Exploring the Relationship between Green IT Awareness and Adoption: A Case Study of IT Students in the Gaza Strip

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Abstract

Green IT, also known as GIT, has emerged as a crucial field in response to environmental concerns. This study focuses on assessing the level of GIT awareness and adoption among IT students at Al-Aqsa University in Gaza, as well as examining the relationship between GIT awareness and adoption. This assessment is crucial for fostering environmentally responsible technology practices and preparing future IT professionals to contribute to sustainable technological advancements. Data was collected through an online questionnaire completed by 273 participants. The questionnaire covered various aspects of GIT awareness, including understanding, environmental awareness, and e-waste awareness. The collected data was analyzed using statistical techniques such as principal component analysis, mean, and standard deviation. The results indicated that students possessed a satisfactory level of understanding of GIT concepts and the reasons for its adoption. Furthermore, the findings highlighted the significant impact of GIT awareness factors, including GIT understanding, environmental awareness, and e-waste awareness, on GIT adoption. However, it was observed that students did not consistently adhere to GIT guidelines, particularly in terms of frequent internet access and extended computer usage. Interestingly, no significant relationship was found between GIT adoption and students' academic standing. These findings provide valuable insights into the current state of GIT awareness and adoption among IT students and underscore the need for further efforts to promote sustainable computing practices.

Keywords: green computing awareness, green computing adoption, e-waste, e-waste management.

Introduction

The demand for electrical and electronic equipment (EEE) is experiencing rapid growth globally, driven by changes in modern lifestyles. This trend leads to an annual increase in global EEE consumption, resulting in a significant amount of electronic waste (e-waste) (Forti et al. 2020). In line with this, the global generation of e-waste exceeds 50 million metric tons each year, equating to an average of approximately seven kilograms of e-waste per person (Statista 2023). Moreover, the growing utilization of the Internet and social media is leading to a rise in energy consumption and electronic waste, thereby directly impacting the environment (Sriram 2022). According to Enerdata (2018), information and communication technologies (ICTs) presently contribute to approximately 5% to 9% of the overall electricity consumption. Examples of e-waste include personal computers, laptops, DVD players,

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cooling and freezing equipment, small and large electrical equipment, display screens, printers, GPS devices, IoT devices, and mobile phones. In 2019, the global production of e-waste reached approximately 53.6 million tons, and this number is projected to increase by nearly 30% by 2030 (Andeobu et al. 2021). According to the research conducted by Forti et al. (2020), out of the 53.6 million metric tons (Mt) of e-waste generated worldwide, only 17.4% was officially reported as being collected and recycled in a proper manner. Since 2014, there has been an increase of 1.8 Mt in the documented amount of e-waste, but the overall generation of e-waste has increased by 9.2 Mt. If no action is taken, it is projected that e-waste production will more than double to 120 million tons per year by 2050 (World Economic Forum 2019). These statistics emphasize the urgent need for enhanced e-waste management practices on a global scale. Implementing effective methods for collection, recycling, and disposal is crucial in order to minimize the environmental and health risks associated with e-waste, while also maximizing resource recovery and promoting a circular economy approach.

E-waste contains many dangerous chemicals, including lead, cadmium, mercury, arsenic, and cobalt (Lama et al. 2022). Additionally, reports have shown that the cost of operating computers worldwide totals $250 billion per year, with more than 85% of energy lost (Abugabah and Abubaker 2018). Green computing (GIT) aims to improve the way computer equipment is used and reduce the use of harmful materials. It includes energy-efficient computers and optimizes disposal and recycling methods. As a result, there is increasing demand for energy-saving technology that is also easy to recycle or dispose of without harming the environment. Therefore, it is the shared responsibility of all users, governments, and industrial and commercial companies to address this issue. The US government launched the first initiative, the Energy Star program, in 1992, which aimed to achieve maximum efficiency while using the least amount of energy for computer peripherals such as USBs, printers, displays, communication systems, servers, and network systems (Mohammed et al. 2015). Recognizing the awareness and adoption of GIT practices among IT students becomes crucial for nurturing a sustainable IT ecosystem. This significance arises from the substantial presence of students as users of computers and associated peripherals. In order to enhance the understanding of GIT in the Gaza Strip, this research has set forth several primary objectives. Firstly, it seeks to assess and analyze the level of student awareness regarding GIT. Secondly, the study aims to investigate the potential correlation between GIT awareness and its adoption among students. Thirdly, it intends to explore how GIT awareness influences the adoption of this technology among students. Additionally, the research will examine the role of gender in influencing students' GIT awareness and its potential impact on their adoption of GIT. Lastly, the study will assess whether the academic level of students has any significant influence on their awareness of GIT.

Research Questions

In order to achieve the research objectives, the following questions will be addressed:

RQ1: What is the extent of students' awareness of GIT?

RQ2: How is GIT awareness related to its adoption?

RQ3: What impact does GIT awareness have on GIT adoption?

RQ4: Are there any gender-based differences in GIT awareness?

RQ5: Are there any differences in GIT awareness based on academic level?

Literature Review

Green Computing

Every day, the world consumes a significant amount of energy to power electronic and electrical devices, particularly in the realm of information technology (IT). However, this consumption also leads to the generation of unwanted and non-functioning devices, which emit dangerous gases like CO2 and contribute to the accumulation of e-waste.

