthening the partnership between the Ministry of Education and ministries and bodies related to the environment. Diversifying the strategies used to develop environmental awareness. It is also important to qualify teachers specialized in environmental matters because they play a key role in educating students. Raising the level of environmental awareness among members of society and benefiting from previous experiences.

The study conducted by (Al-Farhan, 2019) investigated the effect of using a proposed strategy based on the TRIZ theory in teaching the environmental education course to develop awareness and attitudes towards environmental issues among students of the College of Education at King Khalid University. The study sample was divided into two groups, experimental and control, with a total of 64 undergraduate students. The results showed that using the TRIZ strategy had a positive impact on developing awareness and changing attitudes towards environmental issues among students in the experimental group compared to the control group. The study also recommended some points, including the principles of the TRIZ theory in the curricula, due to its major role in promoting creative thinking and solving environmental problems, and teachers adopting modern teaching methods that help develop thinking skills and promote positive attitudes towards environmental issues.

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Additionally, Imran's 2024 study was conducted to consider the impact of environmental education on students' attitudes and values after the 2022 floods in Pakistan. A sample of 87 secondary school teachers from central Punjab regions were surveyed, and the study demonstrated the importance of integrating environmental education into the educational system to address environmental challenges. Several topics were discussed, including curriculum development, teacher training, and institutional initiatives, in addition to students' understanding of environmental issues. It stressed that raising students' awareness of the environment and providing them with the necessary skills to confront threats environmental contributes to enhancing their sense of responsibility towards protecting the environment. The study demonstrated the importance of early environmental education in developing students' experiences and enhancing their knowledge of environmental issues, in addition to its role in developing their values and attitudes towards environmental conservation. This education also contributes to preparing a generation of environmental activities who are committed to sustainability, provided that educational institutions support this passion and direct it properly.

Jurado et al., 2019, analyzed the impact of an educational program for glass recycling in primary schools in the Castilla-La Mancha region (Spain), where a sample of 89 schools was selected. The program was a glass collection competition with additional educational activities, with the aim of raising awareness among primary school students about the importance and benefits of glass recycling. The program also sought to enhance recycling behaviors among students, their families, and the educational community in general. The study showed encouraging results, students actively participated in protecting the environment, which enhanced their understanding of the importance of recycling and contributing to confronting the problem of global pollution. Students benefited from the program by gaining extensive knowledge about glass recycling and adopting positive environmental behaviors and attitudes, while also influencing their social environment by spreading this culture.

Environmental and pollution issues receive wide attention locally and globally, due to the negative effects they have on humans and the environment. Studies dealing with environmental issues and developing environmental awareness have varied in recent years. The topic of environmental pollution was addressed in terms of concept and forms (Ghraiba, 2020), and the role of education in developing environmental awareness was highlighted through the use of educational units and programs specially prepared for this purpose (Al-Hashem, 2016), in addition to studies that focused on using various teaching strategies to enhance environmental awareness among students (Al-Farhan, 2019). Other studies discussed technology in environmental awareness (Cao and Jian, 2024).

Ghraiba, 2010 classified environmental pollution into three main areas: degree, source, and quality. In terms of degree, pollution is divided into acceptable pollution, hazardous pollution, and destructive pollution. In terms of source, it is divided into natural pollution resulting from natural processes, and pollution resulting from human activities. In terms of quality, it has been explained that pollution can be material, such as water, air, and soil pollution, or non-material, such as noise pollution, radiation, and moral pollution. Studies have shown (Farhan, 2019) the importance of involving the individual in planning processes for environmental protection and making sound environmental decisions through awareness of environmental problems and challenges, whether in terms of material depletion or pollution and the impact of consumption that exceeds the speed of renewal or participation in environmental conservation in word and deed. A study by (Ann Cao and Jian, 2024) highlighted that using reality technologies artificial intelligence and virtual to teach environmental challenges can greatly improve university students' understanding of these topics, help them develop a value system for environmental conservation, and motivate them to continue environmental advocacy.

2- The general framework of the proposed strategy

The strategy is based on four main stages: preparation, guidance, analysis, and dialogue. It commences with two stages; the first is general and includes all students, while the second stage is specialized and targets each student individually. Both stages involve individual work and presenting their results collectively in front of the entire class for the benefit of all. Performance is evaluated and progress is monitored through personal interviews with students, which allows for a deeper understanding of the development of their environmental awareness and the extent of their response to the adopted strategy.

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Stages	Step	Procedure	Goal
First Stage	Preparation	Discuss with	Create an
(General)		students their	emotional
		personal	connection between
		experiences with	students and the
		the environment,	environment so that
		such as the most	they are more
		beautiful landscape	prepared to
		they have seen or a	understand
		personal experience	environmental
		with nature that has	messages.
		affected them.	
	Guidance	Brainstorm the	Increase students'
		positive and	awareness of their
		negative	daily behaviors and
		environmental	motivate them to
		behaviors that the	take concrete steps
		student practices	towards adopting
		daily by thinking	more sustainable
		about activities that	and positive
		lead to harm the	behaviours.
		environment (such	
		as excessive use of	
		natural resources,	
		for example,	
		wasting water	
		while showering).	
	Analysis	Identify the most	The beginning of
		harmful daily	the shift from
		environmental	environmental
		nabits practiced by	awareness to
		the student, then	environmental
		analyze the origin	perception, which
		its causes. Identify	is deeper in terms
		its barms and	of understanding the danger of these
		negative offects on	ine uunger of inese
		the environment	inaiviauai ana
		such as the habit of	on the environment
		such as the habit of	on me environment

