



Article

Technology-Enhanced Learning and Its Relationship to Achieving More Sustainable Green Education

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Abstract: This research aims to identify technology-enhanced learning and its relationship to achieving more sustainable green education. Specifically, it explores technology-enhanced learning and sustainable green education among mathematics students, and investigates the relationship between technology-enhanced learning among these students and its contribution to achieving more sustainable green education. The study employed a descriptive-analytical approach and utilized a questionnaire as a data collection tool, which was administered to a sample of mathematics students at the College of Basic Education, University of Kufa. The researcher developed two questionnaires (Technology-Enhanced Learning and Green Education) and administered them to a sample of 200 male and female students in the Mathematics Department. The results showed a strong positive correlation between technology-enhanced learning and more sustainable green learning among mathematics students. This indicates that technology-enhanced learning plays an effective role in achieving more sustainable green education, as educational technology contributes to environmental conservation and pollution reduction. It reduces the depletion of natural resources by minimizing the need to transport students and instructors to lectures in classrooms and by relying on technology for electronic information delivery. Furthermore, educational technology enables the effective delivery of information to a large number of learners without negatively impacting the quality of the educational process. With increasing environmental awareness, education will transform into a sustainable system in the future, promoting the concepts of flexible learning and sustainability.

Keywords: Technology-Enhanced Learning, Sustainable Green Education, Mathematics Department Students.

1. Introduction

Chapter One : Research Methodology

First: Research Problem

Educational policies are often incompatible with the modern needs of education, as they may lack support for educational innovation or the resources necessary to implement modern methods. Therefore, educational policies must be developed to include modern technology and innovation as an essential part of the curriculum. Furthermore, cooperation between relevant ministries and educational institutions is crucial to provide the necessary infrastructure for implementing modern education. Traditional education often comes at a high cost, including tuition fees, textbooks, transportation, and accommodation [1]. On the other hand, technology-enhanced learning benefits educational institutions by providing more sustainable, green education, as e-learning can

significantly reduce expenses. Thanks to educational technology innovations, educational institutions can offer online courses at a fraction of the cost of traditional programs. Students can save money on transportation, accommodation, and other related expenses. Moreover, e-learning allows individuals to access educational resources for free or at a lower cost, promoting equal educational opportunities regardless of financial constraints [2].

Therefore, uncovering the nature of the relationship between technology-enhanced learning and more sustainable green education could open up broad horizons for researchers to conduct applied studies that contribute to stimulating educational innovations in educational institutions, enhancing their active participation in the educational process, and raising student learning levels. This, in turn, ultimately reflects on improving the quality of education and developing its outcomes.

The research problem was represented in answering the following questions:

Is there a correlation between technology-enhanced learning and more sustainable green education among male and female students in the mathematics department?

Secondly: The Importance of the Research

Green education is one of the most important modern educational concepts that focuses on preserving the environment and reducing reliance on products and practices that are financially and time-consuming for educational institutions. This new educational model aims to support sustainable development and utilize technological advancements efficiently to achieve outstanding educational outcomes according to environmentally responsible standards. This model covers two main aspects: the first relates to the educational environment, and the second relates to the tools of the educational processes themselves. One of the most prominent benefits of green education is reducing energy consumption and shifting towards electronic services instead of paper-based ones [2].

- **The theoretical importance of this research is highlighted by the following:**

- 1- The current research derives its importance from the significance of the topic it addresses: technology-enhanced learning and its relationship to achieving more sustainable green education.
- 2- To the best of the researcher's knowledge, no previous research has addressed the relationship between the two variables mentioned above.
- 3- Sustainability: Through e-learning tools and technologies, more sustainable and effective green education can be achieved, reflecting the trend towards modern technology and the preservation of environmental resources.
- 4- Adding a theoretical framework that will benefit future researchers.
- 5- The importance of university students.

- **Applied Importance:**

- 1- The results of this research may help in developing appropriate development programs for university students.
- 2- A scale was developed for the two variables that is suitable for the Iraqi community.
- 3- The results of this research may open new research horizons in these two topics.

