

PROJECT REPORT

Green Education

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University Students' Perception of Green Education: A Way to Encourage and Increase Sustainability Awareness

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Abstract. In the field of information and technology, green education has recently gained prominence. However, little is known about the factors that influence the adoption of green computing in South Asian universities and other educational institutions. In addition to increasing awareness of the subject, this study aims to evaluate the perspectives and comprehension of green education among general East West University students. Survey research and feedback from both teachers and students were used to gather the data needed for the study. Furthermore, one-on-one conversations with the university's higher authorities yielded significant assistance in organizing workshops, seminars, and actual projects related to green computing. As we found that more than 80 percent of the participants were more eager to join campaigns and learn about Green Education throughout the entire study, this confirmed the idea that direct engagement with the participants can bring about a significant change in attitude regarding Green Computing. According to research, awareness, support from upper management, sufficient funding, and curriculum integration are the main elements that affect the adoption of green education in private universities. Securing consistent funding from upper management is crucial for future research in order to guarantee the effective execution of Green Computing projects. A culture of sustainability among students and faculty can also be encouraged by immediately adding Green Computing into the curriculum across all departments and establishing communication with other private universities to learn about their policies and strategies regarding Green Education.

Keywords: Green Education, Campaigns, Green Computing, Sustainability.

1 Introduction

As cities, industries, and technology grow quickly and place greater demands on the environment, sustainability is becoming a big concern. Green computing is now a crucial part of sustainable development due to the increase in the use

of digital technology. The term "green computing" describes the prudent and effective use of computers and other digital devices to lower energy use, minimize electronic waste, and encourage eco-friendly behaviors [1]. In the growing internet age, it is imperative to instill sustainable computing practices in professionals, educators, and students to lessen the negative environmental effects of excessive technology use. By incorporating Green Education into their curricula, raising awareness, and promoting responsible digital behavior, universities contribute significantly to this change. In order to ensure that instructors and students at East West University gain a thorough understanding of environmentally responsible computing, this study attempts to increase awareness about green computing. The need for immediate solutions has been made clear by environmental issues like pollution, food safety emergencies, excessive carbon emissions, and resource depletion. [2]. Traditionally, human-centered approaches to environmental issues have prioritized human needs over the wider effects on the environment. This limited view has widened the gap between ecological well-being and human progress, contributing to environmental degradation. An alternate strategy that highlights the connection between environmental preservation and human welfare is known as "green social work. Applying this method to green computing it promotes a comprehensive change in technology use toward sustainability, motivating people and organizations to adopt digital practices that support ecological sustainability. A number of schools still do not have comprehensive programs to teach students about Green Computing, despite the growing global conversation on sustainability. As a result, there are substantial knowledge gaps regarding environmentally conscious digital consumption.

According to recent studies, most undergraduates are unaware of the fundamentals of green computing. According to a survey of university students in Southeast Asia, the majority were not familiar with basic Green Computing ideas like carbon-free computing, e-waste disposal, and Energy Star certification. [3]. This lack of awareness is concerning, given the growing dependence on digital tools for communication, research, and education. Without knowing how their technological habits affect the environment, students cannot adopt practices that minimize waste and reduce energy consumption. This emphasizes how important it is to implement planned educational interventions that expose students to sustainable digital practices. Universities can lessen their environmental impact and actively support sustainability initiatives by implementing Green Education into their instruction. Green computing has received little attention at East-West University, where sustainability initiatives have historically focused on broad environmental concerns like management and energy conservation. In order to fill this knowledge gap, this study uses a methodical and multifaceted approach to evaluate faculty and student knowledge of Green Computing, dispel myths, and encourage the use of sustainable technology. In order to promote policy changes that support sustainable digital practices, the methodology consists of comprehensive surveys, in-depth faculty discussions, and direct engagement with university administrations. In addition, interactive seminars and practical

workshops have been arranged to impart practical knowledge on important subjects like safe digital consumption practices, responsible e-waste disposal, and energy-efficient computing.