Table (1) Basic steps of the strategy

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Stages	Step	Procedure	Goal
		wasting water while showering	and the planet.
		(identifying water	
		sources - scarce	
		and dry areas) and	
		the effect of	
		wasting water on	
		the environment,	
		people, animals and	
		the entire planet.	
	Discussion	Follow up on the	Develop gradual
		practice of negative	solutions that affect
		habits through deep	daily practice to
		dialogue with the	create a new habit
		students to	acquired through
		consolidate the	knowledge and
		environmental	environmental
		concepts they have	awareness, and
		learned about and	motivate and follow
		change them.	up on its
			changing towards
			adopting a good
			environmental
			habit
Second Stage	Preparation	The teacher	Promote personal
(Individual)		presents a list of	engagement with
		selected	environmental
		environmental	issues and increase
		films whose topics	awareness of the
		are compatible with	environmental
		the negative and	challenges facing
		environmentally	the world.
		harmful habits of	
		the students	
		(selected from the	
		first stage), where	
		the student chooses	
		one film that deals	

Stages	Step	Procedure	Goal		
		with a touching			
		story about the			
		impact of humans			
		on the			
		environment.			
	Guidance	Explain briefly	Motivate them to		
		about the film to be	connect		
		shown, to clarify its	emotionally with		
		subject and now it	the events,		
		environmental	moving situations		
		issues.	in the film.		
		Alignment with the			
		previously chosen			
		harmful			
		environmental			
		habit.			
	Analysis	Analyzing the film	Measuring the		
		and the way the	extent of impact		
		film used emotions	through the film's		
		to reinforce	environmental		
		environmental	messages, in		
		messages. How did	addition to		
		the film's painful	enhancing the		
		scenes or those	connection between		
		with sad endings	the film's events		
		help reinforce the	and its emotional		
		importance of	impact on students.		
		preserving the	Attracting students'		
		environment? What	attention, feelings,		
		is important here is	and empathy		
		the role of sound	towards the		
		and visual effects	environment to		
		in enhancing the	participate in		
		students' emotional	improving		
		impact towards the	environmental		
		environment.	practices.		
	Discussion	-Each student will	-Encouraging		
		be shown the film	students to express		
		they chose and will	their feelings		

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Stages	Step	Procedure	Goal		
		explain the most	transparently,		
		important parts that	believing in the		
		affected them and	importance of the		
		helped them make	individual input		
		a firm decision	and their feelings in		
		regarding their	building societies.		
		personal behaviors			
		towards the	-Enhancing their		
		environment. This	understanding of		
		discussion should	the environmental		
		enhance their skills	issues raised in the		
		of analysis and	films, and enabling		
		critical thinking	them to express		
		and enable them to	their opinions		
		discuss their own	about the		
		personal feelings.	environmental		
			messages that were		
		During personal	presented.		
		interviews, focus	-Developing a		
		on the facial	deeper		
		expressions and	understanding of		
		body movements of	the impact of the		
		the students while	film on their		
		showing the story	individual feelings.		
		of the chosen film	Building emotional		
		and ask about their	awareness that		
		feelings towards	prompts students to		
		the most influential	think about the		
		moments, whether	environmental		
		they were feelings	messages of the		
		of sadness, anger,	film and their		
		or sympathy and	impact on them.		
		write down their	-Activating their		
		feelings.	role as an		
			individual to		
			instigate changes.		

2-1: Study sample:

The study was conducted on a sample of 22 female students majoring in interior design at King Abdulaziz University. For female students registered for the first semester of the academic year 1446 AH in the Environmental Control Systems course, where the course focuses on providing educational content aimed at benefiting from environmental resources in interior design and improving dealing with environmental factors.

2-2: Procedures followed in the study

The study covered three main stages: distributing questionnaires, implementing the strategy, and conducting personal interviews. These stages were as follows:

2-2-1 Questionnaire design:

A questionnaire was prepared that aimed to measure the change in the level of environmental awareness among female students before and after implementing the educational strategy. The questionnaire included two main axises: The first axis involved awareness of contemporary environmental issues. Whereas, the second axis focused on daily environmental behaviours.

Implementing the strategy: The proposed strategy, which relies on integrating environmental films into education, was implemented on female students over a period of eight weeks and adapted to the daily environmental habits of female students. The strategy included steps aimed at enhancing environmental understanding among female students by stimulating their feelings and linking their daily behaviors to the environmental issues raised. The aim of this strategy was to influence the students' behaviors and guide them towards adopting positive and sustainable environmental practices through emotional awareness.

Personal interviews: Personal interviews were conducted with the students twice during the eight-week study period. The aim of these interviews was to ensure that the students adopted sustainable environmental behaviors, and to understand the extent to which the educational strategy affected their environmental awareness and behaviours towards the environment.

2-3: Questionnaire

The questionnaire was designed on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree), to measure the level of environmental awareness of the students in the first axis and to identify the daily habits and harmful environmental activities that the students complete in the second axis.

2-4: Personal interviews

The personal interview, distributed twice over eight weeks, to identify the changed behavior of the students after applying the proposed strategy, especially in the dialogue step in the first and second stages, in order to enhance sustainable environmental behaviours.

3- Results and Discussion

The study followed a quasi-experimental approach with pre- and post-measurement to evaluate the impact of the proposed strategy on promoting sustainable environmental behaviors, as it included 22 participants.

3-1 The results of the strategy:

3-1-1 The first phase (the general phase):

Preparation, when videos and digital clips were shown of the most beautiful views of nature and an explanation of strange environmental phenomena such as the aurora borealis phenomenon, sparkling beaches due to luminous seaweed, pink beaches and black beaches, as well as charming waterfalls with their different colors and gradations, colorful sand, beautiful clouds that are repeated and formed in their amazing, striking shapes, and many other scenes that show the beauty of nature. These clips enabled the students to express their gratitude and admiration for the beauty of nature and their sense of abundance and goodness, and express their desire to see this beauty, its continuity, and its preservation.