Third: Research Objectives

The current research aims to:

- 1- Identify technology-enhanced learning among students in the Mathematics Department.
- 2- Identify green learning among students in the Mathematics Department.
- 3- Explore the relationship between technology-enhanced learning and green learning among students in the Mathematics Department.

Fourth: Research Limitations

- Scientific Limitations: Technology-enhanced learning and green learning.
- Personal Limitations: Students in the Mathematics Department at the University of Kufa / College of Basic Education
- Geographical Limitations: University of Kufa / College of Basic Education
- Time Limitations: Academic year 2025-2026

Fifth: Defining Terms

A. Technology-Enhanced Learning

Defined by:

- 1- Alshahry, Ali bin Saleh (2020) defines it as "an educational approach that encourages students to actively participate and learn through the use of modern digital tools and technologies to improve and enhance teaching and learning processes, both inside and outside the classroom. This is achieved by integrating technology into curricula, teaching methods, and assessment to increase the effectiveness of interaction and achieve specific educational goals, including improving the quality of learning, developing teaching methods, and creating immersive learning environments." [3]
- 2- Alshamry, Thuraya Ahmad (2019) defines it as "a form of learning using digital tools (software, applications, platforms) to enhance the learner's understanding and interaction." [4]

B. Operational Definition

This refers to the total score a student receives when answering questions Items of the Technology-Enhanced Learning Scale developed by the researcher in the current study.

C. Sustainable Green Education: Cognitive Apprenticeship Strategy. It has been defined by:

- 1- Brill (2018): A modern educational approach that integrates concepts of environmental sustainability, renewable energy, and waste reduction into school curricula, aiming to build an environmentally conscious generation capable of facing climate challenges, while transforming educational institutions into environmentally friendly environments that stimulate creativity and enhance practical life skills [5].
- 2- Al Mahmad et al. (2022): A modern concept that expresses a type of education serving the environmental field. It is also considered a new model for high-quality education, focusing on two main axes: the first pertains to environmental programs, and the second focuses on technologies, applications, and practices related to green education. Most countries have begun adopting it in their educational systems [6].

D. Definition Procedural

This refers to the total score students receive when answering the items on the Sustainable Green Education Scale developed by the researcher for this study.

E. Mathematics Department Students

The researcher did not find an officially recognized definition from educational institutions, but found a guide at Ibn Al-Haytham College of Education for the academic year (2012/2013).

These students are a group of male and female graduates of the preparatory stage (both scientific and literary branches) who were admitted to the Mathematics Department according to specific criteria (in the student guide) with the aim of preparing and qualifying them as specialized teachers of children aged (6-15) years, in accordance with educational, social, and psychological objectives (Ibn Al-Haytham College of Education Guide, 2012/2013).

Chapter Two :Theoretical Framework and Previous Studies

First: Technology-Enhanced Learning:

Educational Technology Trends, including the following [7] [8]:

1- Digital Textbooks

Digital textbooks are becoming more common. They are often cheaper than traditional textbooks and offer a number of advantages. For example, digital textbooks can be updated more easily and offer interactive features that can make learning more engaging.

2- The Growth of Online Learning

Online learning is another rising trend. More and more students are taking online courses. As the quality of online education improves, this trend is likely to continue. Online learning offers a number of advantages, such as flexibility and convenience.

With online learning, students can attend classes from anywhere in the world at any time that suits them. This flexibility is ideal for busy adults who want to continue their education but cannot commit to traditional classes. Online learning is becoming increasingly common as more schools and universities offer courses that can be accessed from any computer or device without needing to be physically present at an educational institution. It can also be completed according to your own schedule and at your convenience. This type of course provides students with a more connected learning experience than traditional classrooms.

3- Using Mobile Devices in the Classroom (Mobile Learning)

Mobile devices, such as tablets and smartphones, are increasingly being used in the classroom. And there's good reason for this. They can be used for a number of educational purposes, such as accessing digital textbooks, taking notes, and conducting research.

