

## RESEARCH ARTICLE



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# Sustainable entrepreneurship education: Impacts of the circular economy, health literacy, and well-being

Melinda Timea Fülöp<sup>1</sup> | Javier Cifuentes-Faura<sup>2</sup>

<sup>1</sup>Faculty of Economics and Business Administration, Babes Bolyai University, Cluj Napoca, Romania

<sup>2</sup>Faculty of Economics and Business, University of Murcia, Murcia, Spain

## Correspondence

Javier Cifuentes-Faura, Faculty of Economics and Business, University of Murcia, Murcia, Spain.

Email: [javier.cifuentes@um.es](mailto:javier.cifuentes@um.es)

## Abstract

Education systems that integrate sustainable entrepreneurship education, digitization, and the circular economy (CE) have an effect on well-being and provide a holistic approach to the promotion of sustainable development. Higher education institutions have a valuable dual role in disseminating the CE as a new sustainability paradigm through both the teaching of students and the preparation of future teachers toward the incorporation of sustainability into other educational levels. This study focused on new health literacy (health competence) findings, with the aim to analyze the health literacy, well-being, and socioeconomic status of university students in the era of new normality post-pandemic (COVID-19). The analysis was based on the health literacy questionnaire of Van der Vaart, WHO-5, and the MacArthur Scale of socioeconomic status. The results showed that health literacy among students in Romania tended to improve during the pandemic based on their experience with digital media. This effect was particularly evident in the assessment of health information and digital health competence.

## KEYWORDS

circular economy, digitalization, health, sustainability, well-being

## 1 | INTRODUCTION

The importance of integrating the circular economy (CE) into educational institutions, especially universities, has become increasingly evident (European Environment Agency, 2016; Nunes et al., 2018). Educational facilities play a dual role in communicating the relevant information by providing knowledge about the principles of the CE and preparing future teachers to integrate sustainability practices into subsequent levels of study (Cifuentes-Faura et al., 2020; Steffen et al., 2018; Tiippana-Usvasalo et al., 2023). Specially designed learning activities encourage students to reflect on their daily environmental impact and develop measures to reduce this impact (Cifuentes-Faura & Noguera-Méndez, 2023; Faura-Martínez et al., 2022). These approaches allow educational institutions to transfer knowledge while promoting active participation toward the formation of a more sustainable society (Caeiro & Azeiteiro, 2019; Mendoza et al., 2019a, 2019b; Sima et al., 2019).

Sustainable entrepreneurship education promotes the CE by guiding the next generation of entrepreneurs in the development and implementation of sustainable business practices. This training integrates the basic principles of the CE into the curriculum, including processes such as waste minimization, resource use maximization, and product longevity advancement (Begum et al., 2023; European Commission, 2019; Fauzi et al., 2022; Klapper & Fayolle, 2023).

This training promotes a deeper understanding of sustainable business and enables the development of practical skills for entrepreneurs to find innovative solutions to current environmental problems. The models focus on the principles of repairing, reusing, and recycling to extend the life cycle of products. In addition, the creators of business models should ensure that social and environmental responsibility is a central component of their strategy to promote sustainable development. By incorporating ethical considerations and ecological responsibility into entrepreneurial thinking, sustainable entrepreneurship education strengthens the capacity of future entrepreneurs to

develop long-term, holistic solutions to CE issues. The result is a substantial contribution to the promotion of a sustainable economic model that protects the environment while supporting economic growth (Brennan et al., 2021; Purvis et al., 2023; Ripple et al., 2021; Shayganmehr et al., 2021).

Integrating sustainable entrepreneurship education, digitization, and the CE into education systems has an effect on well-being and provides a holistic approach to sustainable development promotion. The training in sustainable entrepreneurship focuses on the principles of the CE, which emphasize reducing waste and maximizing the use of resources. These factors contribute to economic efficiency and reduce environmental impacts, which in turn improve well-being (Amran et al., 2019; Carattini & Löschel, 2021; Lethone et al., 2019).

Digitization plays a key role in the process by enabling innovative solutions for the use and recycling of resources. Technologies such as the Internet of Things and artificial intelligence (AI) can help increase resource efficiency and facilitate the implementation of CE principles. In addition, digitization supports the dissemination of knowledge regarding sustainable practices and promotes global networks and collaborations, which are essential for scaling up CE initiatives (Del Vecchio, Passiante, et al., 2021; Giesenbauer & Müller-Christ, 2020; Rusch et al., 2023).

Furthermore, public well-being is directly influenced by the application of CE principles. Research shows that a clean environment and reduced environmental pollution contribute considerably to improving public health and overall well-being. Reducing air and water pollution by using more efficient waste and resource management practices can reduce the risk of disease and improve the quality of life (Jayarathna et al., 2023; Rovanto & Finne, 2023).

Despite the clear need, an interface between entrepreneurship education and the CE is lacking in the literature, and the various sustainability perspectives associated with companies moving to a CE are fragmented. This knowledge gap is concerning because education and well-being are the bases of a CE based on successful entrepreneurship.

This study aimed to close this gap by highlighting the importance of education and well-being when addressing the challenges of the CE paradigm. The central research question was: How do universities design their entrepreneurship education programs toward the well-being of students to ensure the development and support of the CE through digitization?

These integrative approaches show that combining sustainable entrepreneurship training, digitization, and the CE contributes to economic efficiency and environmental protection while improving human well-being. By including these components in their curricula and business models, educational institutions and companies can promote sustainable development that supports both current and future generations.