Sustainable Computing, also known as Green IT or Green Computing (GIT), encompasses the thoughtful design, utilization, disposal, and recycling of computing resources with a strong emphasis

on environmental responsibility. It involves the sustainable management of resources while recognizing the positive impacts on both the economy and the environment (Hernandez 2018). The objectives of Sustainable Computing include reducing energy consumption, minimizing the generation of electronic waste, advocating for recycling and responsible disposal of IT equipment, embracing energy-efficient technologies, optimizing operations within data centers, and promoting sustainable practices throughout the entire lifecycle of IT resources.

GIT practices encompass a wide range of strategies, such as utilizing energy-efficient devices, incorporating designs that facilitate recycling, and promoting the use of renewable energy sources. The ultimate aim of GIT is to minimize the carbon footprint and resource consumption of information and communication technology (ICT) while maximizing their societal and economic benefits. By adopting sustainable computing practices, organizations can contribute to a greener future by reducing environmental impacts and fostering more efficient and responsible use of IT resources.

The concept of GIT was developed with the aim of promoting environmental preservation. According to Ahmad (2021), GIT was established to support the implementation of a sustainable environment. Since the introduction of the Energy Star program in 1992, this concept has been utilized to provide a voluntary label for computer devices that exhibit optimal efficiency while consuming minimal energy (Mohammed et al. 2015). GIT encompasses the practices and strategies related to the use and disposal of information and communication technologies, which aim to reduce the emission of carbon and other harmful gases that negatively impact the environment (Ahmed 2018). As noted by Madkhali et al. (2023), GIT represents an eco-friendly computing approach that enables meeting the increasing demand for network computing without posing a threat to the environment. It involves policies and procedures that promote efficient utilization of computing resources, minimize energy consumption, and reduce greenhouse gas emissions (Ahmad et al. 2013). The concept of GIT has been explored by several researchers. For example, Hernandez (2020) conducted a study on GIT practices in Philippine higher education institutions. The findings revealed that various practices, including paperless and digital archiving systems, resource-efficient IT equipment, and responsible e-waste disposal, were being implemented. However, these practices were still in the early stages of adoption. Another study conducted by Mbewe (2019) examined the extent of ICT use in Higher Educational Institutions (HEIs) concerning GIT awareness and adoption. The results indicated that HEIs had a high level of ICT use, but their awareness of GIT was only moderate, and their adoption of GIT practices was low.

Awareness of GIT

GIT awareness is an important factor in promoting the adoption of sustainable computing practices. It refers to an individual's understanding of the environmental impacts of information and communication technologies (ICT) and the ways in which these technologies can be used in a more environmentally responsible manner. This includes knowledge of the materials and processes used in the production and disposal of ICT products, as well as the energy consumption of different devices and the potential for energy-saving measures.

Awareness of GIT can be influenced by various factors, such as education and information campaigns, personal values and beliefs, and the availability of sustainable products and services (Ha et al. 2023). Therefore, measuring and increasing awareness of GIT is crucial for reducing the environmental impact of ICT and promoting the adoption of sustainable computing practices. This can be accomplished through efforts such as social awareness, economic sustainability, education, and outreach, as well as the development of policies and incentives to encourage the use of sustainable technologies (Adubor et al. 2022).

GIT initiatives often begin by assessing the level of awareness and adoption of GIT among students, who are the most frequent users of ICT. A study conducted by Ahmad et al. (2013) examined the knowledge of Malaysian university students regarding GIT. The results indicated that a majority of students were unfamiliar with key concepts, ideas, and issues related to GIT. Similarly, Ahmad (2021) conducted a survey on the level of awareness, acceptance, and adoption of GIT among staff and students at universities in Nigeria, which revealed a moderate level of awareness. In another research by Alamsyah et al. (2021), the role of information in customer green awareness-marketing decisions was investigated. The study found that environmental awareness is influenced by environmental knowledge

and perceived quality. Adubor et al. (2022) conducted a study exploring the relationship between green human resource management (GHRM) and corporate sustainability in manufacturing companies in Nigeria. The research findings highlighted a significant impact of GHRM factors on corporate sustainability within the manufacturing industry. Ha et al. (2023) conducted research on strategies to promote participation in a green lifestyle, starting with a survey of Korean residents. The findings revealed that while a majority of respondents acknowledged the importance of a green lifestyle, only a small portion expressed a willingness to adopt it voluntarily. Table 1 provides an overview of studies focused on GIT awareness.

Table 1. GIT Awareness in literature

No	Type of Respondents	Country	Finding	References
1.	students	NIGERIA	level of awareness, acceptance and practices of GIT is significantly low	(Ahmad 2021)
2.	students	Malaysia	Majority of students lacked awareness of terms ideas and issues central to GIT.	(Ahmad et al. 2013)
3.	faculty members, staff, and students	Ghana	Most institutions and individuals are not aware of GIT, and there are no GIT procedures in place.	(Freeman 2016)
4.	students	Thailand	Green ICT products and services are still not widely used, particularly in developing countries.	(Thongmak 2016)
5.	IT professionals	Malaysia	The GIT attitudes and beliefs of IT professionals are significantly influenced by leadership commitment and environmental awareness.	(Ojo and Fauzi 2020)
6.	students	KSA	The awareness GIT is the most important success factor affecting the adoption of GIT	(Ahmed 2018)
7.	students	United Arab Emirates	Students have a high level of awareness about GIT. Even with that level of awareness, their GIT practices are insufficient daily.	(Abugabah and Abubaker 2018)
8.	supermarket customers	Indonesia	The beneficial aspects of being environmentally conscious can be changed by eco-labeling in product qualities.	(Alamsyah et al. 2021)
9.	ICT centers	Nigeria	The majority of computer users are unaware of how to operate the computer system. The survey also found no statistically significant variations in GIT awareness among computer users.	(Mubarak and Augie 2020)
10.	Higher Education Institutions	Zambia	GIT awareness was simply moderate, and GIT adoption was low.	(Mbewe 2019)