This study's overall objective is to lay a solid basis for Green Education at East West University by giving staff and students the information and abilities they need to incorporate sustainability into their digital practices. This project seeks to foster a culture of digital responsibility and environmental awareness among university students by coordinating with international sustainability initiatives. The purpose of this study is to advocate for the long-term incorporation of Green Computing principles into academic and institutional policies and to focus on the critical role that universities play in promoting sustainability. Colleges and universities are settings for future professionals, leaders, and innovators, so integrating sustainability into academic curricula is crucial to developing a workforce that is tech-savvy. By teaching sustainability now, the next generation of professionals will be prepared to deal with environmental issues, make wise digital decisions, and make a significant contribution to global sustainability initiatives.

2 Research Obejctives

Within our framework, this study's sole objective is:

- To determine East West University students' familiarity with Green Education in order to investigate and comprehend the depths of their awareness of Green Computing.
- To use seminars, practical projects, workshops, and peer discussions to help institutional authorities promote Green Education among general students.

3 Related Work

The paper's author [4] offers a low-cost, solar-powered computer system design to enhance education in rural India. By developing a self-sufficient computing device, the system aims to provide rural residents with affordable access to ICT. Because it will be made by combining Raspberry Pi and Arduino with renewable energy sources, it can reduce reliance on grid electricity. However, because there won't be as much expertise in those areas, it doesn't reflect the long-term maintenance and technical difficulties that rural citizens will encounter. Once more, before application, the system's adaptability in various contexts should be carefully assessed, which is also not mentioned. Additionally, by interviewing 26 academics from different campuses in Java Island, Bali Island, East Nusa Tenggara, and Sumatra, the paper [5] proposes a model that recognizes three factors of successful implementation. The suggested model demonstrates how

various laws and awareness campaigns help lower carbon emissions and university operating expenses. Still, the survey only includes 26 academics, which is not representative of all Indonesian universities, and the model is inaccurate. Furthermore, the study [6] conducted a survey of 700 students at a Nigerian university to determine whether or not they support the use of green computing in their academic lives. It was discovered that 80% of students do so, recommending government-led awareness campaigns. Additionally, it raises student awareness of energy efficiency, which lowers e-waste. Its research is limited, though, because it was conducted solely at a university and did not examine challenges that the government may encounter in putting green education into practice.

Additionally, this paper [7] describes the way Shenyang University in China has transformed into a "Green University," highlighting the university's initiatives in environmental education, e-waste management, water efficiency, and carbon reduction. It outlines a course for other academic institutions to take and strives for a green university model in their own campus operations. Additionally, this study is based on a single university, which makes it tough to apply to other universities because they differ in a lot of ways. Furthermore, this study [3] executed a survey of 224 Malaysian University students to determine the students' unfamiliarity with E-PEAT, Energy Star, and e-waste management. It encourages efforts to raise awareness of environmentally friendly computing methods. All in all, it was more concerned with raising awareness of green education than with its actual application in different schools from various angles. The creation of a green-OER collection to improve the caliber of educational resources that can be environmentally friendly is represented in the paper [8]. It highlights the necessity of enhancing discoverability, interoperability, and educational impact in the context of green education. However, it lacks consideration for financial and technical obstacles while keeping a green OER collection. On the other hand, this study [9] examines the green university initiatives model at Tsinghua University in China, which is founded on green research, green education, and a green campus. The implementation of eco-friendly campus practices and a greater awareness of sustainability are the next accomplishments. Despite all of this, it falls short in examining the administrative and policy obstacles to implementing sustainability in other places.

Southeast Asia's efforts to create a green university campus are exemplified in the article [10]. It examines 52 articles to show that while environmental and social growth account for 46% of sustainability initiatives, building design accounts for 40%. In order to achieve more sustainable development, it recommends an alternate approach to campus sustainability. Nevertheless, it is a review of the literature, which can be biased and limit the conclusion's originality. Furthermore, it doesn't offer in-depth case studies to demonstrate the efficacy of recommended sustainability strategies. However, the paper [11] addresses the significance of sustainability in various Asian universities, demonstrating how these institutions wish to expand their research, teaching, and volunteer facili-

ties based on integrated sustainability. Analyzing the Asian Universities Alliance and their sustainable practices was the primary task. Nevertheless, because it has only looked at Asian universities, it has created a border and does not account for the financial circumstances that may arise when incorporating sustainability into the classroom. Using survey data from 118 universities, the study [12] shows the success factors of implementing green computing at Gulf State universities. It was determined that the government’s ability to enforce initiatives and promote the use of green education in universities is aided by awareness, relative benefits, top management support, sufficient funding, and government policy. However, it is based on survey data that does not fully illustrate the difficulties that various states will face when implementing green education.