The structure of this paper is organized as follows: Section 2 provides an analysis of the specialized literature on digitization in universities, Section 3 presents the research methodology, the “Results” section presents the main findings of the study, the subsequent discussion section highlights the implications in theory and practice, and

the conclusion section summarizes the main contributions and limitations of this study and possible directions for future development.

## 2 | LITERATURE REVIEW

Digitalization has permeated the majority of fields and triggered a comprehensive process of change. The acceleration of digital advancements has increased substantially as a result of the COVID-19 pandemic. Everyday routines were quickly adjusted to adapt to the digital world, and distance learning became the norm, which required both staff and students to understand new technologies. Digital skills have become a key qualification and prerequisite for a successful education and career. Although the “digital natives” are assumed to be competent in handling digital technology, additional needs must be addressed and basic knowledge must be continually updated (Jackman et al., 2021; Núñez-Canal et al., 2022; Wang et al., 2021).

The European Commission has been modernizing and adapting the post-secondary educational system to new technologies since 2006. Universities must be actively involved in the modernization process if they wish to contribute to achieving the objectives of the EU for a knowledge-based global economy. The educational system can provide considerable support toward achieving these objectives; however, this potential often remains unexplored due to rigid regulatory structures. Utilizing the vast reservoir of knowledge, talent, and energy of these institutions requires immediate and coordinated change in the government and management of systems and the fundamental operating procedures of the universities involved (European Commission, 2019).

Universities in Eastern Europe are facing a profound change in their entrepreneurship education programs to meet the current demands of including sustainability, the CE, and student well-being in their curricula. Integrating digitization can promote the implementation of measures that foster both sustainable business models and student health. This study analyzed the specialized literature for research that provided insight into the connection between these topics and illustrated how universities in Eastern Europe are adapting their programs to meet these new requirements.

The most obvious changes in the everyday life of students are the reduction in social contacts and the focus on digital teaching and learning formats. However, the newly acquired and strengthened digital skills obtained during the COVID-19 pandemic served as an important resource in the promotion of individual mental health (Hermosillo-de-la-Torre et al., 2022). Digital health literacy plays a key role in the association between digital skills and well-being, whereby a high level of digital health literacy indicates greater well-being among students (Leung et al., 2022).

Student mental health and well-being have received additional attention due to the COVID-19 pandemic. Digitization changed both learning and access to health information. Studies have shown that students, especially those in Eastern European countries, have difficulty finding reliable health information, which leads to uncertainty and stress (Htay et al., 2022; Shahbaz et al., 2021). This highlights the

need to integrate digital health literacy into educational programs to help students distinguish between reliable and unreliable sources. Universities have responded by offering information campaigns and online training to help students cope with mental and physical challenges (Htay et al., 2022).

The combination of entrepreneurial training and psychosocial support has proven effective in ensuring the well-being of students while preparing them for the challenges of the labor market. For example, many universities now offer workshops on stress management and time management that are integrated into regular entrepreneurship courses (Dadaczynski et al., 2022).

Transforming to new digital technologies requires involved and sustainable management. In the last decade, universities initiated a series of transformations induced by new technologies and recent technological revolutions. Similar to other industrial revolutions, digitalization implies an intense readjustment in all sectors (Shah et al., 2022). Currently, the acceptance of technologies and digital skills by universities requires a paradigm shift, where skill is considered a multifaceted and interrelated commodity that allows for digital learning. In this framework, digitization is a requirement in higher education institutions and it allows the facility to attract more and better students and improve the education resources used in courses and the teaching method in general. In addition, new technologies enable better supervising and detection of difficulties, thereby decreasing the risk of students dropping out. Despite these advantages, there remains a reluctance to understand and subsequently benefit from the opportunities of moving into this digital environment (Frolova & Rogach, 2021).

The digitalization of teaching at universities has been gaining ground for the past several decades. Although numerous virtual universities offer completely online learning, most universities still offer in-person courses. The standard method of teaching changed during the pandemic when students and teachers were quickly faced with the need for digital teaching and e-learning platforms. These changes induced new health issues; therefore, health literacy must be considered to find, understand, evaluate, and apply health-related information (Yadav & Srivastava, 2021). Adaptation to digitization also applies to this field, and this can be seen as a two-dimensional construct involving the ability to use digital resources to access health information as well as the ability to collect, understand, evaluate, and apply information (critical information literacy; Dadaczynski et al., 2021).

Universities in Eastern Europe are beginning to fully exploit the potential of digitization to meet both the needs of the CE and the well-being of students. The literature suggests that future research should investigate the impact of digitization and the CE on entrepreneurial success and student health. It is particularly important to evaluate the effectiveness of educational programs that promote both sustainability and mental health (Dadaczynski et al., 2022; Htay et al., 2022).

The effective integration of the CE into entrepreneurship training involves further challenges. Although the principles of the CE are clearly defined, their application in the business world requires creativity, adaptability, and innovation. Therefore, universities must

develop new teaching approaches that encourage students to explore and utilize these new business models.

The promotion of the CE through digitization is increasingly emphasized in entrepreneurship programs in Eastern Europe. Digitization gives students access to the important resources, networks, and technologies that are needed to develop sustainable business models. Universities are turning to digital tools to promote circular models that use resources efficiently and minimize waste. These digital platforms and online learning environments play an important role in helping students access global markets and exchange knowledge in real-time (Dadaczynski et al., 2022; Htay et al., 2022).

In addition, these programs aid in the development of entrepreneurial skills as well as sensitize students to the responsibilities they will encounter as future leaders in a resource-constrained world. The CE thus becomes an integral part of entrepreneurship education, whereby students learn to develop business practices that are both economically and environmentally sustainable (Htay et al., 2022).