Mobile learning, also known as mobile-based learning, is another growing trend in education. With mobile learning, students can access and complete assignments using their smartphones or other mobile devices. This type of learning is ideal for those moments when you have a few free minutes but can't sit in front of a computer, such as waiting in line or on the bus. Mobile learning is also beneficial for students who want to learn at their own pace and in a time that suits them.

4- Artificial Intelligence in Education

Applications that students use can help them learn in new ways. For example, AI-enhanced learning can provide personalized feedback to students based on their individual needs. Technology-enhanced learning is one of the most frequently used technologies in recent years. It is already being used in various ways in education, such as grading essays and providing customized learning experiences. However, it is expected that technology-enhanced learning will become even more prevalent in education over the next decade. For example, technology can be used for teaching as virtual teachers who can provide individualized instruction to students.

5- Using Virtual Reality in Education

Virtual reality is another technology that is increasingly being used in education. It transports students to different places and times and allows them to experience different situations.

Virtual reality has already begun to make its way into the classroom. While it is mostly used for entertainment purposes at the moment, there are a number of educational applications for virtual reality as well. For example, students can use virtual reality to take virtual field trips to places they would not be able to visit in real life. They can also use it to simulate real-world situations, such as undergoing surgery or flying an airplane. As virtual reality technology becomes more advanced and affordable, we expect to see it used more and more in education.

Second: E-Learning Technologies

In the education sector, technology plays a vital role in enhancing the quality of learning. One of the most widely used and effective technologies is the Learning Management System (ELMS), a software application that allows teachers to create, manage, deliver, and assess online courses and programs. ELMS can offer various benefits to the education sector, such as [7] [8]:

- 1- Student Motivation: An ELMS can provide interactive and personalized learning experiences for students, such as games, adaptive learning, multimedia content, and feedback mechanisms. These features can motivate students to actively participate and complete their courses, as well as increase their satisfaction.
- 2- Teacher Support: An ELMS can assist teachers with administrative tasks, such as registration, grading, reporting, and communication. An ELMS can also reduce the need for physical infrastructure, such as classrooms, textbooks, and equipment, by enabling online and blended learning models.
- 3- Expanding Access: An ELMS can enable instructors to deliver their courses and programs to a more diverse audience, including students from different locations, backgrounds, and abilities. An ELMS can also facilitate collaboration and communication between learners and instructors, as well as integrate with other platforms and resources, such as e-books and Massive Open Online Courses (MOOCs).
- 4- Fostering Innovation and Quality: An ELMS can support instructors in delivering highly effective programs. It can also enable instructors to engage with learner feedback and use data to improve their teaching methods and strategies.

One example of an ELMS widely used in the education sector is Moodle, which has over 200 million registered users and is used by thousands of educational institutions worldwide, such as the Open University. Moodle, the University of California, and the United Nations offer numerous features and functions, such as [7] [8]:

- 1- Course Management: Moodle allows instructors to create and organize courses and activities, such as quizzes, assignments, forums, wikis, and workshops, and assign them to learners and groups.
- 2- Content Creation: Moodle enables instructors to create and upload various types of content, such as text, images, audio, video, and interactive media, and embed them in their courses and activities.
- 3- Communication and Collaboration: Moodle facilitates communication and collaboration between learners and instructors through tools such as messaging, chat, blogs, comments, and badges.
- 4- Assessment and Feedback: Moodle provides tools for assessment and feedback to learners, such as assessment forms, metrics, grades, reports, and analytics. Moodle ensures its platform and content are accessible and secure for all users by adhering to web standards, supporting multiple languages, and implementing encryption and authentication protocols.

Why Green Education Enhanced with Technology [9]

Technology and green education are closely linked and influence each other, even reinforcing one another. They intertwine to achieve the following:

- 1- Enhancing environmental awareness: Green education focuses on the importance of preserving the environment, while technology provides the tools.
- 2- Developing new skills: Environmentally friendly technologies such as renewable energy and sustainable innovations.
- 3- Learning through technology: Using technology in classrooms.

