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Blended Learning and Sustainable Development

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Synonyms

Blended Learning: hybrid Learning, technology-enhanced learning, technology-mediated learning, mixed mode learning

Sustainable Development: sustainability

Abstract

The concept of blended learning has its origins in the 1960's when new options for technology-mediated education became available to complement conventional approaches to face-to-face teaching in higher education and other contexts. In HE institutions, blended learning has now become so widespread that many regard it as the "new normal" in describing HE approaches to teaching and learning. However, the ubiquity of the blended learning concept in HE is problematic for establishing a common understanding of the concept, which is essential for identifying how it contributes to sustainable development. Blended learning may be defined as the design of learning experiences that draw on a combination of face-face, distance, or online delivery methods, learning technologies, delivery multimedia, and pedagogical methodologies to achieve a mix of learning outcomes in educational or training contexts. Blended learning designs can support sustainable development, including the social, economic, and environmental dimensions of sustainability and protect global environmental resources to meet the needs of the present and future generations. This chapter first examines the various conceptualisations of blended learning in HE teaching and learning systems, and then proceeds to examine contemporary understanding of how HE blended learning provision contributes or might contribute to sustainable development and to the Sustainable Development Goals (SDGs).

Definition

Blended learning may be defined as the design of learning experiences that draw on a combination of face-face, distance, or online delivery methods, learning technologies, delivery multimedia, and pedagogical methodologies to achieve a mix of learning outcomes in educational or training contexts. Blended learning designs can support sustainable development, including the social, economic, and environmental dimensions of sustainability and protect global environmental resources to meet the needs of the present and future generations.

Introduction

The concept of blended learning has its origins in the 1960's when new options for technology-mediated education became available to complement conventional approaches to face-to-face teaching in higher education (HE) and other contexts. There are several synonyms for blended learning, including hybrid, technology-enhanced, technology-mediated, and mixed mode learning, although the term blended learning is probably the most widely accepted term (Spring et al. 2016). Sharma (2010) observes that blended learning was first used in the corporate world to describe workplace learning, using distance-taught printed materials, videos, and the web via the Internet. Graham (2012:335) offers a simple definition of blended learning as the provision of "*learning experiences that combine face-to-face and online instruction*", although there are a variety of descriptions of how learning provision is blended, combined, or mixed.

In HE institutions, blended learning has now become so widespread that many regard it as the "new normal" in describing HE approaches to teaching and learning (Norberg et al. 2011). The New Media Consortium (NMC) Horizon Reports acknowledge that the move to blended learning is one of the top trends in contemporary HE (Adams Becker et al. 2017). Moreover, there are claims that blended learning has the potential to radically transform the design and dynamic of teaching and learning in education (Garrison and Kanuka 2004). This is enabled by the widespread availability of information and communication technologies (ICTs), including the digital resources and technologies utilized in the provision of teaching, learning and assessment, underpinned by ICT infrastructure, such as virtual learning environment (VLE) platforms, networks, servers, and cloud computing services (Caird and Lane 2015).

The ubiquity of the blended learning concept in HE is problematic for establishing a common understanding of the concept, which is essential for identifying how it contributes to sustainable development. Graham (2012:333) states that "*Despite current popularity of the term blended learning, it is defined with considerable variation across institutional contexts.*" This entry first examines the various conceptualizations of blended learning in HE teaching and learning systems, and then proceeds to examine contemporary understanding of how HE blended learning provision contributes or might contribute to sustainable development and to the following Sustainable Development Goals (SDGs), established through the United Nations (UN) General Assembly commitment to the 2030 Agenda for Global Sustainable Development (UN 2015):

- SDG 1 "End poverty in all its forms everywhere."
- SDG 4 "Ensure inclusive and quality education for all and promote lifelong learning for all."
- SDG 12 "Ensure sustainable consumption and production patterns."
- SDG 13 "Take urgent action to combat climate change and its impacts."

