

## **Green ICT Practices among Egyptian HEI' Students**

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### **Abstract**

*Awareness of constructing a society that adopts practices aiming at sustaining the environment is essential. This research focuses on issues related to Green ICT practices by students of Egyptian HEIs. Students should be trained and motivated to adopt Green ICT practices, this will aid in saving costs and sustaining the environment.*

*Green ICT practices were investigated using a self-reported questionnaire. The investigated four practices are green search engine, power management, e-mail, and e-learning tools. Analysis involved calculation of frequencies using descriptive statistics. Simple random cluster sampling was used for the selection of the participating HEIs in Egypt. The population of the study was students in the selected HEIs registered in February 2015 semester.*

*Research revealed that the majority of the students practice Green ICT in their routine daily lives, which shows a positive trend among HEI' students to support greenness. Most of the participating students practice Green ICT via the use of e-mail, e-learning and green search engine. The lowest participation was in the practice of power management; however, power management approaches are not popular among the participating students due to lack of awareness.*

**Keywords:** Green ICT; HEIs; power management; green search engine; e-learning tool; e-mail

### **1. Introduction**

This research focuses on issues related to Green ICT (GICT) practices by students of Egyptian HEIs. Students should be trained and motivated to adopt GICT practices, this will aid in saving costs and sustaining the environment.

Drouant et al. (2014) highlighted that among the future challenges is the impact of technological advances and new emerging technologies on the environment. Currently, one of the most important issues, is achieving cost effectiveness and environment sustainability, while keep running operations using ICT. GICT highlights the impact ICT has on the environment and environment change.

In the same context and due to the fact that ICT is invading all aspects of our lives, the adoption of GICT becoming major issue towards achieving cost effectiveness and environment sustainability. Going green is vital in solving various environmental problems and ultimately saving the earth (Riaz et al., 2010). The green theory stress that there are opportunities to reduce energy consumption by making use of power management practices (O'Neill, 2010). With reference to OECD (2009), GICT is all about the practice of using ICT in an efficient, effective and economically way.

This issue is getting more and more attention as the number of manufactured technological devices is keep increasing, and its life cycle is keep decreasing, thus adding to the hazardous environmental impact (Kawa & Golinska, 2010). Adopting GICT practices significantly reducing this dangerous environmentally impact and reducing the overall energy bills, which constitute a mandate to go green (Murugesan, 2008).

There is a global concern of GICT practices, which shows an increase in concerns of environmental issues. Higher education institutions (HEIs) should pay great attention to GICT due to the rapid growth in using ICT by its staff and students. Thus, HEIs contribute high carbon dioxide emission, high power consumptions and hazardous e-waste. Besides this, ICT has also directly affected the financial cost and this is likely to increase every year as the demand for ICT grows. Therefore, GICT practices via HEIs' staff and students can address the environmental pressure and economic pressure through cost saving by reducing the energy usage.

The awareness of constructing a society that is aware of and adopts the practices that aims at sustaining the environment is essential. This awareness has increased as societies are becoming more aware about the concept of greenness and its effect in sustaining the environment (Noorriati et al., 2013). The United Nations Headquarters report (2012) witnessed a drastic awareness regarding sustaining the environment across the world, although the people's engagement in sustaining the environment is still a long way off.

There is an increase in the global awareness of the importance of GICT. For instance, German HEI adopting GICT by forming GICT communities each of more than 300 members, which stimulate and help HEI to go green (Hankel, 2013). On the other hand, UK adopting GICT in a form of policies that direct HEI to go green in order to reduce carbon dioxide releases and to reduce Greenhouse gases progressively (Chai & Nakata, 2011; Pandey, 2010).

In order to enhance the welfare of life, societies have to be environmentally friendly in order to ensure a healthy environment. Thus, one of the critical and essential issues societies have to pay special attention to it is the energy consumption (Theivaa, 2010). This issue has been raised as ICT is significantly used in the daily activities of peoples. Beister et al. (2014) shared the same idea that the primary objective of the GICT is to reduce the overall energy consumption of technological devices. Adopting GICT practices allows people to recognize energy saving opportunities and change their behavior to preserve energy (Weiss & Guinard, 2010). To be green is all about pursuing welfare for all, in an approach that is suitable with the requirements of the lasting effects on naturalness and on members of the environment (Barry, 2008; Markvart, 2009; Fletcher, 2009).

With reference to Thompson (2009), GICT approaches in HEIs have been categorized into four categories: green search engine, power management, e-mail and e-learning tool. Using fast search engines is a vital approach to GICT. Google search engine have been classified as a green search engine. Due to the advancement of software technology, Google relies on the universal search algorithm to locate websites which has directly improved the quality of search speed. Another approach to GICT is power management, which helps HEIs to manage power consumption efficiently. Power management allows HEIs monitoring energy consumptions especially in light of the increasing number of computer devices.

The wide usage of e-mail by both staff and students makes it a basic component in HEI environment. E-mail is a "green" approach because it contributes to reduction of paper use as various document types are distributed electronically, thus enhancing carbon footprints and maintenance cost in HEIs. Electronic course management systems— such as Moodle, Edmodo, connectEDU, Blackboard, Schoology, and much more - has been adopted as an electronic learning tool as they promotes various online learning activities.

In light of today's ICT requirements, ICT has become the main cause to the world's energy consumption, carbon footprint and e-waste (Arayalert & Nakata, 2011). The increasing internet usage added to this increased energy consumption.

Power management practices aims at managing power supply; thus minimizing power consumption, as well as enable users to understand the need to refurbish and recycle computer devices. This approach can reduce e-waste or used-equipment dumping in the future (Rahman et al., 2007).