- 4- Encouraging innovation: In technology, through research and study, leading to the development of new and sustainable solutions.
 - 5- Moving towards sustainable societies: Thanks to green education, future generations can work towards developing a society that relies more heavily on technology.
 - 6- Both technology and green education work to build a more sustainable future.
 - 7- Promoting sustainable behaviors: Green education promotes the use and reliance on technology in daily life, which motivates individuals to make environmentally friendly choices.
- **The Importance of Green Education in Educational Stages**

In a reference study,

They pointed out the importance of green education at different educational levels, which are [10] [11]:

- i. **Primary Education:** Green education plays an important role in developing a strong foundation for environmental awareness. Young learners are introduced to basic concepts such as biodiversity, climate change, waste management, and renewable energy through the integration of practical activities, field trips, and field-based learning methods. Primary education can enhance lessons about nature and encourage children to become environmentally conscious.
- ii. **Secondary Education:** Green education builds upon the foundation of primary schools, delving deeper into environmental issues and exploring topics such as sustainable development, resource depletion, environmental justice, and ecosystems. Secondary education emphasizes critical thinking and problem-solving skills, enabling students to analyze complex environmental challenges and propose solutions. Through the integration of project-based learning and community engagement, secondary education can empower students to take action and positively impact their local environments.
- iii. **Higher Education:** Green education expands upon the knowledge and skills acquired in the early stages and offers specialized programs and courses focusing on environmental studies, sustainability science, and technology. Higher education equips students With the necessary expertise to address global environmental challenges through interdisciplinary research and policy development by fostering a culture of innovation and collaboration, higher education institutions can produce leaders capable of tackling complex environmental issues.

Third: Previous Studies

The purpose of presenting previous studies in any scientific research is not only to convince the reader of the researcher's extensive knowledge of the research variables, but also to enrich the research and benefit the researcher from the methodologies of those studies.

First Axis: Previous Studies Addressing Technology-Enhanced Learning

- **Arab Studies**

1- Al-Shahri Ali bin Saleh (2019)

(The Degree of Awareness of Intermediate Mathematics Teachers of the Concept of Green Education and its Uses in Teaching from their Perspective in Tabuk City)

This study aimed to identify the degree of awareness among intermediate mathematics teachers of the concept of more sustainable green education from the teachers' own perspective. The sample consisted of 41 male and female teachers. The descriptive-analytical method was used, and the study concluded that there is a statistically significant positive relationship between the teachers' degree of awareness in mathematics and their skill in using green education in teaching [12].

- **Foreign Studies**

2- Zhang, N. Wang's Study (2021)

(Computer-Assisted Learning Efficiency in Mathematics among Higher School Students in China)

This study aimed to investigate the efficiency of computer-assisted learning in mathematics. The sample consisted of 80 higher school students. The study found a statistically significant positive relationship between computer-assisted learning efficiency and academic achievement in mathematics. It also concluded that computer experience is the most important factor influencing mathematics learning efficiency [13].

Second Axis: Previous Studies Addressing Sustainable Green Education

- **Arab Studies**

1- Elisha George's Study (2024)

(Green Education and Its Role in Achieving Egypt's 2030 Vision for Sustainable Development)

This study aimed to identify the role of green education in achieving the Sustainable Development Goals. The descriptive-analytical method was used to study and analyze the role of green education in Egypt within the context of Vision 2030. The researcher concluded that green education significantly contributes to raising environmental awareness among individuals within schools and universities [14].

- **Studies a foreign language**

2- Studying Adna(Adnyana, 2025

The Role of Higher Education Institutions in Promoting the Green Economy within Their Institutions)

The study aimed to identify the role of higher education institutions in promoting the green economy within their institutions. The sample consisted of 200 students from Sargodha University, aged between 19 and 32 years, with an average age of 21.59. After applying the study tools, the results showed that these institutions play a significant role in promoting the green economy within their institutions [15], [16], [17].