4 Methodology

4.1 Participants and Collection of Data

We started by using a survey-based method to confirm and ascertain the students’ general understanding of ”Green Education.” Regardless of department or subject, East West University students make up the majority of the study’s research population. A relatively easy questionnaire with predetermined answers is created for the survey in order to comprehend the general student’s viewpoint on green education. These questions are only meant to gauge a person’s level of knowledge and assessment about the subject of green education. To keep costs down, Google Forms was used to create the questionnaire. The students are then sent the questionnaire via their university suite email. Among the questions on the survey were:

- Compared to laser-based printers, ink-based printers consume more energy
- Energy is saved by screen savers
- Applications that run on the cloud are better for the environment
- Computer hardware recycling contributes to environmental preservation
- When it comes to energy conservation, laptops outperform PCs
- Despite having optimal computational power, GPUs for high-end PCs have a significant negative environmental impact
- Our carbon footprint can be reduced by using smaller devices

Over the course of more than two months, the survey was given out to about 800 students at the institution. To increase the response rate, participants got an email reminder after the first two months. Participants provided their answers free from outside influence, yielding a total of 500 responses.

4.2 Measurements

Our survey’s measurement scale is based on preset replies that are already included in the questionnaire. ”Agree” indicates that the participant agrees with

the statement, "Disagree" indicates that the participant disagrees with the statement, and "No idea" indicates that the participant is unaware of the statement. This scale was selected to reduce bias and uncertainty while raising the validity of the questionnaire. However, the other questionnaire for the authoritative figures had pre-programmed responses like "Yes" or "No," which indicated whether or not the authority supported our campaign.

4.3 Technology Factors

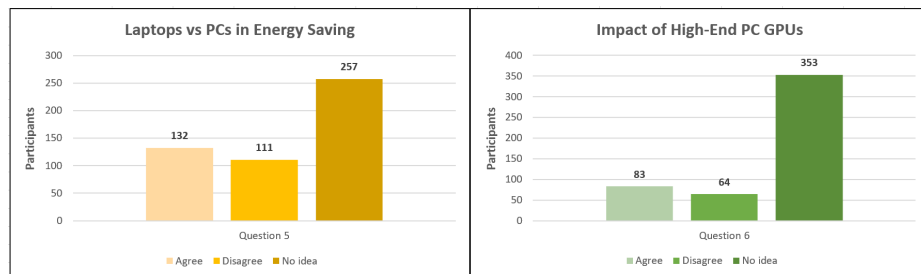
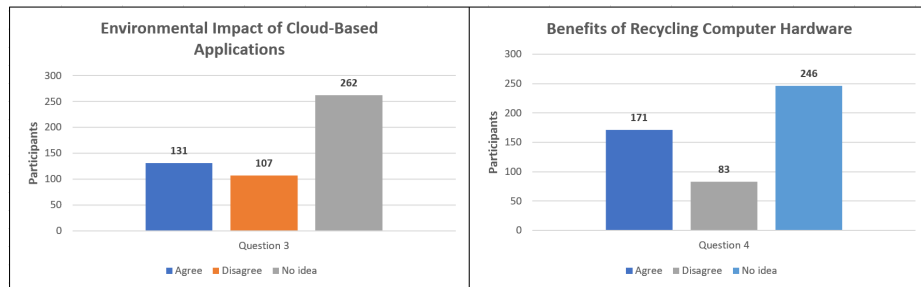
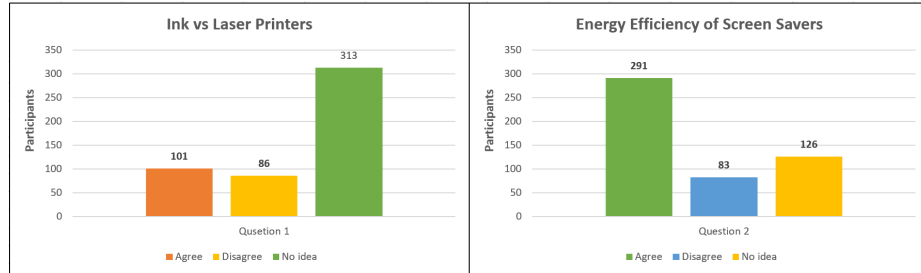
The technical elements of the survey itself are referred to as technological factors. At first, we created our questionnaire with the assistance of Google Forms. The main goal of this is to reduce our expenses and resource usage. We are making sure that the general public understands the significance of green computing by utilizing a cloud-based application such as Google Forms, which employs recent green education techniques. This gives the participants a better understanding of sustainable computing practices, such as cloud computing, energy-efficient hardware, and e-waste management.