3-1-2 The second step is guidance when the students were directed to present most of their daily behaviors that are harmful to the environment and then compare the most harmful habits that they want to change. The students' reaction was through learning about the introduction to the impact of daily habits on the planet, by doing the exercise of calculating the carbon footprint for each of them and their knowledge of the results showed the extent of their negative impact on the planet and thus their desire to change their environmental behaviors.

3-1-3 In the third step, the analysis step, the habit was studied and its effects were analyzed from several aspects. Psychological, health, environmental and social aspects and their impact on the individual and society. The students' reactions began to appear, as some were surprised by the extent of their bad habits and the depth of its negative impact, such as the habit of using plastic unconsciously and knowing the different types of plastic. In this step they often found that the solution to the problem is

generally a simple solution and proposing an action plan and adhering to it helped them change towards positive environmental practices.

3-1-4 Finally, the fourth step involves dialogue, in which the gradual progress was made during the last four weeks of implementing the strategy, as through dialogue and discussion with the student on the new practices proposed to solve the problem of the negative habit, for example, excessive shopping and buying clothes that are quickly produced and easy to buy, which affected the students financially. One of the participants (student A) expressed her dissatisfaction with buying some clothes that do not last long, which then forces her to buy other clothes at close intervals. (student A) learned through her studies that all this negatively affects the environment. After dialogue and discussion with (student A) she gradually got rid of the habit, as she was calculating the spending before and after implementing the strategy. She was able to change the habit to a balanced habit that does not harm the environment, which is choosing good materials from sources with specific environmental values that contribute to reducing the risk of harmful environmental practices in the long term.

3-2 The results of the strategy:

3-2-1 The second stage (individual stage):

Preparation, in which a list of selected and specific environmental films was presented, the topics of which were appropriate to the negative and environmentally harmful habits of the students (selected from the first stage). These are some of the films suggested for the students: (*Wall-E, Memory of Water, Okaja, The Day After Tomorrow, Acide, Deep Water Horizon, Cowspiracy: The Sustainability Secret, The True Coast and The Year Earth Changed*), where the student chooses one film that deals with a touching story about the impact of man on the environment. A brief summary of the list of films was explained, their topics were clarified, and how these carefully selected films reflect environmental issues.

3-2-2 The second step is guidance, where students are assured of choosing films that are appropriate for their previously chosen habits. Students were observed to be enthusiastic about choosing a film that is compatible with their daily habits that are harmful to the environment. For example, if a student recorded that her daily habit that is harmful to the environment is wasting water, the film she watches will be about the disasters of water scarcity and drought, such as the movie *Memory of Water*, to create an emotional connection between the scenes and events

of the film and her habit that is harmful to the environment. Here, work is done to arouse her feelings and thus achieve changing the habit that is harmful to the environment in the student. This will lead the student realising the impact of the choosing habit on the planet and on the basic sources of life, such as water.

3-2-3 In the third step, analysis, the film was shown and watched by the student, who recorded her observations, feelings and desires during and after watching, where she described the nature of her controlling feelings, whether they are feelings of sadness, anger, fear, anxiety, overthinking or frustration, and she mentioned the feelings that prompted her to change and adopt new habits to preserve the environment. The students were affected by the events of the films in which the environment faces the harshest challenges and were asked to describe their feelings through personal interviews conducted after watching the films, as everyone expressed their feelings.

3-2-4 In the fourth step, the dialogue step, the students' personal feelings were discussed and a few students expressed surprise that: "I did not know that this behavior would cause this harm and this greatly affected my feelings." In addition, (student B) said, "I felt angry at the beginning of the film as the people of the city were harmed environmentally, but after that when someone adopted the cause and succeeded in it despite the difficulties he faced, I believed and was overwhelmed with joy and I became convinced that my actions as an individual have a great impact on the environment, which I will not underestimate anymore."

Furthermore, (student C) stated: "I feel angry with myself because I did not appreciate the beauty of nature and the value of water." (student C) had a habit that was harmful to the environment, which was wasting water when showering, as she used to spend more than an hour washing. After watching the suffering in the film *Memory of Water*, she realized the importance of her role in preserving the basic resources for a decent life, and the film played an important role in changing her awareness from knowledge to perception.

Finally, (student D) expressed her dissatisfaction after watching the movie *Cowspiracy: The Sustainability Secret*, saying, "I did not know that this industry (factory farming) was responsible for this amount of environmental damage," and she felt responsible for her daily dietary decisions, as this will certainly affect her physical health. The researchers

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concur with what (F.2019) mentioned in his study about the impact of the individual's role in adopting environmentally friendly practices and its impact on promoting sustainability, reducing environmental challenges, preserving basic resources, and consuming efficiently. This is evident from the number of models, as shown in Figure 1.





The analysis of all 22 students shows the depth of the final analysis of the students, as the moving scenes and moments added a lot of important information about the environment. All students mentioned how much they enjoyed working on this project during the semester, as (student E) expressed her gratitude for participating in this research, saying, "I enjoyed spending time watching the film, analyzing it, and learning from it." (student F) conveyed her happiness to be asked to partake in this experience, saying, "It is an experience that really moved my feelings." Finally, (student G) added, "Thank you for helping us understand the world around us in a fun and wonderful way."

Through the eight general and individual stages, we can see the students' interaction and enthusiasm for learning by activating and integrating digital technology, such as watching films, as it is considered one of the most enjoyable and established teaching strategies. This could be due to the fact that it works on the student's photographic memory, which activates more than two of their senses, and thus the information received is established in a greater and more lasting way. While the results of the questionnaire, which had 40 questions, covered measuring students' environmental awareness, the second axis covered harmful environmental behaviors and habits, Table No. 1 shows the students' opinions before and after the strategy.