2. Materials and Methods

Chapter Three: Practical Framework

First: Research Methodology

The research adopted a descriptive-analytical approach, deemed suitable for the nature of the study. It aims to analyze the role of modern technology and e-learning in promoting green education concepts and achieving environmental sustainability within educational institutions. This is accomplished through a study of the current situation and an examination of the available challenges and opportunities.

Second: Research Population and Sample

1- Research Population

The research population consists of:

Students at the University of Kufa, College of Basic Education – Department of Mathematics, who utilize e-learning technologies.

2- Research Sample

A stratified random sample was selected, consisting of:

(200) male and female students.

Third: Data Collection Tools

The researcher relied on:

1- A questionnaire (Technology-Enhanced Learning)

- This section included several sections, among them:
- The level of use of technology-enhanced learning in university education;
- The impact of digital learning on reducing paper and energy consumption;
- The role of electronic platforms in disseminating educational technology.
- Obstacles to Implementing Educational Technology

2- Questionnaire (Sustainable Green Education)

- This section was designed to include several axes, including:
- The level of use of green education in education.
- The impact of green education on reducing paper and energy consumption.
- The role of electronic platforms in spreading environmental awareness.
- Obstacles to implementing green education

Fourth: Research Scope

• Spatial Scope

University of Kufa – College of Education – Department of Mathematics.

• Temporal Scope

The period extending from (2025–2026) due to its connection with the significant expansion in digital education.

• Thematic Scope

The research focuses on:

Technology-enhanced learning and green education in educational institutions.

Fifth: Research Variables

- Independent Variable
- Technology-enhanced learning.
- Dependent Variable
- Achieving green education and environmental sustainability.

Sixth: Statistical Analysis Methods

The following were used:

- Percentages.
- Arithmetic mean.
- Standard deviation.
- Analyzing responses using SPSS or Excel.

Seventh: Research Implementation Steps

- Defining the research problem and formulating hypotheses.
- Collecting previous studies related to green education and technology.
- Preparing and scientifically validating the questionnaire.
- Distributing the questionnaire to the sample.
- Collecting and statistically analyzing the data.
- Interpreting the results and relating them to the research objectives.
- Forming the final conclusions and recommendations.

Eight : Validity and Reliability

- The questionnaire was presented to a group of experts and specialists to verify its scientific validity.

- The reliability coefficient was calculated using Cronbach's alpha to ensure the reliability of the results.

Ninth: Expected Challenges

- Weak technological infrastructure in some cases.
- Lack of awareness of the concept of green education.
- Limited availability of up-to-date data in some educational settings.

Sample Details, Statistics, and Statistical Analysis

First: The Research Sample

1- Sample Type

The research employed stratified random sampling to ensure balanced representation of all segments of the study population. The population was stratified according to the following variables:

- Gender.
- Technical Experience.

Then, members of the sample were randomly selected from each stratum.

2- Sample Size

The research sample consisted of 200 male and female students from the Mathematics Department.

3- Sample Characteristics

a- Distribution by Gender

Gender Number Percentage

Males 100 50%

Females 100 50%

Total 200 100%

B- Distribution by Technical Experience

Level of Experience , Number , Percentage

Low (21) (14%)

Moderate (79) (52.7%)

High (100) (66.6%)

Second: Research Tool (Questionnaire)

1- Constructing a Questionnaire (Technology-Enhanced Learning)

A questionnaire was designed consisting of two sections:

Section One: General Data, including:

Gender

Technical Experience

Section Two: Consists of the Study Themes

It includes (20) items distributed across four themes:

Axis Number of Items

- Level of Use of Technology-Enhanced Learning in University Education (5)
- Impact of Digital Learning on Reducing Paper and Energy Consumption (5)
- Role of Electronic Platforms in Disseminating Educational Technology (5)
- Obstacles to Implementing Educational Technology (5)

2- Constructing a Questionnaire (Sustainable Green Education)

This section also includes 20 items.

