Integrating Education for Sustainable Development into English for Computer Science: Students and Lecturers’ Perspectives

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ABSTRACT

Integrating Education for Sustainable Development (ESD) into English for Computer Science (ECS) within higher learning institutions remains relatively new. This study investigates students' and lecturers' perspectives on the integration. It was through the survey of 54 students and the interview with three ECS lecturers from a higher institution of education in Indonesia that captured the stakeholders' opinions regarding the integration of ESD into ECS. The survey revealed that most students and lecturers were in support of integrating ESD. The study employed a survey method using questionnaires that measured different items like 1) awareness and acceptance, 2) effective and convenient communication, 3) motivation and attention, 4) engagement, and 5) career preparation. Meanwhile, interviews cover 1) understanding of ESD integration, 2) recognized knowledge and skills, 3) benefits and drawbacks of integration; 4) teaching strategies; and 5) resources and support. The study examines all those indicators of making ECS more relevant to students’ needs and contributing towards a more sustainable English teaching and learning. In this respect, integrating ESD into ECS is a multifarious and evolving procedure that will, when completed, make students better equipped to develop sustainable futures by giving them the knowledge and skills that they need for such an endeavor. This research represents a relevant baseline for those universities and colleges that aim to introduce ESD within their ECS curricula.

Keywords: ECS, ESD, lecturers’ perspectives, students’ perspectives.

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1. INTRODUCTION

Educating students on sustainability about global issues including climate change, dwindling natural resources, and social inequality necessitates integrating ESD into several disciplines. Many research activities have been conducted on how ESD can be incorporated into universities of higher learning and some of these initiatives are in line with UNESCO’s ESD future (Acosta Castellanos & Queiruga-Dios, 2022; Mohammadnia & Moghadam, 2019; Stein et al., 2022; Wahyuni et al., 2023). Numerous studies about ESD in English language teaching, more specifically in General English, have been reported (Bekteshi & Xhaferi, 2020; Jodoin, 2020; Sinakou et al., 2019; Sun & Zhang, 2022; Yılmaz Fındık et al., 2021), nevertheless, very few outside the area of Environmental course and very limited in English for Special Purposes courses (Lavrysh & Lytovchenko, 2019).

ESD in Computer science courses are now being embedded in university classes as well (Becker, 2023; Franco et al., 2019; Gordon, 2010; Koniukhov & Osadcha, 2020; Nwankwo & Njoku, 2020; Sánchez-Carracedo et al., 2021). Gordon (2010) argues that there is a need for integration of ESD into computer science programs to help foster students’ ‘green computing’ whereby they get to learn how to use computers sustainably.

Computing for the Greens seeks to utilize computational processes to assist with sustainability-related issues and therefore requires students’ awareness of what it can achieve (Becker, 2023; Suryawanshi & Narkhede, 2015). It is about ensuring better access to and provision of information and education; building partnerships between the relevant stakeholders to make them accountable for their actions, or lack thereof; monitoring the progress made towards achieving sustainable development goals; and developing a lifestyle of sustainability. Students of today need education about how they can use information gained from computers for teamwork and making responsible decisions concerning development that is sustainable. Technology also has an impact on the environment, so learners should know how to harness it for SDGs.

So far, no work shows the integration of ESD in English for Computer Science (ECS) even though it has started getting incorporated into computer science programs (Wahyuni et al., 2023). As such, the incorporation of ESD into ECS may be able to provide students with the required knowledge for facing sustainability issues in computer science. Incorporating sustainability principles in the ECS syllabus should help students grow their sense of professional ethics toward environmental management. It should also equip, these students with competent decision-making skills toward environmental management that help them become sustainable citizens. All aspects of IT are closely related to computer science. In her study, Symonenko (2020) contended that the development of English for IT jobs is incomplete unless it takes into account the sustainable development of the world. Nevertheless, she discovered that ESD was missing from the ECS even though successful strategies for winning in an international labor market as well as the development of environmental sustainability designs rely on fluency in English of any IT professional.

The survey entailed fifty-four students from the Computer Science program who had previously sat for the course. The study also involved interviewing three lecturers who have taught the course for 10 years or more. The questionnaires for students were related to the indicators of awareness and acceptance, effective and convenient communication, motivation, and attention, and career preparation. In this regard, the interviews from the lectures involved the lecturer’s understanding of ESD integration,
recognized knowledge and skills, benefits and drawbacks of integration, teaching strategies, and resources and support.