The Concept of Blended Learning

While there is general agreement that blended learning refers to a combination of face-to-face teaching and online learning approaches, there are different approaches to the conceptualization and operationalization of blended learning (Graham 2012). A key issue is that blended learning may describe a variety of HE teaching and learning models that utilize ICTs to enhance or replace conventional models for delivering courses and modules. There are at least four main approaches to conceptualizing blended learning that address different combinations, blends or mixes of teaching and learning approaches, learning technologies and delivery multimedia, and pedagogical methodologies. These include:

1. Conventional face-to-face and/or mainly print-based distance teaching and learning approaches blended with technology-mediated online approaches (see Oliver and Trigwell 2005; Graham 2012)
2. A blended selection of learning technologies and delivery multimedia hosted on a virtual learning environment (VLE) platform (see Oliver and Trigwell 2005; Graham 2012)

3. A selection of different pedagogical methodologies underpinning the provision for teaching, learning and assessment, for example, constructivism, behaviorism, cognitivism and transmission learning theories (see Oliver and Trigwell 2005; Graham 2012)
4. Mixed approaches (drawing on the above three approaches) to focus on the intended learning outcomes, for example, a mix of learning outcomes across knowledge, skills, behaviours or competencies (see Oliver and Trigwell 2005)

Difficulties in defining and operationalizing the concept of blended learning are widely recognized. Oliver and Trigwell (2005:24) note that *“The term ‘blended learning’ is ill defined and inconsistently used. Whilst its popularity is increasing, its clarity is not.”* A useful way to operationalize the concept of blended learning is to consider both the quantity and quality of online provision needed in relation to an alternative provision, such as face-to-face teaching or distance learning provision, in the design and delivery of HE courses or modules and qualification programs.

In one approach, Allen and Seaman (2003) classify HE courses based on how much content is delivered online as follows:

- Traditional courses with oral or written delivery and no online learning options (0% online)
- Web-facilitated courses using web-based technology to support mainly face-to-face on-campus teaching (1–29% online)
- Blended/hybrid courses with online learning and face-to-face teaching (30–79% online)
- Online courses with little or no face-to-face teaching (80–100% online)

The Allen and Seaman (2003) classification draws attention to different types of blended learning approaches, including web-facilitated, blended/hybrid, and fully online courses, the last of which is blended in the sense of different learning technologies and delivery media being combined (Allen and Seaman 2003). While this is a useful classification, it assumes that the proportion of online learning provision can be accurately calculated, although this may not be always possible. A similar approach by Jones (2006), albeit not based on quantification, offers a classification of blended learning courses ranging from courses with basic ICT usage (e.g., PowerPoint presentations); e-enhanced courses that supplement face-to-face teaching with access to online resources; e-focused courses that reduce or replace face-to-face teaching with online forums, online assessments and interactive learning materials; and e-intensive courses that are fully delivered online.

Approaches, such as those adopted by Allen and Seaman (2003) and Jones (2006), offer useful, if rather simplistic, classifications that can have a limited facility to discriminate between different models of blended HE teaching and learning provision, particularly in distance HE systems. This draws attention to qualitative issues in the design of HE courses and modules and the ways ICTs are transforming HE teaching and learning delivery. Caird and Lane (2015) developed a new approach to classifying courses and modules by identifying detailed indicators of ICTs and multimedia, including rich multimedia, which create affordances for a more online, interactive, synchronous, and personalized provision for teaching, learning, and assessment with options for integrated teaching materials. This is illustrated by the following examples of ICTs and multimedia that may be used to support the:

- Teaching provision (e.g., structured content, audio/video resources, integrated library resources)
- Learning provision (e.g., online tutorials, game-based learning, virtual 3D laboratory/worlds)
- Communication and collaboration, comprising the use of synchronous tools (e.g., VLE forums, online conferencing) and asynchronous tools (e.g., blogs and social networking media)
- Assessment provision (e.g., plagiarism detection tools, computer-marked assessment/e-assessment, badges of learning)

The approach by Caird and Lane (2015) measures how ICTs are utilised in HE across a planned provision for teaching, learning and assessment. This enables a classification of different HE teaching

and learning models applicable to courses and modules, including conventional face-to-face or mainly print-based distance models and blended ICT-enhanced face-to-face and blended ICT-enhanced distance models and online models. While different approaches to identifying and classifying course or module provision (see Allen and Seaman 2003; Jones 2006; Caird and Lane 2015) may be taken, clarity about the design of different models of HE blended learning provision is an essential step to understanding the outcomes for sustainable development.