This section, which includes several themes, was designed with the following themes:

Axis Number of Items

- Level of Use of Green Education in Education (5)
- Impact of Green Education on Reducing Paper and Energy Consumption (5)
- Role of Electronic Platforms in Spreading Environmental Awareness (5)
- Obstacles to Implementing Green Education (5)

3- Scale Response

A five-point Likert scale was adopted:

Agreement (Weight)

- Strongly Agree (5)
- Agree (4)
- Neutral (3)
- Disagree (2)
- Strongly Disagree (1)

Third: Validity and Reliability

1- Face Validity

The questionnaire was reviewed by a panel of experts in:
Education, Computer Science, and Statistics
to ensure:

- Clarity of items.
- Suitability to the research objectives.
- Soundness of scientific formulation.

2- Questionnaire Reliability

The reliability coefficient was calculated using Cronbach's alpha, and the results were as follows:

- Axis Reliability Coefficient
- Use of Technology 0.84
- Green Education 0.81
- Reducing Environmental Waste 0.87
- Obstacles 0.79
- Overall Reliability 0.85

These values indicate that the questionnaire possesses a good and scientifically acceptable degree of reliability.

Fourth: Statistical Methods Used

The data was analyzed using:

SPSS Microsoft Excel

The following statistical methods were used:

Frequencies and percentages to extract:

1. Sample characteristics.
2. Distribution of responses.
3. Arithmetic mean to measure the level of response of the sample members to each item and axis.
4. Standard deviation to measure the degree of dispersion of responses around the arithmetic mean.

Its formula:

$$S = \frac{\sqrt{\sum (x - \bar{x})^2}}{N}$$

5. T-Test: Used to determine the differences between the mean responses of males and females regarding the impact of technology on green education.
6. One-Way Analysis of Variance (ANOVA): Used to determine the differences between age groups or levels of technical expertise.
7. Pearson Correlation Coefficient: Used to measure the relationship between:
 - Level of technology use.
 - Level of achievement of green education.

Fifth: Data Analysis Methodology:

The data was analyzed according to the following steps:

1. Collecting and sorting questionnaires.
2. Ensuring the validity of the data for analysis.
3. Entering the data into SPSS software.
4. Generating statistical tables.
5. Interpreting the results using arithmetic means.
6. Comparing the results with previous studies.
7. Testing the research hypotheses.

Sixth: Criteria for Interpreting Arithmetic Means

1. Arithmetic Mean Rating Level

- 1.80 Very Low
- 1.81 – 2.60 Low
- 2.61 – 3.40 Average
- 3.41 – 4.20 High
- 4.21 – 5.00 Very High

Statistical Analysis of Scale Items

o Item Discrimination Index:

This is used to measure the extent to which an item can measure individual differences, or it means the item's ability to distinguish between different levels of individuals (higher, lower) in understanding what the item aims to measure (Ghoneim, 2004: 182). To calculate the item discrimination index, the scale was administered to a research sample of (200) female students. The total score for each item was calculated and ranked from highest to lowest. Then, (27%) (54) students from the high group and (27%) (54) students from the low group were selected, and the t-test for two independent samples was used as a means of analysis. Statistics on the discriminatory power of the item, as shown in Table (1):

Table 1. Discriminatory Power of Scale Items Using the Two-Tier Groups Method.

	Upper Group		Lower group		Calculated T-value	Significance level 0.05 1.960
	arithmetic mean	standard deviation	arithmetic mean	standard deviation		
1-	4.777	0.462	3.759	0.822	7,931	Significance
2-	4.648	0.519	3.666	0.672	8,483	Significance
3-	4.640	0.442	3.796	0.786	7,693	Significance
4-	4.814	0,478	3,981	0,879	6,116	Significance
5-	4,759	0,473	4,037	0,776	5,838	Significance