No	Type of Respondents	Country	Finding	References
11.	undergraduate computing and business students	(UK)	Students are unconcerned about the sustainability of their computer practices and hardware choices, but they want policymakers to enact GIT legislation.	(Boloz 2015)
12.	university librarians	Pakistan	Attitude and perceived behavioral control have a significant positive impact on the intention to adopt GIT practices.	(Soroya et al. 2022)
13.	Students	Abu Dhabi, United Arab Emirates	Students have a good level of understanding of GIT, but their daily activities are insufficient.	(Abugabah and Abubaker 2018)
14.	All community's	Indian	The respondents had a low level of awareness of GIT and demonstrated moderate efforts in the proper usage, disposal, and recycling of electronic gadgets.	(Bagla et al. 2022)
15.	Education Sector	Philippine	In higher education institutions, the adoption of GIT practices is still in its infancy.	(Hernandez 2020)
16.	Green Cloud Computing	USA	The potential of green cloud computing lies in its ability to enhance the advantages of cloud computing while simultaneously mitigating its environmental footprint.	(Sriram 2022)
17.	senior managers	Philippine	Achieving sustainability requires considering significant factors such as customer satisfaction, environmental impact, and economic performance.	(Hernandez 2020)
18.	employees	Nigeria	Providing employees with greening abilities and training yields numerous benefits for a company's financial performance.	(Adubor et al. 2022)
19.	Inhabitants	Korea	The majority of respondents demonstrate awareness regarding the importance of embracing a green lifestyle.	(Ha et al. 2023)
20.	academics and students	South Africa	GIT awareness and practices have no effect on GIT adoption.	(Obafemi et al. 2023)

Table 1 presents a summary of various studies examining the level of GIT awareness among different groups of respondents across different countries. The studies indicate that the overall level of GIT awareness among students, faculty members, staff, and computer users is generally low to moderate, with a few exceptions (Ahmad 2021; Ahmad et al. 2013). Additionally, some studies reveal that individuals may possess a good understanding of GIT, but their daily practices related to GIT are inadequate (Freeman 2016). Furthermore, in certain institutions, the implementation of GIT procedures is lacking, and the utilization of green ICT products and services is not widespread, particularly in

developing countries (Thongmak 2016). Although awareness of GIT may be relatively high in some countries, its practical implementation remains limited (Abugabah and Abubaker 2018; Thongmak 2016). Overall, these findings underscore the importance of raising awareness and promoting the adoption of GIT practices to mitigate the environmental impact of ICT.

E-Waste Management

E-waste refers to electronic products that are discarded or reach the end of their useful life, such as computers, mobile phones, televisions, and household appliances. These products often contain harmful materials, including lead, mercury, and cadmium, which can have a negative impact on the environment and human health if they are not managed properly (Awasthi et al. 2023; Madkhali et al. 2023). The amount of e-waste generated globally is increasing, with estimates indicating that over 50 million metric tons are produced each year (Statista 2023).

E-Waste Management involves the responsible handling, disposal, and recycling of electronic waste to minimize its negative environmental impact. The primary objectives of e-waste management are to promote responsible disposal practices, reduce environmental harm, and maximize resource recovery through recycling. Managing e-waste is a significant concern in the realm of GIT due to the environmental repercussions associated with the production and disposal of electronic devices. Proper e-waste management, which includes collection, recycling, and disposal, is a crucial component of GIT practices aimed at minimizing the environmental footprint of information and communication technologies (Ahmad 2021; Madkhali et al. 2023).

The study conducted by Adubor et al. (2022) highlights that offering employees training in environmentally friendly practices has a positive impact on multiple facets of a company's financial performance. These include waste reduction, material reuse, improvement of brand image, attraction and retention of environmentally conscious customers, and mitigation of adverse environmental effects. In addition to mitigating potential negative impacts of e-waste, effective e-waste management also enables the recovery of valuable materials and resources that can be utilized in the production of new products. By prioritizing proper e-waste management, organizations can contribute to a circular economy and foster sustainable practices in the IT industry.

The production of e-waste is generally higher in developed countries compared to developing nations. However, there has been a substantial surge in e-waste within developing countries, primarily driven by illegal exports and inappropriate donations of electronic equipment from developed nations (Perkins et al. 2014). This rise in e-waste poses significant challenges for developing countries, which face the dual issues of increasing e-waste generation and inadequate infrastructure for its proper collection and processing (Awasthi et al. 2023; Singh et al. 2022).