Blended Learning and Sustainable Development

In exploring the contribution of HE blended learning to sustainable development, it is notable that both concepts are multifaceted and open to a variety of interpretations, which complicates the understanding of their relationships and outcomes. This entry has already noted a variety of conceptualizations of the blended learning concept, of relevance to understanding the ways the concept is applied in HE teaching and learning design and delivery, and in related empirical studies. Similarly, sustainable development is a broad concept with social, economic, and environmental dimensions. Key sustainable development concerns identified by the World Commission on Environment and Development (WCED) in the Brundtland Report notably address how to achieve intragenerational and inter-generational justice, recognizing the needs of the living, particularly the global poor, and the importance of protecting limited global environmental resources for the future (WCED 1987). However, a review of the available literature reveals that there are no empirical studies directly examining the relationship and/or contribution of HE blended learning to sustainable development. In view of the paucity of empirical evidence, this entry reframes the review of the contribution of HE blended learning provision to examine how it might address each of the key sustainable development concerns across the social, economic, and environmental dimensions and meet the sustainability triple bottom line, identified by Elkington (1999) across social equity, economic prosperity and environmental protection, with reference to specific SDGs (UN 2015).

Blended Learning and Social Sustainability

It is arguable that blended learning as part of HE teaching and learning systems has the potential to promote social sustainability through policies and plans to develop and maintain the availability of quality, inclusive, lifelong education that addresses the United Nations (UN) Sustainable Development Goal SDG 4 to “*Ensure inclusive and quality education for all and promote lifelong learning*”, which recognizes the importance of quality and equitable education at primary, secondary and tertiary levels (UN 2015). While the extent to which HE institutions address such goals is subject to much academic discourse, few studies have examined the benefits of blended learning as part of HE teaching and learning systems, with reference to delivering inclusive, quality, and lifelong learning.

The integration of ICTs and rich multimedia in blended learning offers more options for providing **inclusive** education online by removing spatial-temporal barriers to learning, thereby offering students unprecedented flexibility to learn at a time and place of their choice (Caird and Lane 2015) and wide access to learning opportunities (Adams Becker et al. 2017). Moreover, ICTs and rich multimedia enable the development of innovative pedagogies (Sharples et al. 2015), which are generally supportive of the SDG 4 to ensure **quality** education at all levels. This is exemplified by innovative pedagogies such as advanced learning analytics supporting individualized and individual-paced learning, crowd learning allowing students to share ideas online, and remote access to laboratories permitting scientific experimentation by students who may not otherwise have access to such facilities (see Sharples et al. 2015). The NMC Horizon Report claims that blended learning approaches support the provision of quality education through improving independent study, self-paced learning, and student creativity (Adams Becker et al. 2017). There are also claims that **lifelong**

learning is supported using a blend of ICT and rich delivery multimedia through HE online learning systems, including the provision of open educational resources (OER) and massive online open courses (MOOCs) (Lane et al. 2014).

Few empirical studies have examined the outcomes of blended learning provision; one longitudinal study in Spain conducted with a large undergraduate student population at the University of Granada examined students' experiences of blended learning provision and found that it has positive pedagogical impacts on student retention levels and improved exam results (López-Pérez et al. 2011). In a US study, Tseng and Walsh (2016) compared the experiences and perceptions of students on a blended and a traditional face-to-face taught undergraduate course at Jacksonville State University, using a range of instruments to collect in-depth data on their learning motivation, learning outcomes, skills, and achievements. This study found that blended learning provision improved students' confidence, learning motivation, and satisfaction (Tseng and Walsh 2016), which is attributable to the affordances of blended learning for facilitating individualized, independent, and self-directed student learning. Moreover, Spring et al.'s (2016) research with leading international academics and researchers specializing in blended learning, confirmed the value of blended learning provision for student engagement, personalized learning, and enhanced learning outcomes. While there is some evidence that blended learning supports quality, inclusive, and lifelong education, more empirical research is needed to develop the evidential base for claims that blended learning improves pedagogical outcomes for students (Halverson et al. 2012) and to clarify the ways different blended learning designs improve learning outcomes (Graham 2012).