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Num.	Question	Stroi	ngly	Ag	ree	Neu	tral	Disa	gree	Stroi	igly
		Agi Before	After	Before	After	Before	After	Before	After	Before	After
	The f	irst ax	is: M	easuri	ng en	vironr	nenta	l awar	eness		
1	I feel the beauty	21.4%	59.1%	39.3%	31.8%	23.1%	9.1%	7.1%	0	0	0
	of the universe										
	appreciate it by										
	preserving it.										
2	I am well aware	4.5%	50%	53.6%	36.4%	28.6%	9.1%	14.3%	4.5%	0	0
	0I contemporary										
	environmental										
	disasters such										
	as climate										
	and air										
	pollution.										
	I am aware of	32.1%	68.2%	17.9%	27.3%	39.3%	4.5%	10.7%	0	0	0
	the importance										
	natural										
3	resources such										
	as water, air and										
	I am familiar	0	18.2%	4.5%	27.3%	17.9%	40.9%	57.1%	13.6%	21.4%	0
	with	Ū	10.270		27.070	17.570	10.070	57.170	10.070	2	Ũ
4	environmental										
	laws and										
5	I know that my	7.1%	9.1%	0	9.1%	17.9%	0	53.6%	54.5%	21.4%	27.3%
	daily behaviors										
	have nothing to										
	do with environmental										
	degradation.										
6	I believe that	4.5%	0	17.9%	0	7.1%	0	28.6%	27.3%	46.4%	68.2%
	daily human										
	contribute to										
	environmental										
	degradation.										
7	I teel	7.1%	31.8%	21.4%	54.5%	25%	9.1%	28.6%	4.5%	17.9%	31.8%
	protecting the										
	environment for										
	future										
	generations.										

Table 2 shows participants' responses before and after the strategy

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Num.	Question	Stroi Agi	ngly :ee	Agree		Neu	tral	Disagree		Strongly Disagree	
		Before	After	Before	After	Before	After	Before	After	Before	After
8	I believe that environmental sustainability depends only on communities and individuals have no important role.	17.95%	0	35.7%	13.6%	0	4.5%	28.6%	45.5%	17.9%	36.4%
9	I feel frustrated when I see the lack of interest in environmental issues in my community.	21.4%	27.3%	39.3%	54.5%	28.6%	13.6%	7.1%	4.5%	3.6%	0
10	I participate in discussions on environmental issues with my friends and colleagues.	7.1%	18.2%	14.3%	36.4%	14.3%	27.3%	32.1%	9.1%	32.1%	9.1%
11	I regularly educate myself on the latest developments in green technology and environmental innovations.	0	9.1%	3.6%	45.5%	21.4%	22.7%	46.4%	18.2%	28.6%	4.5%
12	I am looking for opportunities to participate in environmental or volunteer campaigns.	3.6%	9.1%	17.9%	36.4%	14.3%	36.4%	39.3%	13.6%	25%	4.5%
13	I encourage my friends and family to adopt environmentally friendly behaviours.	0	22.7%	32.1%	54.5%	25%	9.1%	21.4%	9.1%	21.4%	4.5%
14	I feel responsible when I see someone	14.3%	31.8%	42.9%	45.5%	25%	13.6%	10.7%	9.1%	7.1%	0

Num.	Question	Stroi <u>Ag</u> i	ngly ree	Agree		Neu	tral	Disa	gree	Strongly Disagree	
		Before	After	Before	After	Before	After	Before	After	Before	After
	engaging in behavior that harms the environment.										
15	I participate in workshops or lectures related to the environment and sustainability	0	0	3.6%	40.9%	28.6%	4.0%	28.6%	13.6%	39.3%	4.5%
16	I regularly read articles or books about how to save the environment.	0	0	0	9.1%	14.3%	45.5%	17.9%	31.8%	67.9%	13.6%
17	I try to be a role model for others by adopting sustainable environmental behaviours.	3.6%	22.7%	25%	59.1%	28.6%	13.6%	21.4%	4.5%	21.4%	0
18	I am keen to spread environmental awareness through social media.	3.6%	9.1%	3.6%	27.3%	7.1%	31.8%	42.9%	22.7%	42.9%	9.1%
19	I am looking for new ways to contribute to environmental efforts on a personal or community level.	0	9.1%	17.9%	40.9%	10.7%	27.3%	35.7%	18.2%	35.7%	4.5%
20	I am looking for innovative environmental solutions that can be applied in my daily life.	0	13.6%	21.4%	54.5%	10.7%	18.2%	35.7%	9.1%	۳۲,۱32.1 %	4.5%
	Ax	kis II: H	Iarmfu	l enviro	onment	al beha	aviors a	and hab	oits		
21	I use plastic products	67.9%	18.2%	32.1%	45.5%	0	27.3%	0	9.1%	0	0