The use of sustainable materials and resource-efficient manufacturing can help to reduce the environmental impacts of e-waste (Frazzoli et al. 2022). Effective e-waste management can also minimize the risks of criminal and civil liability, operating expenses, and transportation and disposal requirements (Esikuri et al. 2019). In Nairobi County, strategic factors such as managerial capacity, institutional capacity, and resource capacity have been found to impact the successful management of e-waste (Kamau 2020). In Palestine, e-waste has become a growing issue, with 70-80% of e-waste in the country coming from illegal exports by the Israeli occupation (Esikuri et al. 2019). However, there are currently no approved methods for dealing with e-waste in Palestine and the legal framework is insufficient to address the associated risks (Al-Jabari 2014). There is also a lack of national e-waste strategies or goals and a lack of research on e-waste and GIT in Palestine. Increasing awareness of the need for GIT and the risks of e-waste is important for addressing these issues in Palestinian society. Madkhali et al. (2023) emphasize the necessity of implementing a comprehensive approach that integrates diverse management strategies to effectively address e-waste management. The study underscores the importance of enhancing public awareness concerning the appropriate handling and recycling of e-waste to achieve meaningful outcomes. According to data from the Palestinian Central Bureau of Statistics (2016), the energy, agricultural, and solid waste sectors in Palestine collectively emitted 4,645.5 million metric tons of CO2 equivalent in 2016. This constituted approximately 0.61% of the global emissions share. The energy sector accounted for 72.8% of these emissions, followed by the solid waste industry (19.2%) and agriculture (8.0%). However, Palestine lacks approved methods

for managing electronic waste, which is a growing problem. Moreover, the country's legal framework is insufficient to manage the risks associated with e-waste, as highlighted by (Al-Jabari 2014). In addition, Palestine does not have a national e-waste strategy or goals, due to factors such as inadequate funding and the illegal transfer of e-waste. Furthermore, there is a dearth of research on electronic waste and GIT in Palestine. Therefore, this study's significance lies in increasing Palestinian society's awareness of the importance of GIT and the risks of e-waste.

Within the context of these research findings, our study posits the following hypotheses.

H1: There is a significant relationship between GIT awareness and GIT adoption.

This study hypothesizes there is a significant correlation that exists between awareness of GIT (Green Information Technology) and the adoption of GIT practices. This hypothesis is consistent with insights from the literature, as demonstrated by Ahmed (2018) and Alamsyah et al. (2021), who emphasize that GIT practices are designed to promote sustainable computing. The effectiveness of these practices is influenced by the level of awareness individuals and organizations possess about them.

H2: There is a significant impact of GIT awareness on GIT adoption.

This hypothesis is grounded in established theoretical principles that highlight the crucial role of awareness as a precursor to adopting new practices. Existing literature underscores that enhancing awareness of GIT principles is a foundational step in fostering the adoption of sustainable computing practices, as indicated by Obafemi et al. (2023).

H3: There is a statistically significant difference between gender variables on GIT awareness.

Recognizing the importance of equitable access to GIT practices, this hypothesis aims to investigate whether gender-based disparities in GIT awareness exist. Drawing on prior research in this field, such as the work of Adubor et al. (2022).

H4: There is a statistically significant difference between gender variables on GIT adoption.

Gender-related differences in GIT adoption are statistically significant. Building upon insights from the literature review, which highlights the significance of inclusivity in GIT practices, this hypothesis seeks to explore whether gender plays a role in influencing the adoption of sustainable computing behaviors, this hypothesis will address research question (RQ4).

H5: There is a statistically significant difference between students' academic levels on GIT adoption.

this hypothesis will address research question (RQ5).

Research Methodology

In this study, data collection was conducted through a questionnaire designed to assess students' awareness of and engagement with GIT. The construction of the questionnaire was guided by an in-depth review of the literature, as elaborated in Table 1. The survey consisted of a set of 18 questions pertaining to the GIT awareness and 14 questions focused on measuring GIT practices (refer to Appendix A and Appendix B). Participants provided responses using a five-point scale. Data analysis was performed using Microsoft Excel 2010 and SPSS 20. Several statistical techniques were employed to assess the questionnaire's reliability and validity, as well as to test the study's hypotheses. Cronbach's alpha was utilized to evaluate the questionnaire's internal consistency, thereby assuring the reliability of its measurements. In parallel, Principal Components Analysis was employed to establish the questionnaire's validity, affirming its precision in capturing the desired constructs. Descriptive analysis was utilized to determine the extent of GIT awareness and practices among the student sample. Furthermore, Pearson correlation, regression analysis, and t-tests were employed to explore the relationships between GIT awareness and adoption. Figure 1 illustrates the sequential progression of the research steps.

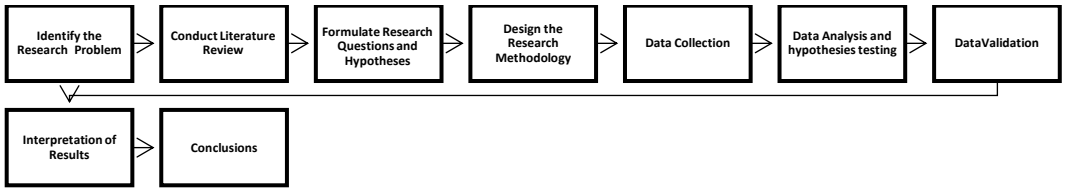

Figure 1. Research Steps

Sampling

The study was conducted at Al-Aqsa University in Gaza, with a sample consisting of 273 undergraduate students, as shown in Table 2. Out of the total participants, 124 students (45.42%) were male, while 149 students (54.58%) were female. Regarding academic level, 47 students (17.22%) were in their second year, 84 students (30.77%) were in their third year, and the majority, 142 students (52.01%), were in their fourth year. The majority of students were pursuing a bachelor's degree, accounting for 249 students (91.21%), while 24 students (8.79%) were pursuing a diploma.

