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STUDENTS' PERCEPTIONS OF SUSTAINABLE SMARTPHONE DESIGN: A CASE STUDY AT THE UNIVERSITY OF CENTRAL LANCASHIRE

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ABSTRACT

Smartphones are the most commonly used devices in universities, accounting for 66.74% of device usage, compared to 42.80% and 6.61% computer/laptop and tablets/iPads usage, respectively, but present a significant environmental challenge throughout their lifecycle. Sustainable smartphone design emerges as a critical approach to mitigate these environmental concerns; hence, this qualitative study sought to explore students' awareness and perceived value of sustainable smartphone design at the University of Central Lancashire (UCLan). Specifically, the study aimed to determine students' understanding and awareness of sustainability in smartphone design at UCLan, and to explore UCLan students' perceived value of sustainable smartphone features. This study adopted a qualitative exploratory research design, where data were collected using semi-structured interviews from twelve UCLan students who were sampled using a purposive sampling technique. The study revealed that while students possessed a general understanding of sustainability concepts such as recycling and reusing, their knowledge of how these principles apply to smartphone design is still limited. The study also found that students valued energy efficiency and end-of-life management practices, such as trade-in and recycling programs, viewing them as tangible and convenient sustainability features. This study concludes that sustainable transformation in smartphone consumption among students requires a dual approach, involving the strengthening of sustainability education within higher learning institutions and the promotion of industry practices that align environmental responsibility with functionality and affordability.

KEYWORDS: Sustainable Smartphone Design, Students' Awareness, Perceived Value, University of Central Lancashire, Eco-Design

1. INTRODUCTION

In modern society, smartphones have become a pervasive technology and have profoundly influenced the various aspects of our daily lives, particularly among university students (Kaysi *et al*., 2021). The ubiquity of smartphones has driven their multifunctionality, portability, and accessibility, thus making

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them indispensable tools for communication, education, and daily organization (Alshare *et al*., 2024). Younger demographics have been the major adopters of smartphones, compared to other age groups. For instance, the usage rate for individuals aged between 10 and 30 is 80%, while 30 to 50 is 90% and above 50 years is 60% (Stefanou et al., 2024). In educational settings, smartphones are the most commonly used devices, accounting for 66.74% of device usage, compared to 42.80% and 6.61% computer/laptop and tablets/iPads usage, respectively (Djeki, *et al*., 2024).

Smartphone integration into the educational environment is a critical aspect of modern university life, reflecting the "4th industrial revolution," which involves addressing circular economy principles and product information for consumers (Bigerna *et al*., 2021). Universities have increasingly incorporated new information and communication technologies, thus becoming "learning organizations" that emphasize independent and meaningful learning (Yesa *et al*., 2020). However, the extensive smartphone usage by universities has raised concerns about problematic smartphone use, characterized y compulsive smartphone use and is linked to anxiety, depression, and sleep disturbances (Alshare *et al*., 2024). While these studies have identified the negative impact of smartphone use on academic performance, other research, such as Lin *et al*. (2021), indicated that, when smartphones are used appropriately, they can motivate better academic outcomes. Lin *et al*. (2021) further perceived that usefulness and ease of use of smartphones are significant factors influencing students' intention to continue using them for academic purposes.

The adoption of smartphones offers numerous societal benefits, but also presents significant environmental challenges throughout their lifecycle, from production to disposal. Environmental concerns primarily revolve around carbon emissions, resource depletion, and electronic waste (e-waste) (Alejandre *et al*., 2023). Sustainable smartphone design emerges as a critical approach to mitigate these environmental concerns, encompassing principles such as modularity, recyclability, energy efficiency, ethical sourcing, and enhanced longevity (Bigerna *et al*., 2021). Sustainable smartphone designs have integrated these principles to minimize these ecological impacts and promote a circular economy model (Bigerna *et al*., 2021). In essence, sustainable smartphone design represents a paradigm shift from a linear "take-make-dispose" model to a circular one, where resources are conserved, waste is minimized, and environmental and social costs are reduced across the entire product lifecycle (Bigerna *et al*., 2021). Due to the inherent characteristics of university students, such as high levels of digital device usage, they represent an ideal demographic for studying digital device consumption and its potential influence on sustainable consumption patterns (Bigerna *et al*., 2021).