It is interesting to note that if, as it has been claimed, HE blended learning systems are becoming the "new normal" (Norberg et al. 2011), it will become increasingly appropriate to extend considerations of the role of HE blended learning approaches to the more general contribution of HE to sustainable development. An important United Nations Educational, Scientific and Cultural Organization (UNESCO) sustainability initiative called "Education for Sustainable Development" (also known as Sustainability Education and Education for Sustainability) has focused on greening the curriculum to support the UN SDGs, established at the time of the 2012 Rio +20 United Nations Conference on Sustainable Development (UNESCO 2014). This includes meeting SDG 4 targets to integrate key sustainability concepts across the curriculum (target 4.7) through the Global Partnership for Sustainable Development framework (UN 2015) as discussed in the "Sustainable Higher Education Systems" entry in this encyclopedia (Caird and Roy 2018). Most recently, MOOCs have been created to deliver online, large-scale, widely accessible "Education for Sustainable Development" curricula to promote pro-environmental behaviors worldwide (UNESCO 2014).

Blended Learning and Economic Sustainability

It is arguable that HE blended learning approaches have the potential to promote economic sustainability through policies and plans to develop and maintain accessible educational services that are economic, efficient, and effective over time and so deliver economic benefits. For HE institutions, there is the potential to use blended learning approaches with some level of online delivery in educational programs to reduce staff time, cut costs, and develop business models to support larger student populations through both efficiencies and economies of scale, thereby improving financial sustainability. For the student, this may reduce the costs of tuition, travel, and residential accommodation, although any cost-savings may be sometimes fully appropriated by HE institutions. For public bodies, there is the potential to demonstrate that blended learning delivers value for money and a good return on public investment in education.

The contribution of HE blended learning to economic dimensions of sustainable development may be considered with reference to SDG 1 "*End poverty in all its forms everywhere*" (UN 2015). This SDG

identifies “*limited access to education*” as a form of poverty, in view of its importance for gaining employment, promoting equality, accessing services, and enabling participation in local and national decision-making. It is clearly also relevant to UN SDG 4 targets to ensure equal access to affordable and quality tertiary education by 2030 (target 4.3). Addressing the constraints on the availability, affordability, accessibility, and acceptability of study opportunities is central to wider participation in HE (Lane et al. 2014) and ultimately to the performance of economies worldwide.

As yet, few studies have been published that examine the financial and economic benefits of blended learning as part of HE teaching and learning systems. The NMC Horizon Report claims that the integration of ICTs and multimedia in learning provision offers students accessible, lower-cost learning opportunities (Adams Becker et al. 2017). Moreover, a UNESCO report claims that online learning approaches can reduce costs, which should also apply to some forms of blended learning (UNESCO 2014). It is clear that cost-cutting is often a key HE institutional driver for developing blended learning approaches (Spring et al. 2016). It is expected, therefore, that HE institutions would have financial data on the benefits of transition from conventional HE approaches to a blended learning provision, although whether this information is publicly available is a different matter. Clearly more empirical research is needed to address claims that blended learning improves cost-effectiveness for HE institutions and deliver benefits for the economy (Halverson et al. 2012).

Blended Learning and Environmental Sustainability

There is the potential for blended learning as part of HE teaching and learning systems to promote environmental sustainability through policies and plans that attend to the design and delivery of HE teaching and learning curricula to reduce negative environmental impacts, energy consumption, and greenhouse gas emissions and to sustain ecosystem services over time. This is relevant to SDG 12 to “*Ensure sustainable consumption and production patterns*” and SDG 13 “*Take urgent action to combat climate change and its impacts*” (UN 2015). A significant challenge for HE is how to develop sustainable HE systems in terms of the design, production and delivery of teaching and learning on courses, modules and qualification programs, as discussed in the “Sustainable Higher Education Systems” entry in this encyclopedia (Caird and Roy, 2018). Few studies have examined the influence of HE teaching and learning models on the environment, in terms of energy use and carbon dioxide emissions, and of those available studies, even fewer have focused on blended learning approaches. However, the proliferation of ICTs transforming HE over past decades and the increasing prevalence of blended learning approaches create new research challenges for understanding the impacts of different HE teaching and learning models. Here we examine empirical studies that inform understanding of the influence of blended learning provision on aspects of environmental sustainability as part of distance and campus-based HE systems.

Several studies, notably the Factor 10 visions study “Towards Sustainable Higher Education” (Roy et al. 2005; Roy et al. 2008) and the SusTEACH “Sustainable Teaching Models” project (Caird et al. 2015a), have examined the environmental impacts of different HE models of teaching and learning on courses and modules in the UK, which included blended learning approaches. These studies involved an environmental audit of HE courses and modules in UK institutions to include staff and student travel; the purchase and use of computers, printed educational materials, and paper; student residential energy use; and campus building energy and site operations. This enabled an assessment of the energy use and carbon dioxide emissions associated with different HE models of teaching and learning of courses and modules in campus-based and distance HE systems, which is relevant to SDG 13 “*Take urgent action to combat climate change and its impacts*” (UN 2015).