Sustainable entrepreneurship education that integrates the CE, health literacy, and well-being can prepare future entrepreneurs for global challenges while strengthening their personal health and resilience. Studies show that the combination of these factors leads to sustainable business success and a healthier and more fulfilling life for those involved. Future research and education programs should focus on refining these approaches and measuring their impact on long-term organizational success and well-being.

Moreover, the CE, education for sustainability and sustainable entrepreneurship education are closely related to the promotion of a sustainable economy (Andrews, 2015; Del Vecchio, Secundo, et al., 2021; Rodríguez-Chueca et al., 2020). The CE aims to use resources efficiently and minimize waste by reusing and recycling products and materials. Sustainability education provides important skills such as systems thinking, the ability to innovate and the willingness to cooperate, which are essential for the development of sustainable business models (Bugallo-Rodríguez & Vega-Marcote, 2020; Kirchherr & Piscicelli, 2019; Renfors, 2024). New technologies such as AI, blockchain, 3D printing, and the Internet of Things (IoT) support the implementation of the CE, helping companies to work more efficiently in terms of resources and more efficiently. These technologies are also essential for training entrepreneurs who focus on the CE and sustainability (Mendoza et al., 2019b).

The current economic model, based on consumerism and linear growth, is a challenge for the CE, as it is based on the disposable mentality and rapid product cycles. Sustainable entrepreneurship education aims to question this model and develop circular business strategies (Scalabrino et al., 2022). The CE also promotes health and well-being by reducing environmental impact by supporting healthier working conditions and more sustainable lifestyles. Overall, the transition to a CE is key to a sustainable future that provides both economic and social benefits (Kowasch, 2022).

In addition, studies have indicated that digital health literacy is related to socioeconomic status (Amoah et al., 2021; Kyaw et al., 2022); therefore, this factor should be considered when studying the connection between well-being and digital health literacy.

A resilient education system can adapt and change when presented with adverse health literacy levels, and this characteristic is critical for recovering from crises like the COVID-19 pandemic. Building resilience-health literacy requires careful assessment of the impact of the current crisis and accurate forecasting of future crises to educate policymakers (Research for CULT Committee—Education and youth in post-COVID-19 Europe—crisis effects and policy recommendations).

The pervasive switch to digital teaching brings major challenges for universities, teachers, and students, as well as opportunities for future education. This study investigated the advantages and disadvantages of digital teaching from the perspective of the students, while the opinions of the teachers were only marginally discussed. In this context, an additional question arises as to whether certain groups of students are more affected by the change to digital teaching than others.

The psychosocial and emotional challenges facing students, especially during the pandemic, were particularly highlighted in the studies. Universities recognize that promoting resilience and mental health is critical to ensuring student well-being (Shahbaz et al., 2021; Vrdelja et al., 2021). Programs that provide psychological support, self-reflection, and stress management in entrepreneurship education can improve the long-term mental health of students while preparing them for entrepreneurial challenges (Dadaczynski et al., 2022; Htay et al., 2022).

Health literacy, which involves the information, inspiration, and aptitude to discover, comprehend, measure, and relate health information (Amoah et al., 2021) has become an important field of investigation in recent years. This concept was generated in Romania by the European Health Literacy Survey (HLS-EU) (Sørensen et al., 2013) and was used to measure health competence in eight European countries for the first time.

A study backed by the European Parliament's Committee on Culture and Education revealed that the COVID-19 pandemic posed unparalleled and multidimensional challenges for teaching organizations and adolescents, particularly in relation to the absence of crisis preparedness and the application of digital teaching. In addition, the results reinforced the current organizational limitations in educational offerings (Van Der Graaf et al., 2021).

The digital transformation of the economy requires an overall reassessment of the current methods, from the development of new products, processes, and services to the creation of business models and processes. This is a major challenge, especially for small and medium-sized companies, and well-trained engineers are required to overcome this issue. To ensure the most effective resolution, these engineers must be adaptable to change. In addition to their technical foundation, updated digital skills, entrepreneurial thinking, and creative problem-solving techniques are required.

Since the Advanced Research Projects Agency Network (ARPANET) was introduced in 1969, digitization has provided researchers with continually upgraded opportunities to exchange, publish, and process data and research results. Platforms such as Researchgate, Mendeley, and Google Scholar provide worldwide

access to research results and researchers. As performance and competition among scientists is intensified by digital exchange, digitization is considerably more advanced in research than in the teaching-learning environment (Tømte et al., 2019).

As with the Technological Pedagogical Content Knowledge (TPACK) model, the European Framework for the Digital Competence of Educators (DigCompEdu) and the accompanying self-assessment tool focus the competencies of teachers in different educational areas. This framework uses a competency model to improve or innovate educational offerings. The model is aimed at digital newcomers, experienced people, and experts.

The DigCompEdu was developed by the Joint Research Center of the EU (2017) and provides a reference framework for assessing and developing the digital competencies of teachers at all levels of education (from general and vocational schools to higher and adult education facilities; Figure 1).

This model attempts to describe the competencies required by teachers to use digital media efficiently. The model does not focus on the use of technology but offers approaches to develop didactically, methodically, and pedagogically and to acquire better strategies for the use of digital media.

The model consists of six sectors. The four core sectors deal with identifying and creating digital content; applying digital media in the classroom and in teaching, emphasizing the independence and collaboration skills of the students; designing learning and performance assessments using digital formats throughout the entire process for self and external assessments; and placing the focus on the individual learners and considering targeted educational offers that will help them personally (“empowering learners”).