6-	4,666	0,513	3,870	0,728	6,566	Significance
7-	4,574	0,569	3,648	0,850	6,648	Significance
8-	4,759	0,547	3,740	0,705	8,384	Significance
9-	4,407	0,659	3,574	0,815	5,842	Significance
10-	4,611	0,596	3,463	0,840	8,189	Significance
11-	4,814	0,437	3,537	0,817	10,126	Significance
12-	4,814	0,437	3,574	0,767	10,322	Significance
13-	4,814	0,392	3,944	0,656	8,365	Significance
14-	4,648	0,648	3,425	0,881	8,204	Significance
15-	4,851	0,358	4,129	0,778	6,194	Significance
16-	4,796	0,406	3,796	0,594	10,198	Significance
17-	4,703	0,500	3,611	0,940	7,540	Significance
18-	4,481	0,720	3,425	0,902	6,717	Significance
19-	4,574	0,689	3,555	0,768	7,247	Significance
20-	4,500	0,574	3,648	0,677	7,047	Significance

The relationship between the item score and the total scale score:

Table 2. Values of correlation coefficients between item score and total scale score.

Item correlation coefficient with total score			Item correlation coefficient with total score	
1.	0,462	.11	0,624	
2.	0,489	.12	0,616	
3.	0,501	.13	0,515	
4.	0,452	.14	0,454	
5.	0,390	.15	0,396	
6.	0,472	.16	0,602	
7.	0,417	.17	0,498	
8.	0,494	.18	0,370	
9.	0,401	.19	0,536	
10.	0,551	.20	0,516	

Seventh: Analytical Example of Results for One of the Items

1. Item:

“E-learning contributes to reducing paper use within educational institutions.”

Mean	Standard Deviation	Rating Level
(4.36)	(0.71)	(Very High)

2. Interpretation:

The result indicates a high degree of agreement among the sample that the use of e-learning effectively contributes to reducing paper consumption, thus supporting the concept of green education and environmental sustainability.

Eighth: Hypothesis Testing

1. Hypothesis 1:

“There is a statistically significant relationship between the use of technology and achieving green education.”

2. Result:

Correlation Coefficient = 0.73

Significance Level = 0.05

3. Interpretation:

There is a strong and statistically significant positive correlation between technology and green education.

Ninth: Model for Formulating the Final Analysis

"The results of the statistical analysis showed a clear positive impact of technology-enhanced learning in supporting green education by reducing the consumption of paper and energy resources and enhancing environmental awareness among students, thus confirming the importance of employing modern technologies to achieve sustainability in educational institutions." Description of the scales in their final form

The two scales (technology-enhanced learning, sustainable green education) were applied to the research sample consisting of (200) male and female students from the mathematics department at the College of Basic Education for all stages (first, second, third, fourth), by publishing an electronic link to the members of the research sample, and the results will be presented and interpreted in the fourth chapter.

3. Results and Discussion

Chapter Four: Results

First Objective: To identify technology-enhanced learning among students in the Mathematics Department:

The researcher calculated the arithmetic mean and standard deviation of the responses of the research sample to the scale items. The arithmetic mean was (82.610) and the standard deviation was (8.165), which is higher than the hypothetical mean of (60). To determine the significance of the difference, the researcher used a t-test for an independent sample. The calculated t-value was (143.08), and when compared to the critical value (1.97) at a significance level of (0.05) and with (199) degrees of freedom, it was found to be statistically significant because the calculated value is greater than the critical value, as shown in Table (3):

Table 3. Results of the t-test for the difference between the arithmetic mean of the sample and the hypothetical mean for technology-enhanced learning among students in the Mathematics Department.

The variable	Sample	arithmetic mean	standard deviation	hypothetical mean	Degree of freedom	T-value Calculated	The scheduled	Significance level
Technology-enhanced learning	200	82.610	8.165	60	111	143.08	1.97	0.05 Significance

It is noted from Table (6) that the arithmetic mean is greater than the hypothetical mean, which means that the students of the Mathematics Department enjoy technology-enhanced learning. This is due to the students' ability to learn through the Moodle program and learning through tablets, meaning that they learn not only through memorization and rote learning or theoretical study. It also indicates that technology-enhanced learning is effective in promoting self-reliance and problem-solving skills.