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Num.	^{n.} Question		ngly	Ag	ree	Neu	tral	Disagree		Strongly	
		Agi Before	After	Before	After	Before	After	Before	After	Before	After
	frequently.										
22	Buy over- packaged and canned products.	42.9%	13.6%	39.3%	22.7%	14.3%	31.8%	0	22.7%	3.6%	9.1%
23	I use plastic bags when shopping instead of reusable bags.	75%	40.9%	10.7%	27.3%	۷,17.1%	22.7%	3.6%	9.1%	3.6%	0
24	I don't care about separating recyclable waste from other waste.	53.6%	18.2%	17.9%	22.7%	10.7%	36.4%	10.7%	22.7%	7.1%	0
25	I don't look for eco-friendly alternatives when buying everyday products.	46.4%	4.5%	28.6%	22.7%	17.9%	18.2%	3.6%	54.5%	3.6%	0
26	I don't leave the air conditioning on when I'm out of the room.	46.4%	31.8%	28.6%	40.9%	3.6%	4.5%	17.9%	18.2%	3.6%	4.5%
27	I use strong- scented cleaners.	21.4%	9.1%	35.7%	36.4%	25%	22.7%	7.1%	31.8%	10.7%	0
28	I spend a lot of time in the shower and waste water.	21.4%	4.5%	28.6%	27.3%	14.3%	18.2%	28.6%	36.4%	7.1%	13.6%
29	Consume large amounts of water when washing dishes or cleaning the house.	21.4%	4.5%	42.9%	27.3%	14.3%	31.8%	17.9%	27.3%	3.6%	9.1%
30	I do not leave the faucet running at full flow while using it.	39.3%	59.1%	25%	18.2%	14.3%	4.5%	14.3%	18.2%	7.1%	0
31	Wash your home and car	4.5%	0	0	0	7.1%	9.1%	46.4%	40.9%	46.4%	45.5%

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Num.	Question	Strongly Agree		Ag	Agree		Neutral		gree	Strongly Disagree	
		Before	After	Before	After	Before	After	Before	After	Before	After
	facilities daily, even if you don't need to.										
32	I use private transportation instead of walking.	57.1%	40.9%	21.4%	22.7%	14.3%	22.7%	7.1%	9.1%	0	4.5%
33	It is better to decorate the house with artificial plants instead of natural ones because they are easier to care for.	14.3%	27.3%	10.7%	13.6%	7.1%	9.1%	28.6%	22.7%	39.3%	27.3%
34	I don't care about buying local or organic products that support the environment	28.6%	9.1%	21.4%	9.1%	21.4%	27.3%	17.9%	40.9%	10.7%	13.6%
35	I leave the lights on in rooms I'm not using.	10.7%	0	14.3%	4.5%	14.3%	18.2%	17.9%	31.8%	42.9%	45.5%
36	I buy clothes internationally frequently without needing them.	14.3%	9.1%	7.1%	4.5%	14.3%	13.6%	32.1%	54.5%	32.1%	18.2%
37	I use electronic devices (such as computers and phones) for long periods of time without turning them off.	35.7%	27.3%	21.4%	31.8%	10.7%	18.2%	14.3%	18.2%	17.9%	4.5%
38	Use conventional batteries instead of rechargeable batteries.	35.7%	18.2%	28.6%	36.4%	10.7%	22.7%	21.4%	13.6%	3.6%	9.1%
39	Leave electrical appliances	21.4%	4.5%	28.6%	31.8%	17.9%	13.6%	17.9%	31.8%	14.3%	18.2%

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Num.	Question	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
		Before	After	Before	After	Before	After	Before	After	Before	After
	plugged in even when not in use.										
40	I do not engage in recycling activities for leftover products or materials.	10.7%	4.5%	21.4%	27.3%	14.3%	40.9%	32.1%	18.2%	21.4%	9.1%

3-3 The Strategy Analysis:

3-3-1 Results of the first axis related to Measuring environmental awareness

It is clear from the previous table in the first axis before and after for the first to fifth question that there is a significant increase in the percentage of female students who have become aware of the beauty and importance of the universe after applying the strategy (an increase from 21.4% to 59.1% in strongly agreeing with a significant decrease in neutrality from 23.1% to 9.1%). As for the female students being well aware of contemporary environmental disasters such as climate change and water and air pollution, despite the strong decrease in agreement from 50% to 36.4%, agreement increased from 36.4% to 54.5%, reflecting the students' re-evaluation of their awareness. The female students' answers revealed that they were aware of the importance of preserving natural resources such as water, air, and food. Strongly agreeing increased significantly from 32.1% to 68.2%, indicating a significant increase in environmental awareness. Agreeing increased slightly from 17.9% to 27.3%, while neutrality decreased significantly from 39.3% to 4.5%, reflecting the students' transformation from a state of hesitation to positive awareness.

The student's knowledge of environmental legislation and laws, strongly agreeing, which did not exist before the strategy, reached 18.2% after implementation, while approval increased from 4.5% to 27.3%. Neutrality increased from 17.9% to 40.9%, indicating limited awareness of legislation, while rejection decreased from 57.1% to 13.6%. Regarding the student's knowledge that their daily behaviors have nothing to do with environmental deterioration, strongly agreeing increased slightly from 7.1% to 9.1%. While approval appeared at 9.1% after the strategy,

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neutrality disappeared completely from 17.9% to 0%, while a large percentage of disagreement remained at 54.5%.

The results for the first axis of questions from sixth to ten indicate that the student's belief that daily human activities do not contribute to environmental degradation decreased while agreement decreased from 17.9% to 0% and neutrality decreased from 28.6% to 13.6%, strongly disagree increased from 25% to 68.2%. Perhaps the noticeable shift to strongly disagree indicates a clearer awareness of the impact of human activities on the environment. The students' response to their feeling of responsibility towards protecting the environment for future generations showed that strongly agree increased from 7.1% to 31.8%, agreement increased from 21.4% to 54.5%, while neutrality decreased from 17.9% to 0%. This shows a noticeable increase in the feeling of responsibility towards environmental protection.

students' response to their belief that environmental The sustainability depends only on communities and that individuals have no important role was that they strongly agreed, decreasing from 17.9% to 0%, agreed, decreasing from 35.7% to 13.6%, while strongly disagreed, increasing from 0% to 36.4%. This indicates that there is a major shift towards rejecting the idea of relying only on communities, with individuals becoming more aware of their role. In the question about the students' feeling of frustration when they see a lack of interest in environmental issues in their community, the students' response strongly increased from 21.4% to 27.3%, agreed, increasing from 39.3% to 54.5%, while neutrality decreased from 28.6% to 13.6%. This indicates that there is an increase in the feeling of frustration with the lack of interest in environmental issues. In the question of participation in discussions about environmental issues with friends and colleagues, the strong agreement increased from 7.1% to 18.2% and the moderate agreement increased from 14.3% to 36.4%, which indicates an increase in engagement in environmental discussions among students. This is extremely promising to hopefully create lasting change amongst the younger generations.