4.4 Sustainable Green Computing Initiatives

To introduce the students to the idea of green education, we carried out interactive projects, workshops, and seminars on green computing throughout the course of the study. In order to make general students more conscious of how they act and the repercussions that follow, these programs are essential for introducing the concepts of sustainability and greening. These courses covered subjects like the use of virtual machines, energy-efficient computing, recycling and disposing of electronic waste, and other moral behavior. Additional projects include solar-powered computational mechanisms, East West University lab electricity consumption, and cooperative discussions on cloud-based systems and virtualizations.

5 Result and Discussions

The survey's importance in this study is established by the participants' opinions about the questions and their overall comments. The degree to which a person understands what green education practices are determines how much they know about green education. All of the students' responses are shown in Fig. 1.



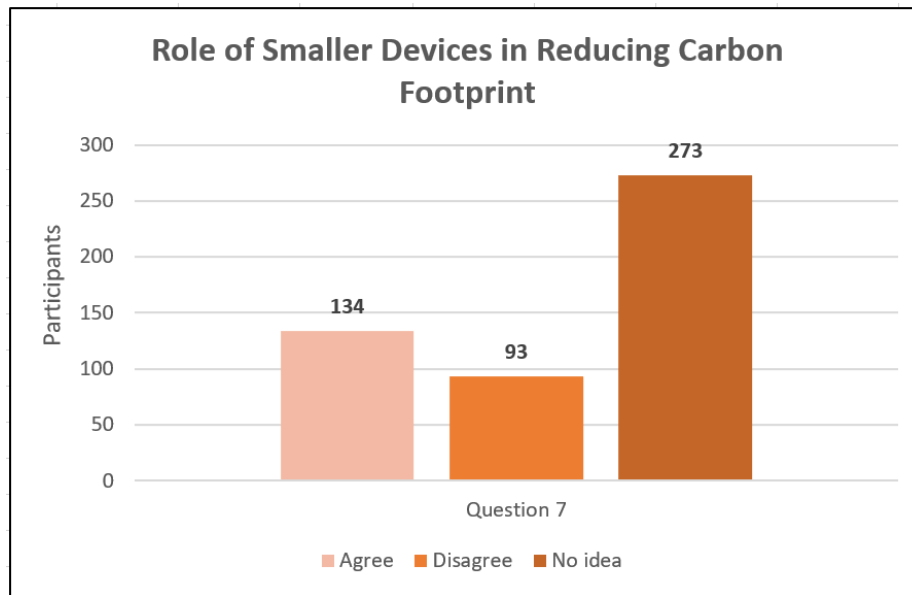


Fig. 1: Collected Responses For the All Survey Questions

In response to the question, "Ink-based printers use more energy than laser-based printers," 20.2% of students agree with the statement, 17.2% disagree, and 62.6% are unaware of it. Furthermore, the question 'Screen savers save energy' reveals that nearly all students (58.6%) agree with the statement, while 16.6% disagree and 25.2% are unsure. Furthermore, the question 'Cloud-based applications are more environmentally friendly' shows that 26.2% of participants agree with the statement, while 21.4% disagree, and a staggering 52.4% of participants are unaware of the issue. Additionally, the topic of 'Recycling computer hardware helps save the environment' shows that 34.2% of participants agree with the claim, 16.6% reject it, and 49.2% are unaware of it. Furthermore, the statement 'Laptops are more efficient in energy saving than PCs' reveals that 26.4% of those surveyed agree with it, 22.2 % disagree, and 51.4% are unsure. However, 16.6% of participants agree with the statement that "GPU for high-end PCs, despite having highly optimized computational power, are highly damaging to the environment," while 12.8% disagree. Additionally, the majority of students, 70.6%, choose to be unaware of the claim. Lastly, students' answers to the question, "Using smaller devices can decrease our carbon footprint," reveal that 26.8% of them select the agree option, 18.6% select the disagree option, and a majority of 54.6% select "no idea."