Such will integrate ESD into the ECS syllabus enlightening, both learners and lectures on how computer science can bring up green environments. This research examines what students and teachers think about ESD within ECS as a means of promoting a holistic approach and responsible technology development.

**RESEARCH METHODS**

A simple mixed methods approach was used to obtain the views of the students and lectures on the need for ESDs in the ECS. It entailed administering of questionnaire to ECS students and interviewing ECS lecturers.

A total of 54 ECS students were recruited from two almost homogeneous classes. The participants were expected to fill in a close-ended Questionnaire that covered indicators such as awareness and acceptance, effective and convenient communication, motivation and attention, engagement, and career preparation. The qualitative data were obtained by giving out the questionnaire personally in a particular room where the participants took time to respond within that time frame and in a controlled environment. Descriptive statistics including frequencies and percentages were used to analyze the quantitative data obtained from the closed-ended questions.

Three (3) lecturers from ECS specializing in English for Specific Purposes provided detailed views on the incorporation of ESD in ECS. A priori interview guide was created for the interviews with those lecturers before the interviews were conducted. This entailed the lecturer's understanding of ESD integration, knowledge and skills they have gained, barriers to integration, teaching strategies used, and resources and support already available. An in-person interview was preferred since it depended on the lecturer's availability and willingness to a permission for tape recordings and transcribed analyses. Interview data were analyzed qualitatively using a thematic approach. The coding of transcripts was done to identify the emerging themes and recurrent topics among the presenters. Specifically, the analysis attempted to encapsulate the lecturers' views about the embedding of ESD within ECS and their encounters as well as their understanding of ESD.

At the close of this research, the combined use of questionnaires together with students and interviews with the lecturers turned out extremely useful. The survey provided a broadened viewpoint into what the student participants felt about their studies in this context. A general outlook on their thoughts on incorporating EDS into ECS was determined by identifying common themes and patterns obtained during data analysis from the surveyed and interviewed sample pool.

**RESULTS**

1. **Students’ Perspectives**

1.1 **Awareness and acceptance**
Table 1 shows that 60% of students (59.3) highly acknowledged the need for incorporating ESD in ECS. In addition, 38.9% of participants showed a high propensity in favor of the incorporation of sustainable development in ECS. Over 84% of students agree that computer science students must attain sustainability literacy. Nonetheless, only half of these students admitted to the integration hurdles. Therefore, sustainable growth is not considered among their topics in class at present. For example, approximately half of the students (about 51.9%) simply would not confirm that they are aware of the ESD concept associated with the English version of computer science concepts. Additionally, 7.4% of them did not admit that they recognized the mentioned ESD concept. This showed that students were largely ignorant about ESD hence the requirement to institute learning materials to bridge the void. Students should have a better comprehension of the ESD concept and how to apply it in their assignments.

Table 1. Results of the questionnaire.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Alternative Answers</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>1</td>
<td>I believe that integrating ESD concepts into ECS is necessary.</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>I believe that computer science students must acquire sustainability literacy.</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>I notice the challenges in integrating ESD in ECS.</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>I recognize ESD concepts linked to computer science in English.</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>I believe it is important to have effective communication about sustainable development in ECS.</td>
<td>0%</td>
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</table>

1.2 Effective and convenient communication

Table 2 indicates that almost fifty percent of students opted for neutrality regarding their willingness to discuss ESD linked to computer science in English. Meanwhile, a substantial number (33.4%) specify a willingness to talk about the specific topic. Less confidence in willingness to use sustainable development-related vocabulary in English (24.1% in combination) is balanced with the number of students who disagree with that. Only less than twenty percent of students often read articles or texts in English related to sustainable development.

The biggest portion (48.1%) chose to neither agree nor disagree to talk about ESD linked to computer science in English. Almost a fifth of students said they disagreed. There was a balance of mixed opinions on being confident in using sustainable development-related vocabulary in English although the majority remained in a neutral position. Only 22.2% (a combination of strongly agree and agree) admitted that they often read articles or texts in English related to sustainable development, indicating that it was not familiar to the majority of students. A bigger number of students (27.8%) disagree that they do not have problems discussing the environmental impact of transmitting, processing, and saving data in English. That number is bigger than a combination of students who agree and strongly agree, demonstrating that did have problems. However, almost all students (a combination of agree and strongly agree, 98.1%) believe that integrating ESD into ECS will help them talk about sustainable technology.
1.2 Effective and convenient communication.