The results of the first axis in the eleventh to fifteenth questions were about the students educating themselves regularly about the latest developments in green technology and environmental innovations. The strong agreement increased from 0% to 9.1% and the agreement increased

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from 3.6% to 22.7%, while the neutrality decreased from 21.4% to 13.6%, which indicates the beginning of interest in green technology and an increase in awareness of the latest environmental developments. In the question of searching for opportunities to participate in environmental or volunteer campaigns, it appears that the strong agreement increased from 3.6% to 9.1% and the moderate agreement increased from 17.9% to 36.4%, which shows a gradual increase in the desire to participate in environmental volunteer campaigns.

As for the students encouraging friends and family to adopt environmentally friendly behaviors, the approval increased strongly from 0% to 22.7% and the approval increased from 32.1% to 54.5%, a noticeable increase in the influence on the students' environment to adopt positive environmental practices. The student's sense of responsibility when someone practices behavior that harms the environment, the approval increased strongly from 14.3% to 31.8%, in addition to the approval increasing from 42.9% to 45.5% the neutrality decreased from 25% to 13.6%. This change indicates an increase in the sense of responsibility towards the negative behaviors around them. Regarding the students' question about their participation in workshops or lectures related to the environment and sustainability, we note that the strong approval remained at 0%, while the moderate approval increased from 3.6% to 40.9%, which shows a clear increase in the students' desire to attend and participate in these types of forums.

Regarding the results from question sixteen to twenty for the first axis there were interesting results. For example, the question related to regularly reading articles or books about how to preserve the environment, strong agreement remained at 0%, while moderate agreement increased from 0% to 9.1%, which shows an increase in students' interest in educational resources. When the students were asked about their attempts to be a role model for others by adopting sustainable environmental behaviors, we note that strong agreement increased from 3.6% to 22.7%, moderate agreement increased from 25% to 59.1%, and neutrality decreased from 28.6% to 13.6%, which shows an increase in students' sense of their identity as role models in their environment. The question about the student's keenness to spread environmental awareness through social media shows that strong agreement increased from 3.6% to 9.1%,

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and agreement increased from 3.6% to 27.3%, which demonstrates an improvement in the use of social platforms to spread environmental issues.

The answer to the question about the student's search for new ways to contribute to environmental efforts at the personal or societal level revealed a strong increase in agreement from 0% to 9.1%, and agreement increased from 17.9% to 40.9%, indicating an increase in the search for opportunities to contribute to environmental solutions. The answer to the last question in the first axis, related to the student's search for innovative environmental solutions that can be applied in daily life, showed that strong agreement increased from 0% to 13.6%, moderate agreement increased from 21.4% to 54.5%, and neutrality decreased from 10.7% to 18.2%, indicating a noticeable improvement in the search for practical and innovative solutions for the environment.

3-3-2 Results of the second axis related to harmful environmental behaviors and habits

In the analysis of the second axis related to harmful environmental behaviors and habits, which is twenty questions, the first question addresses the student's frequent use of plastic products, where before the strategy: 67.9% strongly agreed, but after the strategy, agreement decreased strongly to 18.2%. This 49.7% decrease indicates a significant improvement in students' awareness of the environmental impact of plastic, with some students perhaps turning to more sustainable alternatives such as reusable bags or biodegradable products. When students were asked about purchasing over-packaged and packaged products, strongly agreeing decreased from 42.9% to 13.6%, meaning a decrease of 29.3%, while neutrality increased from 14.3% to 31.8%. This indicates that awareness of the importance of reducing waste from over-packaging appears to have improved, but the increase in neutrality suggests that some students may still need affordable, practical alternatives to sustainable packaging.

The use of plastic bags when shopping instead of reusable bags was strongly agreed upon, down from 75% to 40.9%, while the approval increased from 10.7% to 27.3%. Despite the significant decrease in the excessive use of plastic bags, it seems that a large percentage of students still need additional awareness of the importance of completely eliminating plastic. As for "I do not care about separating recyclable waste

from other waste," the strongly agreed upon decreased from 53.6% to 18.2%, and the neutrality increased from 10.7% to 36.4%. This shift indicates a significant improvement in students' awareness of the importance of recycling. However, the high percentage of neutrality after implementation may indicate challenges in implementing waste separation on the ground among students.

Next the statement: "I do not look for environmentally friendly alternatives when buying everyday products". Strongly agreed decreased from 46.4% to 4.5%, while the approval also decreased from 28.6% to 22.7%. The significant decrease in strongly agreed reflects success in raising awareness of the importance of choosing environmentally friendly products. When asked about not leaving the air conditioning on when out of the room, the students strongly agreed to decrease from 46.4% to 31.8% and agreed to increase from 28.6% to 40.9%. The shift here reflects the beginning of an improvement in the students' energy consumption habits. The increase in agreement means that there is a gradual progress towards more sustainable practices.