This didactical-methodical core is surrounded by two “wings.” One wing relates to the professional environment of teachers in terms of communication within the educational organization, with other participants (e.g., parents in the school context), and with the outside world, as well as the continuing education of the teachers. The other wing focuses on educators developing the digital competence of the learners in addition to teaching subject-related content.

The COVID-19 pandemic of 2020 had a global impact on education and the educational process. UNESCO, one of the organizations that is actively involved in the future of education, published a report entitled “Moving minds: Opportunities and challenges for virtual student mobility in a post-pandemic world” at the beginning of 2022 that emphasized that the innovative and creative achievements made during the pandemic can be capitalized and developed to allow for educational offerings without barriers, regardless of the form of physical or online education. This report presents opportunities for students to embrace cultural exchange and participate in education in any global location in the post-pandemic period through new forms of hybrid or online education that were made available because of the implementation and adaptation to new technologies. The report presents various studies and a series of recommendations because the COVID-19 pandemic affected education differently depending on the educational level and the environment. The studies revealed that preschoolers and primary education students had the most challenges in



**FIGURE 1** DigCompEdu areas and scope. Source: European Commission (2017), <https://publications.jrc.ec.europa.eu/repository/handle/JRC107466>.

adapting to virtual environments, and in these cases, active involvement from the parents was necessary. In contrast, higher education institutions were more adaptable due to their level of student independence and literacy in the health field as well as their involvement and pre-existing use of information and communication tools and virtual teaching methods. However, student mobility was greatly hampered by travel restrictions and national lockdowns (UNESCO, 2022).

Digitization of universities could provide an opportunity to consciously record and compare the different perceptions of the university and its students. Digitization in teaching and learning is strongly influenced by individual lecturers and students, as it depends on how the digital formats and applications are used for their respective courses and the extent of digital content available to students.

Individual levels are shaped differently by interactions between teachers and learners. In principle, digital technology can facilitate the learning process using various mechanisms that provide services such as searching and sorting, comparison and calculation, storage and transmission, and individual interaction. In principle, these mechanisms can be used to apply digital technologies to individual stages of the learning process. The specific digital technologies used and developed depend on the subject, the academic degree sought, and the faculties, departments, and institutions involved. Currently, e-learning platforms offer a wide range of possible interactions within digital learning formats, and the opportunity exists to use digital teaching to enhance these interactions. As the interaction between teachers and learners intensifies, the opportunity for the exchange of information regarding the direction and quality of learning processes increases. Therefore, an e-learning environment such as a social media platform

can continue to improve the quality of content through a multitude of interactions (Alqahtani et al., 2022; Kasim & Khalid, 2016).

The opportunity exists for universities and similar associations to benefit greatly from the implementation of digitization strategies. However, this process is complex, especially in relation to the design and implementation of digital innovations. Central coordination is required to ensure a smooth transition; however, this concept is often opposed based on the decentralized organization generally found in universities, which is based on an independent nature that allows for freedom of research and teaching. University management, administration, and scientific policy are thereby responsible for establishing and providing structures that enable academic freedom while engaging digital platforms (Aldowah et al., 2017).

### 3 | RESEARCH METHODOLOGY

Quantitative and qualitative studies have identified the effects of the pandemic on specific providers of further education such as adult education centers (Coronado et al., 2020), businesses (Bellmann et al., 2020; Flake et al., 2020), e-learning providers (Schmid & Goertz, 2020), and literacy course agencies (Koppel & Langer, 2020) as well as general higher education establishments (Christ et al., 2021; Grotlüschen & Weis, 2021). The international Delphi study by Kämpf and Lichte (2020) provided a general view of the effects of the COVID-19 pandemic on adult education.

Our analysis of the literature revealed a clear knowledge gap. Several studies were found in this field that included data from



various countries; however, no research was identified that focused on an emerging country such as Romania.

The present study used a quantitative survey with standardized questionnaires to examine the associations among the CE, digital health literacy, and student well-being. Data were collected through an online survey, which made it possible to capture a diverse sample of students from different universities and study programs.

### 3.1 | Documenting socioeconomic status

Socioeconomic status in health research has been historically measured using objective indicators such as education, occupation, and income. In the present study, subjective social status indicators were also recorded with the aid of the MacArthur scale (Ding et al., 2021; Dodd et al., 2021; Giatti et al., 2012). The MacArthur scale allows participants to self-assess their social status compared to their contemporaries on a 10-point scale (1 = low, 10 = high). This method captures the personal perception of social rank, which allows for a differentiated assessment of socioeconomic status. Previous research has confirmed the validity of the subjective social status measurement scale.

At the beginning of the questionnaire, the students were asked about their gender, age, type of university attended, and study program. In addition, their subjective social status was queried using the MacArthur scale (Ding et al., 2021; Dodd et al., 2021; Giatti et al., 2012).

### 3.2 | Documenting digital health literacy

Digital health literacy was measured using the Van Der Vaart and Drossaert (2017) questionnaire, which focuses on different dimensions of the ability to search for, evaluate, and apply health information digitally. The questionnaire includes subscales, each consisting of three items, and responses on a 4-point Likert scale (1 = often to 4 = never). The internal consistency of the instrument was confirmed by the return of Cronbach's alpha values between 0.79 and 0.89, indicating high measurement reliability. These values are typical of well-validated instruments, suggesting that the dimensions of digital health literacy measured were robustly and consistently captured.