Most studies on sustainable smartphone design target university academics, with few directly focusing on students' awareness and appreciation of smartphones (Rathnayake *et al*., 2024). Where students are involved, the focus is often on green consumerism broadly, not specifically on smartphone design (Mbokane & Modley, 2024). Although sustainability is a key global agenda, for instance, UN SDG 12, studies consistently show that students' smartphone purchasing decisions are primarily driven by

factors such as camera quality, brand prestige, price, and product features, rather than environmental or sustainability considerations (Sharmin, 2025; Yang *et al*., 2025). At the University of Central Lancashire (UCLan), where sustainability accounts for a significant part of the academic programs, there is a need to assess whether students understand and are aware of the value of sustainability in smartphone design.

In regard to the above problem, this qualitative study aimed to explore students' awareness and perceived value of sustainable smartphone design at UCLan. The study's purpose was guided by the following specific objectives:

a) To determine students' understanding and awareness of sustainability in smartphone design at the University of Central Lancashire

b) To explore the University of Central Lancashire students' perceived value of sustainable features of smartphones.

2. LITERATURE REVIEW

2.1 Sustainability and Sustainable Design

Sustainability in product design is conceptualized through the triple bottom line, which encompasses economic, social, and environmental issues (Mengistu *et al*., 2024). Taramsari *et al*. (2025) indicated that sustainability frameworks emphasize a holistic approach, while others predominantly focus on the environmental impacts, with economic and social aspects. Sustainable product design aims to improve sustainability across the entire product life cycle by considering factors such as quality, reliability, manufacturability, costs, resource use, social well-being, and waste (Mengistu *et al*., 2024). Mengistu *et al*. (2024) indicated that even though eco-design products are widely promoted, their adoption is limited; hence, there is a need for cross-functional collaboration. Zwicker *et al*. (2023) identified Fairphone, Apple, and Samsung as examples of sustainable smartphone design

Cradle to cradle, circular economy, and life cycle thinking provide a theoretical underpinning to the adoption of sustainable smartphones (Amend *et al*., 2022). Sustainable smartphone design should address environmental, social, and economic dimensions using eco-design and circular economy principles. Modular design and circular business models such as Fairphone demonstrate environmental and social benefits, but face economic and consumer adoption challenges (Amend *et al*., 2022; Junge, 2023). While frameworks like the triple bottom line and circular economy are widely endorsed, practical implementation is hindered by trade-offs between sustainability and consumer preferences, and by the need for industry-wide collaboration (Junge, 2023; Mengistu, *et al*., 2024). Achieving truly sustainable smartphone design requires integrating these frameworks.

Awareness of sustainability refers to individuals' knowledge and consciousness about sustainability issues and solutions. Alsaati *et al*. (2020) agree that many students are familiar with the term "sustainability" in a general sense, often associating it with environmental issues like pollution, but

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lack a detailed understanding of how sustainability applies to electronic devices or smartphone design. Alsaati *et al*. (2020) adds that even when students express concern for the environment, this does not always translate into sustainable behaviors, such as choosing eco-friendly devices or recycling electronics. Alsaati *et al*. (2020); Husban (2025) and Shishakly et al. (2023) provided empirical evidence from Pakistan, Saudi Arabia, Jordan, and the UAE that reveal that while students may have heard of sustainability, most lack in-depth knowledge of its technology application. For instance, 71% of Pakistani students were unaware of sustainability in their field, and Saudi students struggled to recognize sustainable materials or practices. Angelaki *et al*.'s (2023) study on Greek university students indicated that low initial awareness of the UN Sustainable Development Goals (SDGs), but educational interventions significantly improved their understanding and intention to act sustainably. Hajj-Hassan *et al*.'s (2024) systematic review indicated that digital tools and immersive education methods such as VR, have been shown to enhance sustainability awareness and engagement

Despite moderate or high concern for sustainability, students often do not act on this knowledge when making purchasing decisions for electronic devices (Alsaati, *et al*., 2020; Angelaki *et al*., 2023). Embedding sustainability into university curricula—through dedicated courses, practical experiences, and digital tools—significantly raises both awareness and pro-environmental behaviors (Alsaati, *et al*., 2020; Angelaki et al., 2023; Hajj-Hassan, *et al*., 2024). Universities with clear sustainability policies and active engagement, such as fostering higher student awareness, green campus initiatives, and action (Shishakly, *et al.,* 2024). Generally, it is evident that while students globally express concern for sustainability, detailed knowledge and actionable understanding—especially regarding electronic devices—remain limited. Hence, integrating sustainability education into university curricula like in UCLan and leveraging digital tools are effective strategies to bridge the awareness and attitude-behavior gap.