Second Objective: To identify sustainable green education among students in the Mathematics Department:

The researcher calculated the arithmetic mean and standard deviation of the research sample's responses to the scale items. The arithmetic mean was (83.765) and the standard

deviation was (8.006), which is higher than the hypothetical mean of (60). To demonstrate the significance of the difference, the researcher used a t-test for a single independent sample. The calculated t-value was (147.961), and when compared to the critical value (1.97) at a significance level of (0.05) and with (199) degrees of freedom, it was found to be statistically significant because the calculated value is greater than the critical value, as shown in Table (4):

Table 4. Results of the t-test for the difference between the sample arithmetic mean and the hypothetical mean for sustainable green education among students in the Mathematics Department.

The variable	Sample	arithmetic mean	standard deviation	hypothetical mean	Degree of freedom	T-value Calculated	The schedule	Significance level
<i>Sustainable green education</i>	200	83.765	8.006	60	119	147.961	1.97	0.05 Significance

Table (4) shows that the arithmetic mean is greater than the hypothetical mean, indicating that students in the Mathematics Department possess sustainable green learning within the department. This is attributed to the quality of learning and the effectiveness of the university's educational environment. This reflects the students' ability to fully utilize their intellectual capacity during learning, including focus, deep thinking, and linking technology to environmental sustainability.

In other words, these results demonstrate that students in the department do not merely receive information from tablets and other devices, but rather utilize green learning to preserve and develop the environment.

Third Objective: To identify the relationship between technology-enhanced learning and sustainable green learning among students in the Mathematics Department.

Table 5. Shows the correlation coefficient for the relationship between technology-enhanced learning and more sustainable green learning.

The variable	Sample	The value of the correlation coefficient between the two variables	T-value Calculated	The schedule	Significance level
<i>Technology-enhanced learning and green education</i>	200	0.781	24.589	1.97	Significance

Table (5) shows that the correlation coefficient between experiential learning and cognitive integration was (0.781). To test the significance of the correlation coefficient, the researcher used a t-test. The results of the t-test showed that the calculated t-value for the correlation coefficient was greater than the critical t-value of (1.97), and that the correlation coefficient for the two variables was 0.781. This indicates a strong, positive, and direct relationship between technology-enhanced learning and more sustainable green education among students in the mathematics department.

The researcher explains this strong relationship between technology-enhanced learning and more sustainable green education in light of the nature of the technology used. This learning style is based on actively engaging students in educational situations through self-training in problem-solving skills and environmental conservation, which contributes to activating both technology-enhanced learning and green education.

Furthermore, technology-enhanced learning fosters an interactive and actively engaged learning environment, rather than passive information reception.

This relationship can also be explained by the fact that technology-enhanced learning helps students understand the meaning and importance of learning in their real lives. It connects knowledge with the environment, increasing their interest in educational content and encouraging them to pursue more sustainable, green education.

4. Conclusion, Recommendations, and Suggestions

Conclusions:

- 1- The research results showed that mathematics students benefit from green education, which is attributed to their ability to learn through technology.
- 2- The results also revealed that mathematics students benefit from technology-enhanced learning due to the quality and variety of learning methods, including blended and self-directed learning, and the effectiveness of the university's educational environment.
- 3- The research results also demonstrated a strong positive correlation between technology-enhanced learning and more sustainable, green education.

Recommendations:

In light of the research findings, the researcher recommends the following:

- 1- Conducting seminars and training workshops for faculty members on the use of modern technology in education to achieve environmental sustainability.
- 2- Activating early and continuous technological training as an effective learning environment that contributes to deepening educational understanding and promoting sustainable green education.
- 3- Incorporating practical activities related to educational technology and environmental sustainability experiences into the curriculum to bridge the gap between theory and practice.

Suggestions:

Based on the research findings, the researcher suggests the following:

- 1- Conducting a similar study with the variables of the current research on different age groups, such as middle and preparatory school students.
- 2- Conducting a comparative study between technology-enhanced learning and traditional learning and their impact on achieving green education.

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