In relation to the following statement regarding the student's use of strong-scented detergents, strong agreement decreased from 21.4% to 9.1%. Agreement remained almost constant at 36.4. The decrease in strong agreement indicates that the students are aware of the harmful effects of strong chemical detergents on the environment and health, but the need for awareness of safe and sustainable alternatives still exists. As for the student spending a long time in the shower and wasting water, the strong agreement decreased from 21.4% to 4.5%. This decrease shows a positive trend towards rationalizing water consumption. Furthermore, consuming large amounts of water when washing dishes or cleaning the house revealed that strongly agree decreased from 21.4% to 4.5% and agree decreased from 42.9% to 27.3%. It is noticeable that the results reflect an improvement in reducing water consumption, perhaps due to the students' acquisition of skills to rationalize use or their awareness of the importance of conserving resources. When the students were asked about leaving the water tap on at maximum flow while using it, strongly agree decreased from 39.3% to 5.9% and agree decreased from 25% to 18.2%. The significant decrease in both percentages reflects an increasing awareness of the importance of rationalizing water consumption and reducing daily waste.

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In the question about washing household facilities and cars daily even if they do not need to before the strategy, I strongly agree was 4.5%, but after the strategy 0%. The results show a significant decrease in practicing this water-wasting behavior. The students' increased awareness of the importance of rationalizing water consumption helped reduce unnecessary washing operations.

When analysing the statement concerning using private transportation instead of walking, before the strategy, I strongly agree was: 57.1% Agree: 21.4% Neutral: 14.3%. However. after the strategy, I strongly agree: 40.9%, meaning a decrease of 16.2% Agree 22.7% A slight increase of 1.3% Neutral 22.7% An increase of 8.4% Through this result, there is a relative improvement in the students' tendency to think about walking as a sustainable alternative to private transportation, but the need to improve the infrastructure for walking or public transportation may explain the continued reliance on cars.

Ease and convenience may explain the next result too e.g. I prefer to decorate the house with artificial plants instead of natural ones because they are easier to care for. Before the strategy I strongly agree: 14.3%,

Agree: 10.7% While after the strategy I strongly agree: 27.3% Agree: 13.6%. This was a slight increase of 2.9%. The results show the beginning of awareness of the importance of natural plants, but the continued reliance on artificial plants may be explained by the ease of caring for them compared to natural ones.

I do not care about buying local or organic products that support the environment revealed that I strongly agree: 28.6%, Agree: 21.4%. While after the strategy: Strongly agree: 9.1% A decrease of 19.5% Agree: 9.1% A decrease of 12.3% The results show an increase in the trend towards buying local and organic products, reflecting the students' awareness of the role of these products in supporting the local economy and reducing the environmental impact.

Furthermore, in relation to lighting: I leave the lights on in rooms that I do not use. The answers were as follows: I strongly agree: 10.7% Agree 14.3%. While after the strategy I strongly agree: 0% meaning a decrease of 10.7%. I agree: 4.5% which is a decrease of 9.8%. The significant decrease in agreement reflects an improvement in students' awareness of the importance of rationalizing electricity consumption

In the question related to buying clothes internationally frequently without needing them before the strategy I strongly agree: 14.3% and I agree was 7.1%. While after the strategy I strongly agree: 9.1% I agree: 4.5%. The improvement in the results reflects the beginning of awareness of the importance of reducing excessive consumption and its role in preserving resources and reducing emissions associated with international transportation.

I use electronic devices (such as computers and phones) for long periods without turning them off. Before the strategy I strongly agree: 35.7%. I agree: 21.4%. While after the strategy I strongly agree: 27.3% Decrease by 8.4% Agree: 31.8% Increase by 10.4%. Despite the slight improvement, the continuous use of devices is still high, which shows the need to raise awareness of the impact on energy consumption, but perhaps this is due to the fact that female students need to use these devices especially when completing specialization work on specific interior design projects.

Concerning using conventional batteries instead of rechargeable Strongly agree: 35.7%, Agree: 28.6%. Yet after the batteries strategysStrongly agree was 18.2% (decrease by 17.5%), Agree: 36.4% Increase by 7.8% The results show that there is a growing awareness of the importance of switching to rechargeable batteries, but there is still use of conventional batteries, perhaps due to their easy availability. As for the question about electrical appliances being connected to electricity even when not in use, results showed: Strongly agree: 21.4% Agree: 28.6% But after the strategy it was clear that strongly agree: 4.5% (decrease by 16.9%) Agree: 31.8% (Increase by 3.2%). While neutral: 13.6% (decrease by 4.3%). The significant improvement reflects the students' awareness of the need to unplug electrical appliances to save energy and reduce waste. The last question in this axis was about not practicing recycling activities for products or leftover materials before the strategy. I strongly agree: 10.7% I agree: 21.4% While after the strategy I strongly agree: 4.5% (decrease by 6.2%) I agree: 27.3% (Increase by 5.9%) The results indicate a slight improvement in reuse behaviors, with challenges related to increasing neutrality and not fully adopting this behaviour.

Overall, it is noticeable in the **results of the questionnaire** that there is an evident increase in the percentage of strong agreement and agreement for most of the questions, indicating the success of the strategy in

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increasing environmental awareness and changing behaviors, while neutrality declined in general, meaning that the students became more decisive in their awareness of environmental behaviours and their importance.

3-3-1-2 Personal interviews were conducted with the students twice during the eight-week study period. The aim of these interviews was to ensure that the students adopted sustainable environmental behaviors, and to understand the extent to which the educational strategy affected their environmental awareness and behaviors towards the environment. The results show several observations. One of the students confirmed that she benefited from the information she took from the beginning of the first week She changed her perception first, then her behavior and practice, as after dialogue and discussion, she gradually got rid of the habit of throwing away food leftovers in an exaggerated way. (student H) studied the habit and learned about the stages of planting, harvesting, selling, buying, and types of crops according to the regions and climate, and that it is a long way for food to reach the end user. At that time, (student H) decided to calculate the amount of food that she and her family need and to organize more purchasing and storage methods. (student H) stated: "I did not know that solutions were so easy to achieve." She added, "All we have to do is take the necessary measures and the individual plays their role to spread goodness in the environment."