Student awareness of sustainability is shaped by a complex interplay of information sources, socio-demographic factors, institutional environments, and cultural context. Ali *et al*. (2022); Hamid *et al*. (2017); Bedard and Tolmie (2018); and Alfirević *et al*. (2024) indicate that in the USA, Pakistan, and Europe, social media is a powerful driver of sustainability awareness and green consumption intentions among students and millennials globally. Alfirević et al. (2024) and Hamid *et al*. (2017) agree that social media facilitates the rapid dissemination of environmental information and peer-to-peer influence, though the quality and credibility of information can vary. Ali *et al*. (2022) study among millennials indicates that eco-labels, eco-branding, and sustainability messaging from brands positively influence students' green purchase intentions and awareness. Salehi *et al*. (2021) contradict this by stating that the impact depends on perceived credibility and visibility of such labels. Welbeck and Larbi (2025); Essiz and Mandrik (2021); and Mishra et al. (2024) indicate that in the USA and India, peer influence is significant, while in Ghana it is less so, where altruism and personal values are stronger predictors. Essiz and Mandrik (2021) add that family communication can foster or hinder sustainability knowledge. Alsaati *et al*. (2020) and Michel and Zwickle (2021) indicate that classroom

learning and university-led initiatives are among the most effective sources for building deep sustainability knowledge.

On the socio-demographic front, Alsaati *et al*. (2020), Husban (2025), and Salehi *et al.* (2021) indicated that younger students and females often report higher sustainability awareness and pro-environmental behaviors, though effects can vary by region. Kukkonen *et al.* (2018) in their study among university students revealed that students in engineering, agriculture, and environmental sciences tend to have higher sustainability knowledge and attitudes than those in social sciences or business. Alfirević *et al*. (2024) found that socioeconomic status can affect access to information and engagement with sustainability issues, though findings are mixed. On the institutional environment, Alsaati *et al*. (2020), Husban (2025), and Mohammadi *et al*. (2023) studies revealed that universities with strong sustainability policies, green campus initiatives, and curriculum integration significantly boost student awareness and participation in sustainable behaviors. Mohammadi *et al*. (2023) and Dagiliūtė *et al*. (2018) added that leadership, campus culture, and visible sustainability activities are key drivers. Dagiliūtė *et al*. (2018) indicated that students at "green" universities participate more in sustainability activities since they receive more environmental information, though general attitudes may not differ significantly.

In Saudi Arabia and Pakistan, most students first hear about sustainability at university, with social media and peers as secondary sources. However, detailed knowledge and behavioral engagement remain limited (Alsaati *et al.,* 2020; Abbas *et al.,* 2019). Central and Southeast European students' awareness is shaped by personal values, IT usage, and academic discipline, with universities playing a strong role (Alfirević *et al*., 2024; Dagiliūtė *et al*., 2018). In Ghana, sustainability consciousness and altruism are stronger predictors of sustainable behavior than peer influence (Welbeck & Larbi, 2025). In Iran and Japan, self-efficacy and social awareness are key, with gender moderating some effects (Salehi *et al*., 2021). In the USA, classroom learning is the strongest predictor of sustainability knowledge, while parental influence can be negative (Michel & Zwickle, 2021; Bedard & Tolmie, 2018).

2.2 Perceived Value of Sustainable Smartphone Features

Perceived value is the overall assessment consumers make about a product's worth, shaped by multiple dimensions (Sheth & Parvatiyar, 2020). Functional value relates to practical benefits such as durability, repairability, and energy efficiency. For sustainable products, consumers value features that promise long-lasting use, easy repair, and lower energy consumption (Sweeney & Soutar, 2001). While emotional value involves the feelings of responsibility, pride, or eco-consciousness. Choosing sustainable products can make consumers feel they are contributing positively to the environment or society (Sweeney & Soutar, 2001; Sheth, *et al*., 2011). Social value is concerned with how product ownership affects social image. Sustainable products can signal environmental awareness or ethical commitment, enhancing social status among peers (Sheth & Parvatiyar, 2020). Finally, epistemic

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value **r**eflects curiosity and the desire to learn or try innovative, eco-friendly technologies. Consumers may be attracted to sustainable products because they offer new experiences or satisfy a desire for novelty (Sweeney & Soutar, 2001).