<table>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>1</td>
<td>I will feel comfortable talking about ESD linked to computer science in English.</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>I will be confident in using sustainable development-related vocabulary in English.</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>I often read articles or texts in English related to sustainable development.</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>I don’t have problems talking about the environmental impact of transmitting, processing, and saving data in English.</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>I believe that integrating ESD into ECS will help me in talking more about sustainable technology.</td>
<td>0%</td>
</tr>
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</table>

1.3 Motivation and attention

As illustrated in Table 3, most of the students strongly agreed and just agreed that they would participate in the environment sustainability projects on computer course for English, get motivated on sustainable development in computer science, and feel convinced that introducing ESD to ECS improves learning generally. Many of the students will like ECS English vocabulary of sustainable development and will be glad to give their whole to master sustainable development in ECS.

<table>
<thead>
<tr>
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<th>Statement</th>
<th>Alternative Answers</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>1</td>
<td>I will be keen to participate in projects connected to sustainable development in computer science in English.</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>I will be motivated to learn about sustainable development linked to computer science in English.</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>I believe that integrating ESD into ECS will boost my overall learning experience.</td>
<td>0%</td>
</tr>
</tbody>
</table>
4. I will be interested in English vocabulary related to sustainable development in a computer science context.  

| Alternative Answers | 0% | 0% | 3.7% | 33.3% | 63% |

5. I will be enthusiastic to spend time and give my best effort to learn sustainable development in ECS.

| Alternative Answers | 0% | 0% | 1.9% | 61.1% | 37% |

1.4 Engagement

Concerning engagement, Table 4 shows that about 70.4% of the population strongly agree that they would like to investigate how sustainable technology can address ecological and societal concerns. At the same time, only 3.7% of them remain indifferent. The majority of the students feel that they need to understand sustainability ethics when it comes to English. In respect of the enthusiasm shown towards participation in English debate or discussion concerning sustainability in their field, 44.4% stand on a neutral ground while the percentage is much lower among students who either agree, that is 18%, or strongly agree, that is 7%. Almost all the students support the inclusion of English service learnings or community engagements surrounding sustainability in ECS, though they cannot express themselves well when it comes to engaging in discussion or debate. In addition, they demonstrate an eagerness to participate in social events and communication (a combination of 98.2%).

Table 4. Engagement.

<table>
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<th>No.</th>
<th>Statement</th>
<th>Alternative Answers</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>1.</td>
<td>I am eager to explore how sustainable technology can overcome environmental and social challenges in ECS.</td>
<td>0%</td>
</tr>
<tr>
<td>2.</td>
<td>I believe learning about sustainability ethical considerations related to computer science in English is a must.</td>
<td>0%</td>
</tr>
<tr>
<td>3.</td>
<td>I will be excited to participate in English discussions or debates about sustainable development in computer science.</td>
<td>0%</td>
</tr>
<tr>
<td>4.</td>
<td>I think it is important to incorporate English service learning or community engagement activities related to sustainable development in computer science.</td>
<td>0%</td>
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</table>
5. I am willing to actively engage in activities and discussions related to sustainable development in ECS.  

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>1.9%</td>
<td>51.9%</td>
<td>46.3%</td>
<td></td>
</tr>
</tbody>
</table>

1.5 Career preparation

The last item is related to career preparation. Table 5 shows that more than three-quarters (75.9%) of the student state that their interest lies in learning about career opportunities while less than a quarter (22.2%) of them agree with their area of interest. Also, most learners affirmed that including ESD in ECS will better prepare them for employment while enhancing their future careers. Sixty-three percent strongly agree while thirty-five points three percent agree that they will work together with their fellows or others for the sustainability development projects related to computer science, in England.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Alternative Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I will be interested in learning about career opportunities in sustainable computing.</td>
<td>0% 0% 1.9% 22.2% 75.9%</td>
</tr>
<tr>
<td>2.</td>
<td>I believe that integrating ESD into ECS will improve my future career prospects in Computer Science.</td>
<td>0% 0% 1.9% 44.4% 53.7%</td>
</tr>
<tr>
<td>3.</td>
<td>I think integrating ESD into ECS will prepare me to compete for a sustainable computer science career.</td>
<td>0% 0% 1.9% 33.3% 64.8%</td>
</tr>
<tr>
<td>4.</td>
<td>I believe that integrating ESD into ECS will allow me to be an aware and more responsible computer science worker in the future.</td>
<td>0% 0% 3.7% 40.7% 55.6%</td>
</tr>
<tr>
<td>5.</td>
<td>I will collaborate with classmates or others on sustainable development projects linked to computer science in English.</td>
<td>0% 0% 1.9% 35.2% 63%</td>
</tr>
</tbody>
</table>