GICT practices developed aiming at maximizing energy efficiency, reducing carbon footprints and promoting recyclable products. Green use reduces the energy consumption of computer components, green disposal is a method of refurbishing and recycling old computer components, green design promotes

energy efficient and environment friendly computer components and lastly green manufacturing enhances the design of electronic components with minimal or no impact to the environment (Porritt, 2010).

Although authorities encourage the adoption of GICT practices, there is no defined set of GICT procedures and approaches explicitly defined for adaptation by HEI' students. In order to achieve this goal, HEIs play an important role to promote the GICT culture among their students.

With reference to Sharp (2002), due to the universal lack of support of the GICT practices, HEI' students as well as staff awareness and participation is an important approach to bring these practices into light. HEIs that adopted GICT practices have witnessed positive environmental impact and ultimately reducing the energy consumption cost.

Although GICT is gaining widespread popularity in HEIs worldwide, it is noted that GICT lacks universally accepted definition, moreover, there is limited attention paid to the GICT awareness level among the students of HEIs especially in developing countries in general. Therefore, further study is required to investigate GICT practices among HEI students in Egypt. GICT in Egypt is still at its early stage, therefore, greater efforts and promotion are required to ensure successful of implementation of GICT across all HEIs.

## **2. Methodology**

The objective of this research isto identify Egyptian HEI students' GICT practices regarding the categories of green search engine, power management, e-mail, and e-learning tools.

To address the objectives of this research, GICT practices were investigated using a self-reported questionnaire survey construct to collect the required data. The used questionnaire construct isadopted from Thompson (2009) after necessary adaptations in order to comprise the investigated four GICT practices' categories of green search engine, power management, e-mail and e-learning tools. Participants are students of a group of randomly selected Egyptian HEIs studying various domain fields.

The adopted survey constructwas designed using a dichotomous closed ended questionnaire methodology, and the implicit options to collect the required data are only "Yes" or "No". Thus, the survey provides reliable and valid data; this is because both participants and researcher have the same interpretations of the nominal dichotomous items presented (Mueller, 1986).

When an instrument is accurate and consistent, it is supposed to have a high degree of reliability; thus, minimizing the errors and biases in a research study (Slavin, 1992). Expert comments were used to check the validity of the instrument used. Research instrument was presented to 8 experts, who were asked to review and give their feedback, and then the instrument was evaluated and revised with their comments. The reliability of the questions was calculated as 76% using Cronbach's Alpha coefficient and confirmatory factorial analysis.

Statistical Package for Social Science (SPSS) program was used in coding and analyzing the data in light of the questions of study instrument. The probability level for a test of statistical significance for the study is  $p < .05$ , to ensure 95% confidence in generalization of the findings. Descriptive statistics were used for data analysis of the collected data.

Simple random cluster sampling was used for the selection of the participating HEIs in Egypt. The target participating HEI were chosen randomly based on the list of HEI obtained from HEI list registered in the higher council of Egyptian universities website. The population of the study was students in the selected HEIs registered in February 2015 semester.

One HEI in Alexandria city of Egypt and two HEIs in 6th of October city of Egypt were chosen as the participating HEIs. After obtaining the required approvals, several visits were organized in order to distribute and collect the questionnaires, also precise instruction were given to the participants to reduce human made error and to produce valid data for statistical analysis.

### 3. Analysis and Results

Of the distributed 420 questionnaires, only 193 were collected, among which only 152 were usable and completed questionnaires, which represent 36.2% response rate. Analysis involved calculation of frequencies of various GICT practices using descriptive statistics.

Gender of the participating students was male participants representing 59%, while female participants representing 41%. All participants' ages range from 18 to 22 years old.

Analysis of the collected data revealed that, as a response to the general question regarding practicing GICT in daily live, the majority of the students (69%) practice GICT in their routine daily lives, which shows a positive trend among HEI' students to support greenness as shows in table 1, while only 31% reported that they do not practice GICT in their daily lives.

Table 1: Green ICT Practices Percentage

		Green ICT Practices Percentage		
		Yes	No	Total #
Total	#	105	47	152
	%	69%	31%	100%

Responses to GICT approaches adopted by HEI' students are varies as shown in table 2. Although the majority of the participating students said “Yes” to GICT (69%), the figures are very promising in terms of three of the four categories of GICT investigated approaches, while it require special attention for one of these four categories.

Table 2: Green ICT Practices adopted by the HEI' students

Green ICT Practices	Yes%	No%
Green Search Engine (Google)	83	17
Power Management	36	64
Electronic Mail (e-mail)	96	4
E-Learning (Moodle)	85	15

Most of the participating students practice GICT via the use of e-mail (96%), then e-learning (85%), followed by green search engine (83%). The lowest participation was in the practice of power management, as only (36%) of students reported that they are practicing power management.

The analysis shows that the majority of the participating students practice GICT in order to sustain the environment. However, power management approaches are not popular among the participating students due to lack of awareness.

### 4. Conclusion

A possible explanation for the high awareness and practices of GICT among students may be due to receiving the appropriate education and support from HEIs, another reason may be due to the wide use of the internet and the possibilities of self-education exercised by the students themselves; as the internet is an important tool for knowledge where students can learn from it.

In terms of the four practices underlined in this research, the analysis revealed that the majority of students practice GICT via the use of green search engine. Social pressure could be a reason to this practice as many find Google search engine to be very effective and saves time. Moreover, the universal search algorithm adapted by Google increased the quality of search speed compared to the other search engines.

Among the other GICT practices adopted by the majority of the participating students are the use of e-mail and e-learning. A possible explanation for the high awareness and practice of these GICT tools may be due to the roles played by HEIs in making the use of these tools a mandatory and an important element in their educational environment.

However, power management practice is not popular among the participating students may be due to lack of awareness. This calls for a need to educate HEI students about the approaches and benefits of adopting power management as one of the green practices in using ICT.

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