Consumers attribute value to sustainable products when they recognize environmental responsibility, such as reduced emissions and ethical sourcing, or ethical production practices, such as fair labor and mindful consumption, as meaningful benefits (Sheth & Parvatiyar, 2020; Sheth *et al*., 2011). However, the strength of each value dimension can vary by individual and context. For example, some may prioritize functional value (durability), while others are more motivated by emotional or social value (feeling responsible or gaining social approval) (Sweeney & Soutar, 2001; Sweeney & Soutar, 2001). Consumers perceived value of sustainable products is multi-dimensional, encompassing functional, emotional, social, and epistemic aspects. Recognizing and enhancing these dimensions can drive greater appreciation and adoption of environmentally responsible and ethically produced goods.

Recent research reveals that consumers perceived value of sustainable smartphone features is multi-dimensional and varies by demographic, with both enthusiasm and skepticism present. Consumers recognize energy efficiency as a valuable feature, associating it with lower operating costs and environmental responsibility. However, this value is often secondary to performance and price, especially among younger users (Radi & Shokouhyar, 2021). Modular design is seen as innovative and empowering, enabling self-repair and extending product life. Users with a higher perceived self-repairability are more likely to engage in repair activities and report positive experiences; however, mainstream adoption is limited by concerns over aesthetics, convenience, and initial cost (Amend *et al*., 2022). Radi and Shokouhyar (2021) add that there is a growing appreciation for recycled materials, especially when brands communicate these efforts transparently. Still, some consumers remain skeptical about durability or associate such products with a lower status or less fashionable design. Radi and Shokouhyar (2021) further stated that social media analysis reveals that consumers increasingly value corporate social responsibility (CSR), including ethical sourcing and fair labor practices, but this is often less influential on purchase decisions than environmental or functional attributes. Amend *et al*. (2022) indicated that extended warranty or trade-in programs are features that are positively received, as they signal durability and brand commitment to sustainability, but their impact on purchase intent depends on perceived convenience and cost.

Students and younger consumers often value innovation and are open to sustainable features, but prioritize affordability and high performance. While they express interest in modularity and ethical production, actual students' purchasing decisions are still heavily determined by brand image and price (Amend *et al*., 2022; Radi & Shokouhyar, 2021). Many consumers, including students, express positive attitudes toward sustainability but do not consistently act on these values, especially when sustainable options are perceived as more expensive or less stylish (Amend et al., 2022; Radi & Shokouhyar, 2021). Consumers—especially students—view sustainable smartphone features as

valuable and innovative, but adoption is tempered by concerns over cost, performance, and style. Bridging the attitude-behavior gap requires brands to align sustainability with affordability and mainstream appeal.

Students perceived value of sustainable products is determined by a combination of economic, psychological, social, and institutional factors. Students are highly price-sensitive and often prioritize affordability over sustainability, especially when green products are more expensive. While some are willing to pay a premium for quality and sustainability, high prices can widen the gap between actual purchase and intention (Roy, 2023; Tu et al., 2018; Naz *et al*., 2020). Lower-income students place greater emphasis on perceived price, making cost a decisive factor in sustainable product adoption (Tu *et al*., 2018). Students are more likely to purchase and value sustainable products from brands they perceive as trustworthy and credible in their sustainability claims. Brand trust reduces skepticism and increases willingness to buy green products (Roy, 2023; Castro-Gómez *et al*., 2024). Sustainability initiatives at universities can enhance institutional trust and commitment, influencing students' perceptions of both university and product brand (Roy, 2023).