The Factor 10 Visions study compared several distance learning courses delivered by blend of print and online materials with some supportive face-to-face, telephone, or online tuition with distance-

taught courses delivered by mainly printed educational materials. This found that the distance learning courses, which blended print with online provision, offered only a small reduction in energy use and carbon dioxide emissions (20% and 12%, respectively) when compared to mainly print-based distance-taught courses. This relatively small reduction was explained by the high student use of computing and consumption of paper for printing off web-based online material (Roy et al. 2005). However, comparisons between the distance-taught HE courses, including the courses with a blended learning provision, and the conventional campus-based courses revealed that on average the production and delivery of the distance HE courses used 87% less energy and produced 85% fewer carbon dioxide emissions than the campus-based courses when standardized per hundred student hours of planned teaching and learning.

Opportunities to extend the examination of the impacts of HE blended learning approaches on energy use and carbon dioxide emissions in both campus-based and distance HE systems were addressed through the SusTEACH project. This study first developed a new classification of HE courses and modules in UK institutions based on their primary teaching and learning model (Caird and Lane 2015) as outlined in the above section “The concept of blended learning”. It then conducted an environmental assessment and calculated the energy use (in megajoules) and carbon dioxide emissions (in kilograms) associated with different HE teaching and learning models when standardized per student per hundred study hours (Caird et al. 2015b). This found that the average energy use and emissions associated with HE teaching and learning models per student per hundred study hours were from lowest to highest as follows: online models, blended ICT-enhanced distance models, print-based distance models, blended ICT-enhanced face-to-face teaching models, and conventional campus face-to-face models (Caird et al. 2015a).

As with the Factor 10 study, within the HE distance teaching system, blended ICT-enhanced HE models were comparatively better than the print-based distance teaching models at reducing energy use and carbon dioxide emissions (Roy et al. 2008), although these reductions were small relative to the significant reductions associated with online teaching and learning models (Caird et al. 2015a). The picture was more complex in campus-based HE systems when examining blended ICT-enhanced face-to-face teaching models, which only achieved slightly lower impacts than traditional campus models. The SusTEACH analysis revealed that a third of the energy use and carbon dioxide emissions associated with the blended ICT-enhanced face-to-face teaching model was attributable to student air travel between home and term-time residence. In some cases, this blended model involved students traveling long distances to attend the campus for short periods of face-to-face teaching, while also learning online for part of the course, thereby offsetting the potential gains of increased online provision (Caird et al. 2015a). More attention is now being given to student travel (Versteijlen et al. 2017) particularly international travel, although the likely carbon dioxide emissions generated by international student air travel is rarely discussed (Davies 2015).

Both the “Factor 10 Visions” and “SusTEACH” studies showed that distance delivery of courses and modules was the most important factor in explaining the major differences between the distance- and campus-based HE systems, in terms of the energy usage and consequent carbon dioxide emissions. The strikingly lower impacts of distance learning were mainly due to a significant reduction in student travel and residential energy use, and efficiencies and economies of scale in utilizing campus site facilities and operations by spreading the costs of production and delivery across large numbers of students (Roy et al. 2008; Caird et al. 2015a). The SusTEACH study findings suggested that where ICTs are used to design modules and courses to reduce the need for student travel and commuting, and to reduce the use of residential buildings, campus buildings, and operations, then significant reductions in energy use and carbon dioxide emissions can be achieved

(Caird et al. 2015a). The SusTEACH toolkit was subsequently developed to facilitate the design of sustainable HE modules and courses supported by an OpenLearn course (Caird and Lane 2013).