### 3.3 | Documenting well-being

Student well-being was measured using the WHO-5 Well-Being Index, which is a globally recognized instrument for measuring subjective well-being. This index consists of five items that identify the positive experiences of participants in the past months. Responses are given on a 5-point Likert scale (0 = never to 5 = all the time), with higher values indicating greater subjective well-being. The index showed high cross-study reliability with a Cronbach's alpha of 0.88, confirming excellent internal consistency and suitability for use in different

cultural contexts (Downs et al., 2017; Holm-Hadulla et al., 2021; Lara-Cabrera et al., 2022).

Specific statements are used in the index regarding the frequency of positive experiences in the past few months (e.g., During the past few months I have been happy and in a good mood) and the 6-point Likert scale contained the following levels: 0 = never, 1 = every now and then, 2 = a little less than half the time, 3 = a little more than half the time, 4 = most of the time, and 5 = all the time. The total score of the scale ranges from 0 (low well-being) to 100 (optimal well-being), with a total score  $\leq 50$  considered an indicator of possible depression.

### 3.4 | Validity and reliability

High internal consistency was measured, with Cronbach's alpha values between 0.79 and 0.89 for health literacy and 0.88 for well-being indicating the reliability of the scales used. These high values signify a solid and reliable database to analyze the relationships among the examined variables and a high degree of robustness of the research results.

Various statistical software programs can be used to evaluate data collected from the MacArthur Scale and the WHO-5 Well-being Index. We chose the SPSS package for data processing, which is widely used for statistical analysis, especially in social and health research. This software provides straightforward data entry and analysis features that are suitable for assessing data from the two sources.

The results were bundled and exported via the statistics function of Isondaje. The data were first imported into the Microsoft Excel program to view general statements about the sample and the response distributions and eliminate responses with missing items. The statistical software SPSS was then used to conduct more detailed analyses and make concrete assertions.

## 4 | STUDY RESULTS

Health literacy is considered a key competence for positive health behavior; therefore, strengthening this component can promote prevention and good health in educational environments. The first results identified that the majority of students had limited health literacy. The present study examined the health literacy and health state of students. Of the 1212 students invited to take part in the survey, 940 answered our questionnaire. The students were enrolled in a single university in Romania that had a low number of doctoral students when compared to students in the master's and bachelor's programs. This difference is explained by the high level of difficulty and advanced academic requirements, longer duration of studies, limited resources available, and competition for funding for doctoral candidates. In addition, many students prefer to enter the job market after completing lower degrees, as these credentials offer immediate professional opportunities. Furthermore, academic and research careers are more competitive and insecure, which discourages students from pursuing this route. The composition of the sample is shown in Table 1.

**TABLE 1** Demographic data distribution.

	No. of respondents	Percentage
Student category		
Bachelor	628	66.81
Masters	306	32.55
PhD	6	0.64
Total	940	100
Age group		
18–25 years	553	58.83
25–35 years	221	23.51
35–45 years	134	14.26
Over 45 years	32	3.40
Total	940	100
Environment		
Urban	738	78.51
Rural	202	21.49
Total	940	100
Type of university		
Public	923	98.19
Private	17	1.81
Total	940	100
Subjective scale of social status—Society		
1 (low status)	32	3.40
2	134	14.26
3	126	13.40
4	98	10.43
5	105	11.17
6	153	16.28
7	117	12.45
8	55	5.85
9	43	4.57
10 (high status)	77	8.19
Total	940	100

The present study adopted a descriptive cross-sectional design to sample Romanian students. After eliminating the questionnaires that lacked some information, 940 questionnaires were used in this study. The ages of the participants ranged from 18 to over 45 years (mean age = 24.15; SD = 7.45). A confirmatory factor analysis (CFA) was performed with a total of 940 cases. The fit of the specified model (7-factor structure, 21 items) was deemed acceptable.

To test the model fit we applied a multiple regression analysis based on SPSS to determine the multicollinearity of the model, which refers to the linear relationships among the independent variables. Collinearity indicates two variables that are close to perfect linear combinations of each other. Multicollinearity occurs when the regression model includes several variables that are significantly correlated

**TABLE 2** Data fitness.

Bartlett's test	$\chi^2 = 2278.360, p < .001$
$\chi^2/df$	4.798
Correlation matrix	<0.9
Kaiser–Meyer–Olkin	0.887
RMSEA	0.067
SRMR	0.059
CFI	0.932
Tucker–Lewis index/non-normed fit index	0.952
AVE	0.456
Cronbach's alpha	0.79–0.89
Omega	0.78

with the dependent variable and each other (Young, 2018). For our model,  $r = 0.670$ , which signified a positive correlation between the variables ( $R^2 = 0.655$ , adjusted  $R^2 = 0.574$ , std. error of estimate = 0.678). The VIF value for our model was 1.973, which indicated that the variables were moderately correlated. The  $F$ -value was considered statistically significant at  $p < .001$ .

The model fit was determined by applying subsequent measures and thresholds (Table 2):  $\chi^2 \leq 2$  signifies a good result, while a value  $\leq 5$  is acceptable. The acceptable values for the root mean square error of approximation is  $<0.07$ , for the comparative fit index is  $\geq 0.95$ , and for the Tucker–Lewis index or non-normed fit index a value of  $\geq 0.95$  is indicated (Hair et al., 2014). A Kaiser–Meyer–Olkin measure value  $>0.5$  is considered mediocre, while  $>0.7$  is good,  $>0.8$  is great, and  $>0.9$  is considered superb (Hair et al., 2014) (Table 2).