Sustainable products must meet students' expectations for design, performance, and aesthetics. If eco-friendly products are perceived as less fashionable or lower performing, their perceived value drops—even among environmentally conscious students (Tu, *et al*., 2018). Friends, experts, and campus campaigns can increase students' intentions to purchase sustainable products by shaping subjective norms and perceived social value (Paladino & Ng, 2013; Theocharis & Tsekouropoulos, 2025). Active sustainability campaigns and visible institutional commitment, for example, at UCLan, can foster a culture where eco-friendly products are seen as more important and valuable (Castro-Gómez *et al*., 2024).

2.3 Summary of Literature Review and Research Gaps

Despite growing interest in sustainability and digital transformation in higher education, there is a notable lack of qualitative research exploring how students interpret and assign meaning to sustainability in smartphone design at the university level. Most existing studies on sustainability in higher education and technology use rely on quantitative methods, such as structural equation modeling and surveys, to assess attitudes, knowledge, and behavioral intentions (Sayaf *et al*., 2021; Alfirević *et al*., 2024; Al-Rahmi *et al*., 2021; Wang *et al*., 2020; Qiang *et al*., 2021). These approaches provide valuable statistical insights but do not capture the nuanced, subjective ways students interpret or make sense of sustainable smartphone design features. Qiang *et al*. (2021) additionally failed to provide specific meanings students attach to sustainable design features in smartphones—such as ethical sourcing, energy efficiency, or modularity — or how these meanings influence their attitudes and behavior. Based on these reviews, there is a need for more qualitative research—such as focus group discussions or interviews—to uncover discrepancies between students' stated attitudes and their actual understanding or practices regarding sustainable smartphone designs. This was especially

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relevant for UCLan, where institutional sustainability initiatives may influence student perceptions in unique ways.

3. MATERIALS AND METHODS

3.1 Research Design

This study adopted a qualitative exploratory research design. This is a type of research design used to investigate phenomena or concepts that are not well understood or have not been extensively studied (Oranga & Matere, 2023). Qualitative exploratory research design is characterized by the collection and analysis of non-numeric data—such as interviews—to gain in-depth insights into participants' experiences, perceptions, and meanings (Akyıldız, 2021). This design was particularly well-suited for investigating students' perceptions, interpretations, and meanings related to sustainable smartphone design since there is limited knowledge related to the concept, and hence nuanced understanding is required. These studies also lack qualitative depth, which this study intended to bridge.

3.2 Data Collection

Semi-structured interviews were used to collect data from selected study participants from UCLan. The use of semi-structured interviews was justified since it integrates the advantages of structured and unstructured interviews and allows the interviewer to ask follow-up questions (Khoa *et al*., 2023). This study interviewed 12 participants, where 11 were interviewed through face-to-face and one through Zoom. The audio collection was then transcribed word for word to capture the exact words from the study participants. Ethical considerations such as signing of the consent form, anonymizing the study participants, and allowing they were also allowed to participate in the study voluntarily. Further, before the start of data collection, ethical approval was obtained from the UCLan Research Ethics Committee

3.3 Sampling

The purposive sampling technique was used in this study. Purposive sampling is widely recognized as an effective and rigorous approach in qualitative research, especially when the goal is to gain an in-depth understanding from information-rich participants who are most relevant to the research objectives (Campbell *et al*., 2020). UCLan students were sampled in this study, since they are digital natives and they heavily depend on smartphones for both academic and personal activities. A sample size of 12 participants was well-justified in this qualitative research, since it particularly aimed to explore in-depth perspectives within a relatively homogenous group (UCLan students), and the research questions are focused and specific. The sample size could also enable the researcher to achieve data saturation.

3.4 Data Analysis

Thematic analysis was conducted using NVivo 14, where emphasis was based on the study participants' sentiments, experiences, and thoughts. NVivo 14 was used to code and organize themes. Thematic analysis allowed the researcher to come up with insights from the collected interview sheets.

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The analysis followed a six-step approach developed by Braun and Clarke (2022). The steps are: i) familiarization with the data, ii) generation of the initial codes, iii) construction of the initial themes, iv) themes review and development, v) naming and defining themes, and finally, vi) report production. This approach was relied on since it emphasized reflexivity, active researcher interpretation, and theoretical transparency.

4. RESULTS

Based on the thematic analysis, three themes and three sub-themes were developed to answer the following research questions:

RQi) What is the level of understanding and awareness of sustainability in smartphone design among students at the University of Central Lancashire?

RQii) How do students at the University of Central Lancashire perceive the value of sustainable features in smartphones?