Very few other studies have compared the environmental impacts of blended learning through different models for delivering HE teaching and learning (see Alharthi et al. 2018). However, there are several comparative studies of online HE models discussed in the “Sustainable Higher Education Systems” entry in this encyclopedia, which could be considered to be blended learning in some definitions given their use of a mix of learning technologies and delivery media hosted on a virtual learning environment (VLE) platform (see Oliver and Trigwell 2005; Graham 2012). Collectively, these studies point to the conceptual and methodological complexities (Roy et al. 2005; Roy et al. 2008; Caird et al. 2015a; Caird et al. 2015b; Stewart and Khare 2015; Oliveira et al. 2017) and contextual factors (Harlow 2016) involved in making environmental comparisons between different models of HE teaching and learning. Moreover, such studies could be extended to cover additional environmental impacts, such as resource depletion, air and water pollution, threats to wildlife, and waste. However, energy use and carbon dioxide emissions are often a good indicator of these other environmental impacts (e.g., Kalbar et al. 2017), and so the design of HE teaching and learning models to reduce energy use and carbon dioxide emissions will often result in the reduction in other negative impacts.

Conclusions

This entry has examined blended learning in HE systems and sustainable development, observing that both concepts are complex and multifaceted and have various interpretations and applications in research and practice. Particular challenges hang on the limited empirical evidence available to establish the relationships between blended learning, now considered prevalent in HE, and sustainable development, although there is currently growing research interest in seeking to understand the impacts of blended learning technologies (Adams Becker et al. 2017).

This entry has considered the contribution of ICTs and multimedia in HE teaching, learning and assessment to providing inclusive, quality, and lifelong learning (SDG 4) (UN 2015) through the development of innovative pedagogies (Sharples et al. 2015) to provide the benefits of online learning. The benefits of rich multimedia ICTs include the provision of opportunities for students to learn at a place and time of their choice using specially designed interactive materials and integrated resources to support independent and individualized learning, with options for collaborative learning with international online student community groups (Caird and Lane 2015). Moreover, the review has identified evidence that blended learning is associated with greater student confidence, motivation, engagement, creativity and satisfaction with a greater capacity for independent and self-paced learning, and enhanced learning outcomes (Tseng and Walsh 2016; Spring et al. 2016; Adams Becker et al. 2017).

This entry has also addressed the paucity of empirical evidence supporting the contribution and benefits of HE blended learning across social, economic and environmental dimensions of sustainability, noting that blended learning offers the potential to promote:

- Social sustainability, for example, by developing and maintaining the availability, affordability, accessibility, acceptability and equitability of HE (Lane et al. 2014) to address SDG 4 “*Ensure inclusive and quality education for all and promote lifelong learning*”
- Economic sustainability, for example, developing and maintaining accessible educational services that are economic, efficient and effective over time, and delivering economic benefits, with reference to SDG 1 “*End poverty in all its forms everywhere*”
- Environmental sustainability, for example, by improving system efficiencies, economies and effectiveness with reference to SDG 12 “*Ensure sustainable consumption and production*”

patterns”, and also by reducing negative environmental impacts, carbon-intensive energy use and greenhouse gas emissions and sustaining eco-system services over time, with reference to SDG 13 “*Take urgent action to combat climate change and its impacts*” (UN 2015)

While the benefits of blended learning HE models for the SDGs have been supported by a number of empirical studies, there is stronger evidence for the benefits of online and distance HE systems for social, economic, and environmental dimensions of sustainability (Roy et al. 2008; Caird et al. 2015a). This is achieved by widening access to learning beyond the campus context, achieving scale efficiencies and economies by spreading costs across larger student numbers, and substituting the main uses of energy and sources of carbon dioxide emissions using distance methods and ICTs.

In conclusion, blended HE teaching and learning models can be valuable for promoting the SDGs, particularly the targets around inclusive quality education (SDG 4), although the greatest gains across the environmental, economic, and social dimensions of sustainability may be achieved by making greater use of distance and fully online HE models. The benefits of blended HE models for *social sustainability* are conditional on whether the design of blended HE models improves learning outcomes, widens access to education, and supports lifelong learning, whereas the benefits for *economic sustainability* are conditional on whether the design of blended HE models reduces costs, improves system efficiencies, increases scale efficiencies and economies, and delivers a good return on investment for the economy. The benefits for *environmental sustainability* are conditional on the design of blended HE models offering effective substitution or reduction in the main sources of HE energy use, including student travel, campus buildings and site operations, student residential buildings, and the purchase and use of equipment, to reduce energy use and carbon dioxide emissions. Nonetheless, the contribution of blended HE teaching and learning models to sustainable development requires further empirical studies to identify the best ways to support the sustainable development goals.

Cross-references

Sustainable Higher Education Systems

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