A construct reliability  $>0.6$  is considered acceptable, while a value  $>0.7$  is good. For the average extracted variance, a value  $\geq 0.5$  is considered acceptable for validating our indicators (Field, 2018; Hair et al., 2014). According to Fornell and Larcker (1981), an AVE value  $>0.4$  is adequate and a value of  $>0.6$  indicates the composite reliability of the model. The reliability of the instrument was verified as the Cronbach's alpha (0.79–0.89) and Omega (0.78) values were higher than 0.70 (Dunn et al., 2013; McDonald, 1999). A factor loading value  $>0.4$  is considered significant and a cross-loading value  $<0.4$  is acceptable (Field, 2018; Hair et al., 2014) (Table 3).

As an example, the relationship between operational skills and the addition of self-generated content was 0.63, whereas the relationship between determining relevance and navigation skills was 0.42 (see Figure 2).

In addition to investigating the relationship between health literacy and psychological well-being (WHO-5), a path analysis was conducted to determine any direct and indirect effects. The results indicated a score of 53.14 (SD = 20.19) for the WHO-5. Moreover, based on the cut-off score of  $\leq 50$ , 52.65% ( $n = 495$ ) of 940 participants were classified as having poor well-being and were at risk of depression. This proportion falls to 28.51% ( $n = 268$ ) when examining the students below a cut-off score of  $\leq 28$ , which is a more restrictive screening threshold of reported depression symptoms (Heun et al., 2001; Low et al., 2021; Merlo et al., 2021; Topp et al., 2015).

**TABLE 3** Factor loading and composite reliability.

	1	2	3	4	5	6	7	R <sup>2</sup>	Cronbach's alpha	Composite reliability (95% CI)	Omega $\omega$
Factor loading (95% CI)											
How easy or difficult is it for you to...									0.89	0.89	0.78
Item 1.1	0.77*							0.73		0.88	
Item 1.2	0.78*							0.64		0.89	
Item 1.3	0.77*							0.66		0.81	
When you search the Internet for information on health, how easy or difficult is it for you to...									0.79	0.79	0.76
Item 2.1		0.81*						0.55		0.79	
Item 2.2		0.79*						0.54		0.81	
Item 2.3		0.77*						0.65		0.79	
Item 3.1			0.67*					0.49	0.80	0.79	
Item 3.2			0.82*					0.51		0.82	
Item 3.3			0.61*					0.69		0.81	
Item 4.1				0.65*				0.60	0.79	0.79	
Item 4.2				0.81*				0.53		0.81	
Item 4.3				0.78*				0.65		0.82	
When you search the Internet for health information, how often does it happen that...									0.83	0.83	0.77
Item 5.1					0.84*			0.49		0.81	
Item 5.2					0.66*			0.57		0.79	
Item 5.3					0.87*			0.65		0.83	
When typing a message (e.g., to your doctor, on a forum, or on social media such as Facebook or Twitter) how easy or difficult is it for you to...									0.80	0.81	0.79
Item 6.1						0.77*		0.53		0.79	
Item 6.2						0.81*		0.68		0.81	
Item 6.3						0.89*		0.55		0.82	
When you post a message on a public forum or social media, how often...									0.82	0.82	0.78
Item 7.1							0.84*	0.49		0.79	
Item 7.2							0.89*	0.67		0.81	
Item 7.3							0.88*	0.78		0.80	

Note: 1—operational skills; 2—information searching; 3—evaluating reliability; 4—determining relevance; 5—navigation skills; 6—adding self-generated content; 7—protecting privacy.

\*Loadings significant at  $p < .001$ .

Well-being increased with higher self-assessed socioeconomic status (Figure 3). The multivariate analysis of variance identified a clear positive relationship between the subjective assessment of social status and well-being ( $F = 9.502, p = .000$ ).

## 5 | DISCUSSION

Digital health literacy is a critical and front-line tool for combating and preventing health crises. Research has identified that people with