4.1 General Awareness of Sustainability Concepts but Limited Application to Smartphone Design

This theme was contributed by all 12 study participants, and it answered the research question on the level of understanding and awareness of sustainability in smartphone design among students at UCLan. The majority of the study participants were familiar with concepts such as reusing and recycling, which are related to sustainability, but were not aware of how these concepts could be applied in the context of smartphone use. Concepts like modularity and repairability on smartphones could only be associated with a few study participants. Participant 3 indicated that he was generally aware of sustainability in Samsung smartphone designs, in terms of energy saving, especially Samsung S24 ultra. “Yes, I would say that I am generally aware of sustainability in smartphone design. My Samsung S24 ultra and past Samsung phones that I have used have energy-saving batteries.” On the contrary, Participant 3 added that he was not familiar with terms like modularity and repairability in the context of sustainable smartphone design. “However, I did not know that things like repairability and modularity were part of sustainability.” These assertions were supported by Participant 7, who added recycling as another concept related to sustainability. Participant 11 stated that recycling programs are practical. “To me, recycling programs are practical.”

4.2 Misconceptions about Sustainability in Smartphones

This theme was also identified to answer the research question on the level of understanding and awareness of sustainability in smartphone design among students at UCLan. Study participants identified certain misconceptions about sustainable smartphones. Participant 1 indicated that recyclable products in smartphones only involve the phones’ covering or casing. “I have always known that sustainability in electronics pertains to the use of recyclable materials for the phone's covering or casing.” Participant 3 added that sustainability in Samsung smartphones involves buying

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gadgets with less packaging. “Well, to me, sustainability has always been about buying gadgets that have less packaging. That is why I bought my Samsung Galaxy S7 series, because Samsung claimed that it had reduced the packaging by up to 96.6%."

4.3 Perceived Value of the Sustainable Features

This theme was identified to answer the second research question, on how students at UCLan perceive the value of sustainable features in smartphones. The theme was based on three sub-themes: energy efficiency as the most valued sustainability feature, end-of-life management practices, and variation in the students’ perception of repairability as a valued sustainable feature.

4.3.1 Energy-Efficiency as the Most Valued Sustainability Feature

This sub-theme was contributed by eight study participants who indicated that they value energy efficiency as one of the sustainability features. This helps mobile device users save power and plan their days. Participant 7 indicated that his Xiaomi 13T Pro smartphone allows him not to charge the whole thus allowing him to plan for the day. “Would you imagine that my Xiaomi 13T Pro lasts all day without charging, and sometimes even a whole day and a half if I do use it intensively?” Participant 7 added that for him, an energy-efficient phone was more sustainable. “For me, an energy-efficient phone would be more sustainable because I can freely come to campus without a charger and still have enough charge when I get back home."

4.3.2 End-of-Life Management Practices

This sub-theme was also intended to answer the research question on how students perceive at UCLan value sustainable features in smartphones. It was contributed by seven study participants who indicated end-of-life management as an important sustainability feature. Financial incentives have been associated with end-of-life management practices, such as take-back programs. Participant 8 indicated that he appreciated that he could trade his old phone at a price at EcoATM in the UK and use the amount given for a new phone. "I like that I can be able to trade in my old phone for a price at EcoATM here in the UK, and use to budget for a new phone." Participant 12 indicated that recycling programs are good for disposing of old smartphones. “So, I find recycling programs are good for disposing of old phones without bearing the guilt of e-waste."

4.3.3 Variation in the Perception of Repairability as a Valued Sustainable Feature

This final sub-theme was also intended to answer the research question on how students at UCLan perceive the value of sustainable features in smartphones. The study participants presented contradicting perceptions on the repairability of mobile devices. Those who appreciated the repairability of the devices, since it prolonged the smartphone's lifespan. Sceptical study participants complained about the complexity of repairing or replacing certain parts of the smartphone. Participant 2 indicated that repairability is good theoretically. "It is a good idea theoretically that I can be able to fix my phone without throwing it away when some of its parts malfunction.” But he cannot practically fix the broken parts. “However, I do not think that I am competent enough to pry it open and fix the

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broken parts myself." Participant 4 added that he was not able to find repairable parts for the Huawei phone, as this would allow him to fix the phone. "I am relatively new in the UK, but if knew where to buy the repairable parts to my Huawei phone, I would easily try to fix it, and keep using rather than throw it away."