Following a thorough analysis of the participants' responses, it is evident that nearly 52.28% of them lack a good understanding of green education in general. Once all of the responses had been recovered, we went to East West University's

higher authority. We discussed our survey results as well as the input we received from each participant. In order to increase knowledge of green computing and improve its integration into the university's infrastructure, we had a comprehensive one-on-one conversation with the administration and management. We then requested their help and support in order to launch a comprehensive campaign at East West University to increase awareness of green education. We created a list of questions for the authorities involved in judicial processes, which included:

- Can we hold workshops and seminars on green education with permission?
- Does the organization of such events have access to any financing or resources?
- Is it possible for us to work together on this project with other departments or student organizations?
- Is it possible to incorporate green education into the curriculum?

These questions have already been given established responses, which are "Yes" or "No." Fortunately, the authority responded with "Yes" answers to every question and said they would support our campaigns and help us enhance and integrate more green computing endeavors to create an academic community that is more conscious of the environment. The subject **CSE 407: Green Computing** is currently inaccessible to students in other disciplines, even though it is being provided by East-West University to CSE department students. Promoting green education throughout the university would be greatly aided by opening up the topic to students from every walk of life. Students from a variety of academic backgrounds will become more conscious of energy efficiency, e-waste management, and other sustainable behaviors by improving and incorporating this subject into a larger curriculum. Going forward, we arranged a green computing workshop with the authority's assistance. This workshop's main goal is to introduce the students to green computing. This workshop's subject was:

- Fundamental Ideas and Principles of Green Computing-Based Energy Efficiency.
- Green Data Center, Energy conservation is essential for achieving stability.
- The internal workings of virtualization and its significance in modern technology.

Additionally, we organized peer lectures and discussions about green computing, its history, its purpose, and its significance for ethical computing. The goal of these lectures was to increase the students' interest in the fundamentals of green computing by putting them in a discussion-based environment. We also planned a practical exercise in which students were required to track the amount of electricity used in East West University's labs for a full week. The goal of this project is to determine how much energy and electricity the labs use and how the students may reduce this usage in whatever way they can. In addition to this, there was certainly a competitive atmosphere on campus, and everybody was ready to show off their skills. During the course of the campaign, we observed an increasing number of students exploring with green computing. Importantly,

more students immersed into green education and studied more about energy efficiency, sustainability, and other greening initiatives following the campaigns. Our results demonstrate that the campaign's engaging events, initiatives, and discussions have led to an increase in the number of students. This is because, as the campaign progressed, an increasing number of students learnt about the green education system and showed interest in it.

6 Conclusion and Future Work

Increasing awareness of green education is essential for encouraging environmentally conscious behavior in academic institutions and sustainable digital activities. A significant awareness gap was highlighted by the East West University survey, which found that 52.28% of respondents at first knew nothing about green computing. Seminars and practical workshops were held to address this, and the results showed significant increases in participation, with more than 80% of attendance expressing a greater interest in Green Education. Securing institutional support through direct interaction with university authorities was crucial in enhancing the effectiveness of organized awareness campaigns. Notwithstanding these developments, obstacles, including a lack of finance, still prevent wider adoption. The next crucial measures still include bolstering funding and making Green Computing a required course in university curricula. Looking forward, extending these initiatives outside of East West University will result in a greater understanding of the effects of green education. Deeper insights will be provided, and larger, more successful projects might be developed by engaging with other universities, examining their policies and methods, and surveying multiple organizations. Future graduates will be more prepared to embrace environmentally conscious behaviors if sustainability is included into education more broadly, providing a constant commitment to the preservation of the environment and digital sustainability.

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