Table 2. Demographics of the Students

Characteristics		Sample Number	%
Gender	Male	124	45.42
	Female	149	54.58
Academic level	Second	47	17.22
	Third	84	30.77
	Fourth	142	52.01
Type of Study	Bachelor	249	91.21
	Diploma	24	8.79

Reliability and Validity Analysis

The reliability and validity analysis are used to examine the consistency of the questionnaires. Cronbach's alpha is a measure of internal consistency, which is a measure of how closely related the items in a questionnaire or scale are to each other. It is commonly used to assess the reliability of a questionnaire or scale. Cronbach's alpha value for the GIT Awareness and Adoption Scale was higher than 0.85, which was considered reliable for the present study.

Principal Components Analysis (PCA)

In this study, Principal Component Analysis (PCA) was utilized to reduce the dimensions of students' GIT perceptions and and to validate the research instrument. The PCA method relied on Eigenvalues and cross-loading to determine the appropriate number of dimensions in the instrument. Eigenvalues played a crucial role, where components with Eigenvalues exceeding one were considered more significant, while those below one was deemed negligible. Cross-loading referred to the distribution of items across two or more dimensions. A survey was conducted involving 273 students, which underwent component analysis and varimax rotation. The findings revealed that out of the 18 items, only three dimensions exhibited Eigenvalues exceeding 1.0. As a result, six items were eliminated due to cross-loading issues. The removed items consist of Q2, Q3, Q4, Q9, Q10, and Q12 (refer to Appendix A). Consequently, the ultimate GIT awareness questionnaire consisted of 3 dimensions and 12 items, as shown in Table 3.

Table 3. Results of Factor Analysis

Factors	1	2	3
Factor 1: GIT Understanding			
1. Have an idea about green computing.	0.614		
2. Studying green computing in some university courses	0.543		
3. Using the screen saver saves power when the computer is idle.	0.450		
4. Green computing activities are very expensive, so the university cannot afford them.	0.487		
5. Many computers are produced from many hazardous materials like cadmium, mercury, and other toxic substances	0.596		
Factor 2: Environmental Awareness			
6. Green computing is very beneficial for academic institutions.		0.758	
7. Green computing is essential to environmental sustainability		0.732	
8. Laptop LCD/LED screen consumes less power than a desktop computer.		0.671	
9. Improper disposal of computer waste leads to the leakage of chemicals such as lead and mercury, which pollute the environment.		0.782	
Factor 3: E-Waste Awareness			
10. Recycling printer cartridges is better than refilling them.			0.510
11. Recycling ICT devices is better to keep our environment clean.			0.753
12. ICT equipment waste must be disposed of properly			0.729

The factor analysis results revealed three distinct factors within the questionnaire: GIT Understanding, Environmental Awareness, and E-Waste Awareness. The GIT Understanding factor encompassed items that assessed participants' knowledge of GIT, including their understanding of GIT and awareness of the environmental impacts associated with computer production. The Environmental Awareness factor consisted of items that explored participants' recognition of the significance of GIT for environmental sustainability and their understanding of the energy-saving advantages of specific technologies. The E-Waste Awareness factor comprised items that gauged participants' understanding of the proper disposal of ICT equipment and their awareness of the environmental benefits associated with recycling. The factor loadings for each item, presented in the table above, indicated the strength of the relationship between the item and its corresponding factor, with values exceeding 0.5 indicating a robust association.

Results and Discussion

The Level of Students' Awareness of GIT

To address RQ1, this study utilized descriptive analysis to investigate the scope of students' GIT awareness. Table 4 delineates three evaluated factors within the survey: GIT understanding, environmental awareness, and e-waste awareness. The table displays the mean, standard deviation, and the percentage of respondents who agreed with each item for each factor. The items are arranged on a scale of 1 to 12, with 1 indicating the item with the highest mean and 12 representing the item with the lowest mean.

Table 4. GIT Awareness Descriptive Statistics

No.	Item	Mean	%	Std. Deviation	Rank
Factor 1: GIT Understanding					
1.	Having an idea about green computing.	2.853	57.06	1.1807	11
2.	Studying green computing in some university courses	2.137	42.74	1.3862	12
3.	Using the screen saver saves power when the computer is idle.	3.696	73.92	0.8876	4
4.	Green computing activities are very expensive, so the university cannot afford them	3.578	71.56	0.8377	7
5.	Hazardous elements including cadmium, mercury, and other poisonous compounds are used in the production of many computers.	3.287	65.74	1.1166	9
		3.11	62.20		
Factor 2: Environmental Awareness					
6.	Green computing is very beneficial for academic institutions.	3.608	72.16	0.9351	6
7.	Green computing is essential to environmental sustainability	3.765	75.3	1.0453	3
8.	Laptop LCD/LED screen consumes less power than a desktop computer.	3.618	72.36	0.9232	5
9.	Improper disposal of computer waste leads to the leakage of chemicals such as lead and mercury, which pollute the environment.	3.882	77.64	0.9471	2
		3.718	74.36		
Factor 3: E-Waste Awareness					
10.	Recycling printer cartridges is better than refilling them.	3.431	68.62	0.9175	8
11.	Recycling ICT devices is better to keep our environment clean.	4.049	80.98	0.9988	1
12.	ICT equipment waste must be disposed of properly	3.186	63.72	1.1918	10
		3.555	71.1		