5. DISCUSSION

The study findings revealed that while UCLan students were aware of the sustainability concepts, such as recycling and reusing, they had limited understanding of these concepts in the context of smartphone design. Few students mentioned features like energy efficiency, modularity, and repairability. These findings were supported by Malik *et al*. (2019) and Alsaati *et al*. (2020), who both agree that university students often associate sustainability with environmental protection but lack detailed knowledge of its technological or design applications. Husban (2025) and Shishakly *et al*. (2023) also add that students' awareness tends to be conceptual rather than practical, indicating an awareness–application gap. These findings were contrasted by Angelaki *et al*. (2023), who indicated that sustainability education integrated into ICT curricula significantly improved students' understanding and ability to apply sustainability concepts to technology. Despite the embedding of sustainability programs into the UCLan curricula, there is limited understanding of these programs in smartphone design. The study also revealed the misconceptions—such as equating sustainability only with recyclable packaging, which was supported by Alsaati *et al*. (2020) and Michel and Zwickle (2021), who highlighted that limited sustainability literacy leads to oversimplified interpretations.

Energy efficiency was the most valued sustainability feature in smartphones among the students. These students appreciated long battery life and low energy consumption on smartphones, associating them with convenience and reduced environmental impact. This finding aligned with Radi and Shokouhyar (2021) and Sweeney and Soutar (2001), who identified functional value, such as durability and energy efficiency, as a key driver of consumer appreciation for sustainable products. Amend *et al*. (2022) added that users value energy-efficient and modular devices for their extended usability and lower operating costs. End-of-life management practices, such as recycling and trade-in programs were also identified as perceived value of sustainable smartphone features. This finding was consistent with that of Roy (2023), who emphasized that such programs enhance perceived brand responsibility and sustainability credibility. Student references to EcoATM trade-ins mirror consumer preferences for convenience and financial incentives reported by Radi and Shokouhyar (2021). The study revealed mixed perceptions regarding repairability, illustrating a persistent gap between theoretical appreciation and practical adoption. This was in tandem with findings of Amend *et al*. (2022), who found that while modularity and repairability are central to sustainable design, consumer adoption is hindered by barriers like usability, aesthetics, and cost. Similarly, Bigerna *et al*. (2021) and Junge (2023) noted that despite circular economy principles promoting repairability, market preferences still favor convenience and brand aesthetics.

Study findings revealed that awareness of sustainability and perceived value of sustainable smartphone features are interrelated but not necessarily mutually reinforcing. This implies that UCLan students' general awareness of sustainability does not automatically translate into valuing or acting upon sustainable smartphone attributes. This finding was supported by Sheth and Parvatiyar (2020), who argued that sustainable marketing must connect consumer values to tangible benefits. The integration of sustainability programs into the UCLan curricula may have raised general awareness, but has not yet influenced specific behavioral outcomes. This was consistent with Mohammadi et al. (2023) and Dagiliūtė *et al*. (2018), who found that "green universities" improve awareness but not necessarily consumer action. This finding implied that there is a need to enhance behavioral impact by integrating hands-on sustainability experiences and linking them directly to technology, as this could bridge this gap.

6. CONCLUSION

This qualitative study explored students' awareness and perceived value of sustainable smartphone design at UCLan. The study revealed that while students possessed a general understanding of sustainability concepts such as recycling and reusing, their knowledge of how these principles apply to smartphone design is still limited. This is particularly prominent in areas like modularity, repairability, and ethical sourcing. The study also found that students valued energy efficiency and end-of-life management practices, such as recycling and trade-in programs, viewing them as tangible and convenient sustainability features. Generally, the study suggested that while UCLan's sustainability initiatives may have increased general environmental awareness on the campus, there is a need for a more targeted education linking sustainability concepts to everyday technologies. This study concludes that sustainable transformation in smartphone consumption among students requires a dual approach, through strengthening sustainability education within higher learning institutions and promoting industry practices that align environmental responsibility with functionality and affordability. This study recommends that future studies should investigate the impact of educational interventions on consumer sustainability behavior, and also explore the role of marketing strategies in promoting sustainable consumer behavior.

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