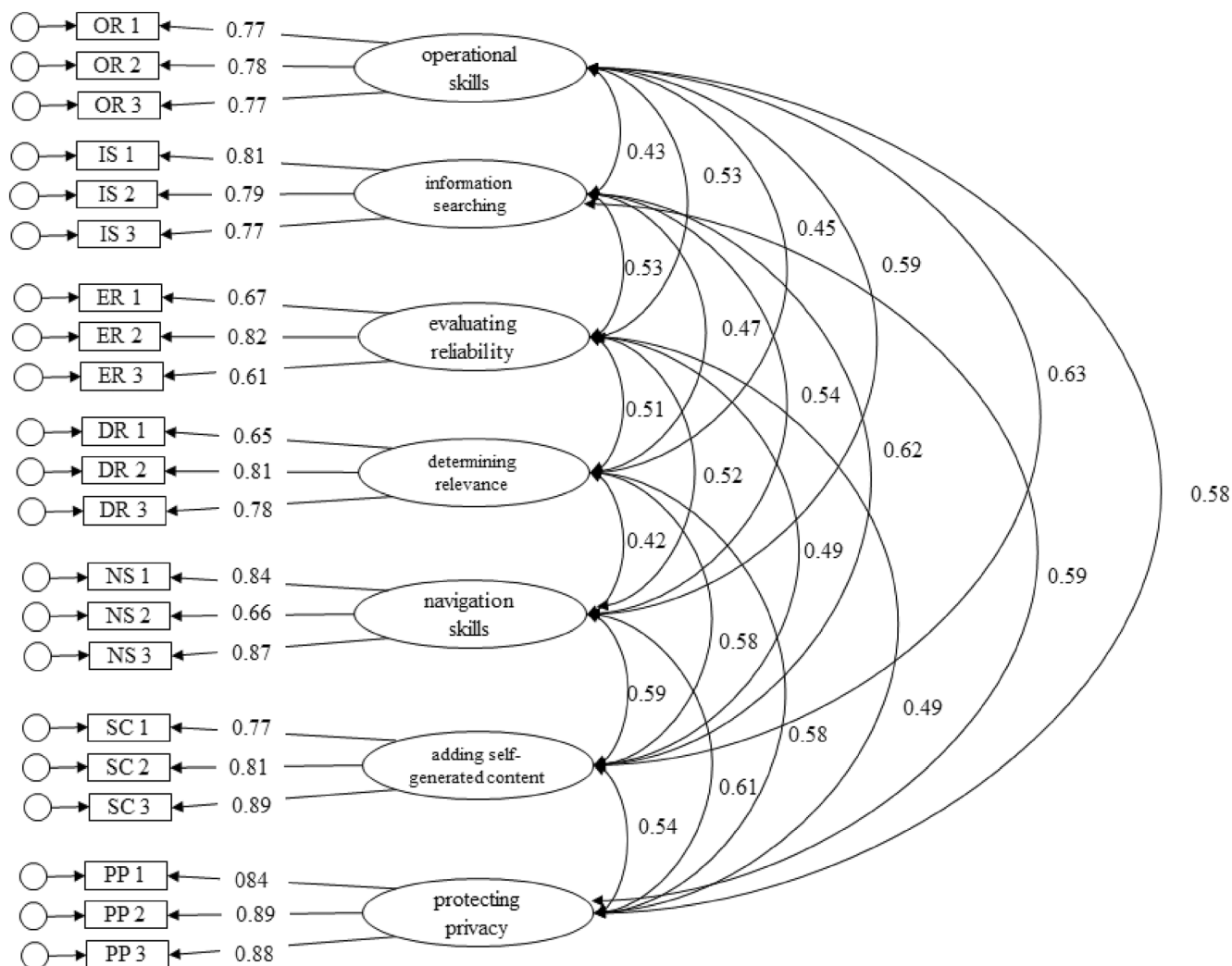


FIGURE 2 Confirmatory factor analysis model with 7-factor structure and 21 items.

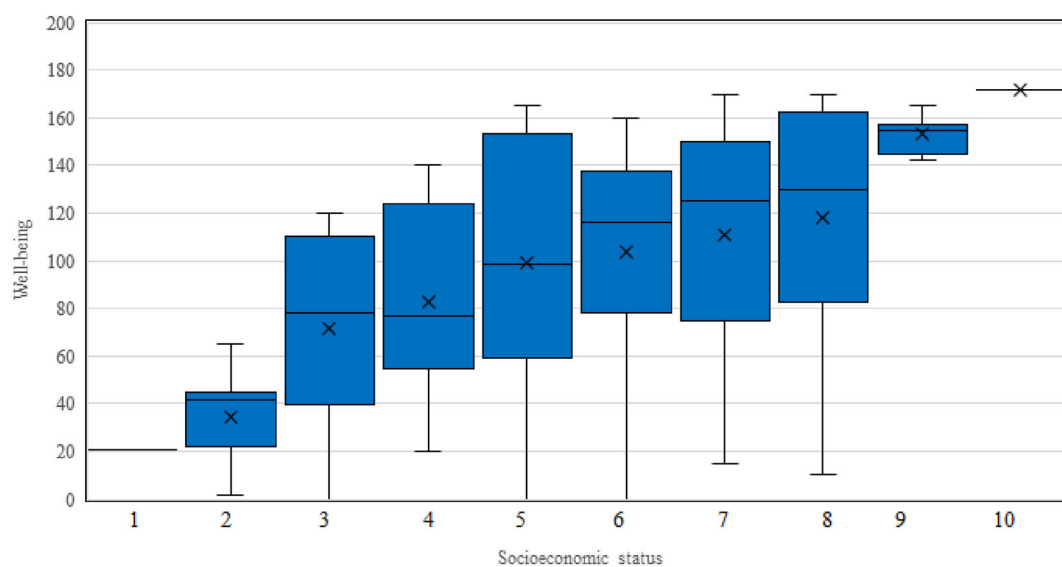


FIGURE 3 Correlation between well-being and socioeconomic status.

greater knowledge are more likely to adopt preventive and protective behaviors regarding health-related adversities (Dadaczynski et al., 2021; Patil et al., 2021).

In this study, we aimed to validate the health literacy questionnaire of Van der Vaart based on a survey distributed among students in Romania. The results provided information on digital health literacy levels, health-related attitudes and behaviors, and the use of digital health-related innovations during the COVID-19 pandemic for a diverse sample of college students.

The source of information is relevant to this discussion on preventing and combating health crises and challenges. Historically, this information would be obtained from sources such as friends and family; however, we now have the benefit of the internet, which provides global data on these subjects.

The study revealed a moderate proportion of correlation among the individual items, which corroborates the results found in the specialized literature. However, the association among inter-dimensional items was low, implying homogeneity between items based on the related sub-constructs.

The vast majority of students used online health information and shared it in a social context; therefore, a familiarity with new digital technologies was evident. Consistent with the literature, we found that health literacy and digital health literacy were related but unique constructs (Martins et al., 2022; Patil et al., 2021; Rosário et al., 2020).

The questionnaires revealed that students faced significant literacy problems despite their level of education, and the general claim was that they found it difficult to filter information. The complex informational environment and the challenges endured due to the COVID-19 pandemic caused a forced adaptation to this new environment. During this time of health crisis, digital health information sources were increasingly accessed, which presented obstacles in terms of inconsistent or misleading health messages.