Most of the students' comments were positive comments that revealed a deep understanding of the impact of the studies and linked them to the films, which increased the students' sensitivity, and long-lasting solutions of the impact of the individual, and society habits on the environment. Through watching the visual storytelling, the students realized that change is possible and can be achieved in different ways, and the most important thing is for them to reach balanced environmental habits, behaviors, and practices that do not harm the environment and contribute to reducing the risk of harmful environmental practices in the long term. We found that the students were affected by the teaching strategy, which is consistent with the researcher (Jurado, 2019) results that environmental education is an important means of raising students' environmental awareness and the extent of students' influence on their families, thus increasing the number of those who are aware and conscious of the effects and risks that environmental ignorance places on the

environment. The results of the research questionnaires also confirm what was mentioned by (Bettaieb, 2019) about the existence of a gap between students' understanding of sustainable practices and their actual application in design projects. Yet the solution is consistent with the findings of the study (Cao and Jian, 2024) that the role of technological media is an effective role in education and that what bridges this gap is adopting an effective teaching strategy that stimulates the senses and emotions of the recipient to sympathize with the situation they are dealing with, which is the integration of digital technology (watching movies) to form a visual memory that motivates the adoption of the issue raised and its effect in achieving the desired goal, as shown in Figure 2 below



Figure 2: The figure shows the steps to achieve the implementation of positive environmental behaviors

4- Conclusion:

The use of environmental films as an interactive educational tool contribute significantly to enhancing environmental awareness and moving students from mere cognitive awareness to an awareness of the effects of harmful and environmentally unfriendly practices, thus becoming a desire for change and implementing the proposed strategy and encouraging students to adopt sustainable practices that reflect the values of sustainability. According to the results of the study, visual storytelling enabled the students to adopt a new approach and this then became part of their daily routine. It is also clear from the results that integrating digital media and using it as an educational tool is an effective way to raise awareness and motivate positive behavior, as shown in Figure 3.

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Figure 3: Emotional stimulation result

5- Recommendations:

The study recommends integrating digital media into environmental education, such as environmental films, more broadly into educational curricula, especially those related to interior design and sustainability. The key is to cooperate with local and international environmental bodies using digital media integration (watching films) as a teaching strategy. Design institutions can support curriculum with documentaries and new interactive experiences. In addition, future research could be conducted on larger samples of students and in other design fields, this will expand the scope of benefit of visual storytelling.

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المجلة العربية الدولية لتكنولوجيا المعلومات والبيانات المجلد الخامس – العدد الثاني/ الجزء الثاني (أبريل – يونيو 2025)

الاستفادة من التكنولوجيا الرقمية مثل الأفلام لتعزيز الوعي البيئى والممارسات المستدامة بين طلاب التصميم الداخلى

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المستخلص:

استجابة للقضايا البيئية المتصاعدة محليًّا وعالميًّا، أصبح من الضروري الاستفادة من التكنولوجيا الرقمية، مثل الأفلام والقصص المصورة البيئية، كأدوات تعليمية قوية لتعزيز الوعي البيئي وتعديل سلوكيات الطلاب وبناء ممارسات بيئية سليمة. يهدف هذا البحث إلى تقييم فعالية النهج التعليمي الذي يدمج الأفلام لتحسين الوعي والسلوك البيئي للطلاب. أجريت الدراسة ضمن مقرر "أنظمة التحكم البيئي"، بمشاركة مجموعة من 22 طالبة في برنامج التصميم الداخلي بجامعة الملك عبد العزيز لعام 2024، باستخدام نهج شبه تجريبي مع تقييمات قبلية وبعدية لقياس التحولات في الوعي البيئي بين المشاركين. بالإضافة إلى ذلك، أجريت مقابلات شخصية لجمع رؤى أعمق حول تأثيرات الاستراتيجية على سلوك الطلاب. أظهرت نتائج الدراسة أن النهج التعليمي عزز بشكل كبير إدراك الطلاب وسلوكهم تجاه أظهرت نتائج الدراسة أن النهج التعليمي عزز بشمكل كبير إدراك الطلاب وسلوكهم تجاه التضايا البيئية، مما يسمح لهم بالتخلي عن العادات البيئية الضارة وتبني ممارسات المهرت نتائج الدراسة أن النهج التعليمي عزز بشمكل كبير إدراك الطلاب وسلوكهم تجاه أظهرت نتائج الدراسة أن النهج التعليمي عزز بشمكل كبير إدراك الطلاب وعلي مارسات المهرت نتائج الدراسة أن النهج التعليمي عزز بشمي لين المستراتيجية على مارسات أظهرت نتائج الدراسة أن النهج التعليمي عزز بشمكل كبير إدراك الطلاب وسلوكهم تجاه أطهرت نتائج الدراسة أن النهج التعليمي عزز بشمي ليئية الضارة وتبني ممارسات المهرت نتائج الدراسة أن النهج التعليمي عزز بشمي لما تراتيجية المستواتيجية المالاب. مالستدامة، والتي يجب أن تنعكس في مساعهم التصميمية المستقبلية. وتكمن أهمية هذا المحث في تعزيز المعرفة وتوسيع آفاق دمج الاستراتيجيات التعليمية مع التكنولوجيا الرقمية لتمكين الطلبة من اتخاذ خيارات مستدامة تحافظ على البيئة.