2. Lecturer’s Perspectives

2.1 Understanding of ESD integration

The three lecturers have different perceptions about the importance of integrating ESD into their teaching practices within the ECS program. Integration was supported by Lecture 1 and Lecture 2 by pointing out its contribution to students’ understanding as a complete package and also students’ career development. It will help students to note that
they can make ethical choices as well as work in interdisciplinarity. On the other hand, Lecturer 3 holds that the integration should be opposed, considering it irrelevant to the purely analytical techniques in computer science and classifying it among the optional electives only. Therefore, more talks and deliberations have to be initiated by all the primary stakeholders in this issue such as educators, administrators, and students so that they may agree on the most suitable strategy of incorporation of sustainability principles in the ESC curriculum. An agreement would be based on many factors including those that would focus on what the ECS was aimed at achieving.

2.2 Recognized knowledge and skills

The various perspectives of all of the lecturers as far as the relevant knowledge and skills regarding sustainability, are important for ECS pupils. Lecturer 1 focuses on ethical communication in decisions among its students which takes into account their impact on society and the environment. Such technologies will enable students to make advancements sustainably. The second lecturer stresses the importance of systemic thinking and trans-disciplinary cooperation to deal with multiplexed sustainability problems. This perspective posits that sustainability usually involves consideration of interconnected systems and interdisciplinary cooperation. Through adopting systemic thinking principles and promoting teamwork, ECS students will gain expertise in holistic approaches to dealing with sustainability matters. However, Lecturer 3 is against including sustainability in ECS education. However, she does not suggest what knowledge and skills the ECS students should imbibe. The absence of concrete recommendations suggests that there are some unclarities or omissions in the perception of the importance of competencies related to sustainability within ECS teaching.

2.3 Benefits and drawbacks of integration

The lecturers (Lecturers 1 and 2), on the other hand, bring up several advantages of integrating education for sustainability in ECS. They argue that these include: ethical awareness, good career outcomes, systems thinking, innovativeness, social responsibilities, and promotion. These benefits conform with the general objectives of fostering citizenship awareness, appreciating international challenges, and developing eco-friendly solutions to worldwide problems. On the contrary, Lecture 3 is concerned with issues such as the irrelevancy and possible drawbacks to integration like diverting attention towards non-technical competencies and limiting available resources. She argued that computer science is an individual discipline different from sustainable development while stating clearly that ECS is just a general course offered within a computer science program which should not be complex. It implies that one should explore these advantages as well as discuss the limitations of curriculum design, allocation of resources as well as point of view of lecturers.

2.4 Teaching strategies

Lectures 1 and 2 on incorporating SD in ECS. Lecturer 1 proposes project-based learning wherein learners work on sustainability issues relating to computer sciences, share ideas in English and eventually suggest solutions at the school or community level as well as internationally through the use of internet communication tools. The second lecturer praises organizing debates or role-playing on sustainable development. The language to be used as a medium should be English. The objectives of these strategies are to improve students’ language, thinking, and problem-solving skills. However, Lecturer
3 considers those teaching strategies inapplicable, referring to them as not relevant and unmotivating, stating they should be offered as a separate elective course. However, these high points on the need to consider existing pedagogical approaches for incorporating sustainability into ECS.

2.5 Resources and support

They discuss the instructional materials, teaching aids, and other support required to integrate sustainable development in ECS by lecturers 1 & 2. Lecture 1 identifies how it would be possible to create straight and multimedia materials within a cooperation group with ECS lecturers, instructional designers, and sustainability experts. Lecture 2 emphasizes employing technology, which involves the use of gadgets or the internet for worldwide understanding and broad-ranging collaboration. Lecturer 3 is worried about economic implications, the need for syllabus alteration, and infrastructure reforms. This section focuses on the role of institutional support and a resource as an asset to facilitate integration effectively.