The results in table (4) indicates that the students had a high level of awareness of GIT and its importance for environmental sustainability, with a mean of 3.718 for the environmental awareness factor and a mean of 3.555 for the e-waste awareness factor. The students had a lower level of understanding of GIT concepts and practices, with a mean of 3.11 for the GIT understanding factor. This suggests that while the students had a general awareness of the importance of GIT, they may not have had a detailed understanding of specific GIT concepts and practices. These results are consistent with a variety of studies, including those conducted by Ahmad et al. (2013) and Freeman (2016), which have emphasized the restricted comprehension of GIT among students. However, other studies have reported moderate to strong student understanding of GIT, as demonstrated by research conducted by Abugabah and Abubaker (2018) and Mbewe (2019)

The Level of Students' Adoption of GIT

To address RQ1, this study utilized descriptive analysis to investigate the scope of the adoption of GIT among the students. The results in Table 5 indicated that the level of Students' adoption of GIT is generally high (72.32%). The highest levels of adoption were observed for practices such as accessing the internet and owning a computer or other ICT equipment, with 85.8% and 83.6% of students engaging in these activities, respectively. Other highly adopted practices included using the computer as necessary. and being careful to purchase e-devices that consume less energy, with 80.6% and 79.8% of students reporting these behaviors, respectively. On the other hand, some GIT practices had lower levels of adoption among the students. For example, only 48.62% of students reported using solar energy to power their computers, and 63.34% reported reading the GIT Handbook that came with their PCs. However, even for these less adopted practices, the majority of students still reported engaging in them to some degree.

Table 5. GIT Adoption Descriptive Statistics

No.	Green ICT practices	Mean	%	Std. Deviation	Rank
1.	Utilizing the internet as necessary.	4.29	85.8	0.8395	1
2.	Owning a computer and other ICT equipment.	4.18	83.6	0.9164	2
3.	Using the computer as necessary.	4.03	80.6	0.9383	3
4.	Be careful to buy electronic devices that consume less energy.	3.99	79.8	0.9746	4
5.	Using a computer for many years	3.86	77.2	1.0812	5
6.	Acceptance of green computing activities.	3.76	75.2	0.8919	6
7.	Switch the computer to "low power consumption" mode every time.	3.66	73.2	1.1124	7
8.	Correct methods are used to dispose of unwanted computers and ICT tools.	3.6	72	1.0075	8
9.	Be careful to use e-books and e-learning tools.	3.58	71.6	1.0571	9
10.	Turn off the computer when not in use.	3.554	71.08	1.2092	10
11.	Reducing energy consumption by powering down ICT devices.	3.294	65.88	1.154	11
12.	Use of recycled paper and reduce paper consumption.	3.23	64.6	1.3924	12
13.	Read the content of the Green IT Handbook that is provided with ICT equipment.	3.167	63.34	1.2324	13
14.	Using solar energy to power a computer.	2.431	48.62	1.4555	14
Average		3.62	72.32		

Relationship between GIT adoption and GIT Awareness

The relationship between GIT adoption and awareness factors (GIT understanding, awareness of the environment, and awareness of e-waste) among students was investigated using the Pearson correlation coefficient, and the results are shown in Table 6.

Table 6. The Relationship between GIT Adoption and GIT Awareness

Factors	Person Correlations	Sig
GIT understanding	0.474**	0.000
Awareness of the environment	0.512**	0.000
Awareness of e-waste	0.381**	0.000
GIT awareness	0.566**	0.000
**. Correlation is significant at the 0.01 level (2-tailed).		

The strongest link between GIT awareness and GIT adoption among students (p=0.566**, Sig=0.000) is seen in table 6. This indicates that there is a positive relationship between GIT awareness and GIT adoption among students. Hence, the first hypothesis (H1) is accepted.

The Effect of GIT Awareness on GIT Adoption

In this study, the impact of GIT awareness on GIT adoption among students at al-Aqsa University in the Gaza strip was analyzed by stepwise multiple regression. The results of the regression analysis were revealed as presented in Table 7. The value of R is 0.576, and the p-value is 0.000, indicating that GIT awareness and adoption are positively associated, according to the regression analysis. GIT awareness accounts for 32.5% of the total variance in the dependent variable (GIT adoption).

Table 7. Regression Models (GIT Awareness: GIT Adoption)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.583	0.164		9.658	0.000
Environmental Awareness	0.242	0.043	0.332	5.575	0.000
GIT Understanding	0.226	0.061	0.230	3.726	0.000
Awareness of e-Waste	0.105	0.043	0.138	2.425	0.016
Where, R=.576**, R^2**=.332**, Adjusted R^2**=0.325**, F value**=45.99**, Sig. =0.000**					

The regression equation (Equation 1) predicted the following based on these findings:

$$\text{GIT Adoption} = 1.583 + .242\ \text{GIT Environmental Awareness} + 0.226\ \text{GIT Understanding} + 0.105\ \text{Awareness of e} - \text{Waste} + e$$

Equation (1)

The previous equation has indicated that an increase in GIT awareness factors (GIT Environmental Awareness, GIT Understanding, and Awareness of e-Waste) will have a positive impact on GIT Adoption. Therefore, the second hypothesis (H2) is accepted. This outcome aligns with the findings from the study by Ahmed (2018), underscoring the significance of GIT awareness in GIT adoption. However, it contrasts with the outcomes of the research conducted by Obafemi et al. (2023), which concluded that GIT awareness and practices hold no influence over GIT adoption.