Generally, the concept of integrating sustainable development in this ECS program has been strongly supported but with differing views and challenges. There will be a need for consensus-building among stakeholders, handling resource limitations, and creation of suitable instructional methods that will enhance successful integration.

DISCUSSION

This study has major implications for higher education across the globe, ECS curriculum designers as well as those involved in teaching computer science. Such strong student support for ESD integration is indicative of increased consciousness of sustainable challenges in the CS world (Abernethy & Treu, 2014; Gordon, 2010; Nwankwo & Njoku, 2020; Rashid, 2019; Swacha et al., 2021). Therefore, the study emphasizes that good communication skills for better vocabulary sustainability are paramount (Agyeman, 2005; Koniukhov & Osadcha, 2020; Sterling, 2001; Sterling & Thomas, 2006). These are necessary abilities that future computer scientists will use when discussing with their colleagues around the globe.

The varying views among ECS lecturers point out that the incorporation of ESD in technical fields is a challenging undertaking (Brahmbhatt et al., 2020; Ozden, 2021). Some lecturers appreciate the positive results that may come along with it while others question its relevance and compatibility to the learning process. Such disparities in ideology necessitate an all-encompassing deliberation between participants toward forging integrated policies suitable for ECS systems. In addition, it highlights the importance of continued learning and capacity building among tutors in ESD pedagogy integration.

These findings point to the significance of including students in ESD to improve their chances for employment, to improve their sense of accountability, and therefore make a real contribution to ethically acceptable technology development. The adoption of the ESD to ECS program empowers technology innovation. These institutions produce many generations of qualified computer scientists who understand ESD from a broader perspective of sustainability. These show that ESD inclusion can improve students’ career possibilities as well as make them ethically conscious in contributing towards sustainable ICT/technology developments. In this way, institutions can help produce a generation of qualified computer scientists with a comprehensive view of sustainability.
CONCLUSION

The incorporation of ESD in ECS brings out the great role that educational institutions can play in enhancing sustainable development by preparing learners with relevant knowledge and experience needed to tackle environmental and societal problems in the information technology arena. The study found that by doing surveys with students and lectures, there were important lessons learned concerning the pros, cons, and opportunities associated with integrating ESD into ECS.

The student’s strong support for the integration of ESD into ECS was evident from the survey result. Most of the respondents noted that it is vital to include sustainability aspects within their study. They showed their intent to get involved in topics concerning sustainability and to participate in sustainable development activities, including discourse. Nevertheless, issues of efficient communication and vocabulary were clear pointing towards language-specific assistance. The results showed that these students were also keen on investigating whether sustainable technologies could be the solution to a range of environmental and social problems.

Interviews with ECS lecturers offered an insightful understanding of how they perceive ESD integration in ECS. There were two lectures, which stressed the expected gains concerning ethics, possible employment opportunities, and cross-cultural approach to learning. The emphasis on communication, system thinking, and ethics in decision-making will help ECS students prepare for a safe future environment. On the other hand, one lecturer was skeptical of ESD integration and thought that it should be done as a separate elective course. The multiplicity of views also shows the difficulty in incorporating sustainability notions into techniques.

As a result, the researchers found out that most learners and instructors agreed with the fact that ESD should be injected into ECS. The students acknowledged the need for sustainability to be included in the curricula with ease of communication. This would ensure that they remained engaged and excited about the topic. Secondly, the learners believed that the incorporation of ESD would also help them prepare adequately for their profession since they are bound to meet sustainable demands within the computer sector.

The incorporation of ESD within ECS is quite intricate to accept yet its implications are far-reaching. This does not mean a blanket approach where all institutions have to integrate in the same manner; rather, each institution ought to use its context to adapt integration strategies. As starting points for institutions considering using ESD in their ECS, this research presents its findings. These perceptions will allow institutions to understand what challenges they may encounter and opportunities they could capitalize on since they are looking at the perspectives of the students and lectures about ICT Integration.

Integration of ESD could make ECS more student-centered and socially relevant. By providing ECS students with relevant knowledge and skills to build environmentally conscious and ethically appropriate solutions, educational institutions will nurture prospective computer scientists with awareness of the impact of their jobs on society’s development. More research and investigation need to be done on how best to customize the integration of ESD into ECS for different education environments so that it continues to enhance sustainability within the field in question.
REFERENCES