Gender Differences in GIT Awareness and Adoption

The analysis of GIT awareness and adoption by gender aims to determine if there are any gender-based differences in how IT students at Al-Aqsa University in Gaza perceive and adopt GIT practices. statistically significant impact on GIT awareness. Similarly, there is no significant difference between GIT adoption and gender [t = 0.070, p = 0.994 > 0.05], implying that there is no relationship between

gender and GIT adoption. Based on these the results of this analysis can help identify any potential areas where targeted interventions may be necessary to improve GIT awareness and adoption among male and female students. Table 8 shows the results of an independent t-test done on two independent groups to investigate gender differences in GIT awareness and adoption. Table 8 indicates that there is no significant difference between gender and GIT awareness [t = 0.043, p = 0.966 > 0.05]. The analysis indicates that gender does not have an impact on GIT awareness and adoption. As a result, the third hypothesis (H3) and fourth hypothesis (H4) are both rejected.

Table 8. The differences of gender in GIT awareness and Adoption

Factor	Sig. (2-tailed)	t	Mean		Std. Deviation	
			Female	Male	Female	Male
GIT awareness	0.966	0.043	3.4435	3.446	0.50448	0.5685
Adoption GIT	0.994	0.070	3.4530	3.4575	0.50116	0.04105

Academic level Differences in GIT Awareness

A one-way analysis of variance (ANOVA) was conducted to determine whether there is a significant difference in the mean of GIT awareness among students at different academic levels. Table 9 shows that there was no statistically significant difference in mean scores for GIT awareness between student academic levels [F = 0.973, p = 0.522 > 0.05]. This suggests that academic level does not have a significant impact on GIT awareness. As a result, the fifth hypothesis (H5) is rejected.

Table 9. One-way ANOVA for Academic Level and GIT

Source of Variation	SS	Df	MS	F	P-Value
Between Groups	22.532	40	0.563	0.973	0.522
Within Groups	127.911	221	0.579		
Total	150.443	261			

The outcomes of hypothesis testing indicate a notable influence of the independent variable (GIT awareness) on the dependent variable (GIT adoption). These findings are visually presented in Figure 2.

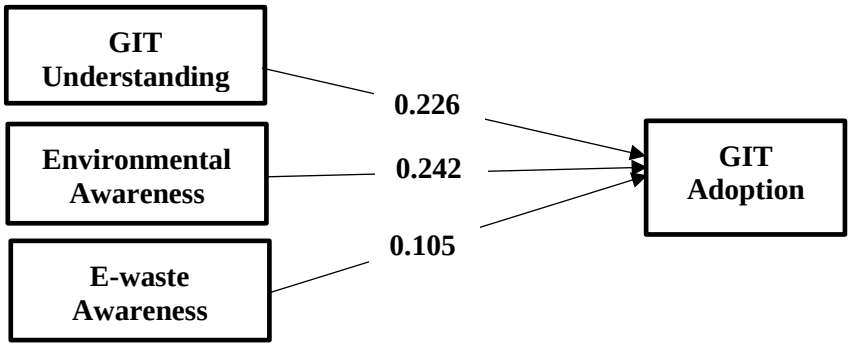

Figure 2. GIT Adoption Barriers Model

Implications

Theoretical Implications

This study contributes significantly to the theoretical understanding of the relationship between GIT awareness and adoption. It solidifies the existence of a positive correlation between awareness and adoption, offering valuable insights that can enhance existing theories related to technology adoption and environmental behavior. Furthermore, the identification of a substantial awareness-action gap, where awareness doesn't always translate into action, aligns with established theories in psychology and behavioral economics. This stresses the critical need to address barriers that impede behavioral change, even when individuals are aware of the benefits associated with the sustainable practices. Additionally, this research challenges conventional assumptions about gender disparities in technology-related behaviors by demonstrating that there are no significant gender differences in GIT adoption. These findings contribute to the development of theories regarding gender and technology adoption. Lastly, the observation that academic level has minimal influence on GIT awareness suggests the consistent integration of GIT concepts throughout the academic journey, enriching our theoretical understanding of how technology and sustainability education are interwoven into IT programs.

Practical Implications

In terms of practical implications, the outcomes of this study hold promise for policy development and guidelines concerning GIT adoption. Educational institutions can leverage these findings to bolster GIT awareness among IT students. This includes the integration of GIT principles, e-waste management topics into the curriculum, as well as organizing awareness campaigns and workshops. While academic level does not significantly affect GIT awareness, institutions should persist in their efforts to maintain and enhance GIT awareness among students at all academic levels, emphasizing the importance of continuous education and awareness campaigns to ensure long-term GIT adoption. The study underscores the necessity for behavioral interventions that bridge the awareness-action gap, offering practitioners the opportunity to design targeted interventions addressing specific barriers preventing individuals from translating their GIT awareness into action. Moreover, businesses and organizations can utilize these findings to inform their sustainability initiatives, potentially involving the adoption of energy-efficient technologies and responsible e-waste management practices. Finally, this study highlights areas where additional research is warranted, particularly in exploring the factors influencing GIT adoption, thereby guiding future research endeavors within the realm of GIT and sustainability.

Conclusion

This research aimed to examine the level of GIT awareness and adoption, as well as the relationship between GIT awareness and GIT adoption, among IT students at Al-Aqsa University in Gaza. The findings revealed a moderate level of GIT awareness and a high level of GIT adoption among the students. While a significant number of students recognized the importance of recycling ICT devices, proper e-waste disposal, and practicing GIT, there was a gap between awareness and actual implementation. Although a majority of students acknowledged the significance of computer waste disposal and GIT practices, a smaller percentage actively engaged in using solar energy to power computers or using recycled paper. These results indicate that while the students possessed a general understanding of GIT principles, there is room for improvement in integrating these practices into their daily lives. Furthermore, the study demonstrated a positive association between GIT awareness and adoption, suggesting that increased awareness leads to higher levels of adoption. However, no significant gender differences were observed in terms of GIT awareness and adoption among the students. This study underscores the significance of formulating a well-defined strategy for the implementation of GIT and ensuring the appropriate disposal of e-waste, especially considering the unique context of Palestine, which is impacted by the recycling practices of neighboring countries. The findings highlight the need for Palestinian authorities to prioritize the establishment of effective mechanisms for GIT adoption and proper e-waste management. Given the increasing global concern over e-waste and its environmental implications, it is essential for Palestine to develop robust strategies and policies that address the challenges associated with e-waste recycling. This includes initiatives

aimed at raising awareness among individuals, organizations, and institutions about the importance of responsible e-waste disposal practices and the adoption of GIT principles. By implementing comprehensive measures and regulations, Palestine can mitigate the negative environmental impact of e-waste and create a more sustainable computing ecosystem. Collaborative efforts between government agencies, educational institutions, and relevant stakeholders are crucial in achieving effective GIT adoption and ensuring proper e-waste management. Furthermore, international cooperation and knowledge sharing can play a vital role in supporting Palestine's efforts to establish a sustainable GIT framework and develop local capacity in e-waste management. By addressing these challenges and embracing GIT practices, Palestine can contribute to a more environmentally conscious and technologically sustainable future. This study is subject to several limitations. Firstly, the study's sample was limited to IT students from a single university located in a specific geographical area. Moreover, while the study extensively investigated various aspects of GIT awareness, it might not have taken into account all the variables that could influence adoption behaviors. In the future, it is recommended that research delve more extensively into these variables to establish a comprehensive understanding of the factors that contribute to the adoption of GIT.

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Appendix A

GIT Awareness Measurement Questionnaire

Please use the checkmark (√) to indicate your level of approval on the following axes:

GIT Awareness		Strongly agree	Agree	Moderate	Disagree	Strongly disagree
Q1	I have an idea on GIT.					
Q2	GIT focuses on using computers and related technology in a way that uses the least amount of energy possible.					
Q3	Hazardous chemicals are used in the manufacture of computers					
Q4	I've read a number of articles and academic papers on GIT.					
Q5	The media has informed me about GIT.					
Q6	I have taken various university courses on GIT.					
Q7	Green computing is very beneficial for academic institutions.					
Q8	GIT is essential to environmental sustainability					
Q9	Laptop LCD/LED screen consumes less power than a desktop computer.					
Q10	Computer use is growing, which contributes to global warming.					
Q11	When the computer isn't in use, the screen saver helps conserve power.					
Q12	Your computer will use more energy if you turn it off and on again frequently than if you leave it on.					
Q13	Because they are so expensive, green computing initiatives are not something the institution can afford.					
Q14	Instead than replenishing printer cartridges, recycle them.					
Q15	Chemicals such as lead and mercury seep from improper computer trash disposal, harming the environment.					
Q16	ICT device recycling is preferable for maintaining a clean environment.					
Q17	Hazardous elements including cadmium, mercury, and other poisonous compounds are used in the production of many computers.					
Q18	Waste from ICT equipment must be appropriately disposed of.					

Appendix B

GIT Adoption Measurement Questionnaire

Please use the checkmark (√) to indicate your level of approval on the following axes:

GIT Adoption		Strongly agree	Agree	Moderate	Disagree	Strongly disagree
Q1	I recycle my old PCs and ICT equipment properly.					
Q2	I make sure to get electrical equipment that consumes little energy.					
Q3	I make use of electronic books, libraries, and learning materials.					
Q4	I'm open to participating in green computing activities.					
Q5	I've been using a computer for a long time.					
Q6	I typically spend hours each day on the computer.					
Q7	I essentially spend a few hours each day online.					
Q8	I have access to computers and other ICT tools.					
Q9	I use a laser printer to print documents, memoranda, chores, notes, etc.					
Q10	Every time, I set the computer in "low power consumption" mode or leave it there all the time.					
Q11	I power my computer with solar energy.					
Q12	Instead of putting my computer to sleep, I shut it down.					
Q13	The use of GIT can lower university facility costs and preserve a sustainable environment.					
Q14	I regularly read the material in the GIT guide that comes with my computers.					

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