Although health misinformation has been a challenging issue, both in the current environment and during the pandemic, our results showed that students were confident in their ability to navigate. However, research has identified that overconfidence brings other issues to the forefront (Lorini et al., 2022; Patil et al., 2021). The current research showed that more than 50% of university students perceived themselves to have higher digital health literacy levels because of the adjustments due to COVID-19. Although these findings are comparable to studies conducted in Vietnam (Nguyen et al., 2021) and Germany (Dadaczynski et al., 2021), they are inconsistent with those from Pakistan (Zakar et al., 2021) Spain, Puerto Rico, and Ecuador (Rivadeneira et al., 2022), where students showed low-to-moderate levels of health literacy.

The health crisis brought about by the pandemic and the related proliferation of technology and other information and communications technology devices has enabled the timely development and revalidation of digital health literacy. This concept provides useful information on the ease or difficulty in accessing, evaluating, and using health information through an analysis of the combination of technology and competence among students.

Digitalization allows for the creation of a new educational experience because automatic tools contribute to flexibility, a diversity of approaches, and the inspiration to study. In addition, the independence of space and time can be a beneficial component, particularly for international students. Online presentations can be accessed from anywhere in the world, and the consequent chats and forums can inspire computer-generated flexibility and cross-cultural exchange. Furthermore, linguistic blockades can be overcome effortlessly with e-learning units that are accessible in diverse languages. Digital education prepares students for their future working life, which will be increasingly shaped by digitization (Maatuk & Abdelnabi, 2021; Moubayed et al., 2019).

The advantages of e-learning methods can be summarized as follows:

- **Cost savings:** Reduced training and travel costs aid teachers and decreased attendance requirements allow learners to gain valuable work time. Within the university, e-learning saves space and provides cost-effective updating of learning materials.
- **Time savings:** E-learning through seminars and courses can be conducted at home and simultaneously across various other environments, thus saving travel time for both students and teachers.
- **Flexibility:** Users of e-learning platforms are flexible because there is no fixed learning time and space. They are often able to learn anytime and anywhere through remote providers.
- **The ability to adapt learning to an individualized pace and method:** There is usually a preferred way of learning and the intervals between learning and breaks differ among individuals. In addition, preferences generally exist between an active or passive learning style.
- **Reinforcement of personal responsibility:** In the learning environment, the student is normally under the control of the teacher and must perform at certain times according to instructions. With e-learning, this constant control by the teacher is no longer present, and students must organize their own time and method of learning.
- **Working with different technologies and media:** Working and learning with the aid of a computer allows users to improve their media skills. Many learning programs use various media and technology approaches, resulting in a vast knowledge gain for the user.
- **Advantages of using computers in e-learning:** Communication with the user is interactive: the computer can react flexibly and present a different evolution of the program depending on the individual knowledge of the user. Through constant feedback, the user can monitor their learning progress.
- **The hypertext structure:** individual content can be connected through links, allowing the user to quickly switch back and forth between individual topics and access a clear picture of the networked structure of the learning material.

However, there are also disadvantages associated with the e-learning method. Thus, from the disadvantages found in the specialized literature, we emphasize the following:

- E-learning has a dependence on technical infrastructure and many learning programs require a fast online connection.
- The ability to print relevant materials or information is not always available to all participants.
- The lack of permanent supervision means that open questions can be asked only at times when the actual meeting takes place.
- Learners must first learn to use the e-learning methods, especially the various digital media, before they can access the actual course materials.
- There were relatively few teachers who worked with e-learning before the pandemic; therefore, the quality of the programs may be lower until educators adapt to the new system. The market is currently dominated by technology and technicians, and programs are oriented more toward technology than teaching requirements.
- Due to the novelty of the technologies, an exchange of experience is lacking.
- The use of e-learning is limited to certain fields and subjects.
- Learners are generally alone in front of the computer and lack social contact.
- Long periods of studying in front of the screen can be tiring.
- The requirements in the e-learning system can lead to stress and excessive demands.
- Discipline and self-learning skills are required to organize learning.

E-learning and digitally supported teaching and learning methods are central challenges for knowledge-based societies in the digital age. Therefore e-learning has a pervasive effect and is used and discussed in areas ranging from social policy to internal employee qualifications.

## 6 | CONCLUSIONS

The well-being of society is greatly influenced by the integration of sustainable entrepreneurship education, digitization, and the CE as a comprehensive strategy. This approach prepares future entrepreneurs to develop sustainable business models that are economically efficient, environmentally friendly, and socially responsible. Sustainable entrepreneurship training combined with CE principles guides aspiring entrepreneurs toward the development of business models that minimize environmental impact and maximize resource efficiency. The result is an economically viable, environmentally sustainable, and socially responsible society. We also note that the CE and sustainability education are closely related and that both promote systemic change in the economy and society. The CE offers a clear alternative to the linear, consumption-based economic model, relying on the conservation, reuse and recycling of resources. Sustainability education plays a crucial role here as it provides the skills needed to successfully shape this change. Entrepreneurs must be empowered to develop sustainable and circular business models and exploit the potential of new technologies such as AI, blockchain, and 3D printing. Furthermore, the link between the CE and well-being makes it clear that a sustainable economy not only brings ecological and economic benefits, but also leads to healthier living and working conditions. Ultimately, the

transition to a CE requires a fundamental rethinking of business and education to overcome current consumer-oriented structures and create a sustainable future. Digitization plays a key role in improving environmental quality and social well-being by facilitating the implementation of CE principles through advanced data analysis and resource management. In addition, the clean environment that results from employing the principles of the CE improves public health and minimizes environmental damage. Educational institutions are crucial in this process as they provide awareness and knowledge and promote the commitment of students to sustainable practices through practice-oriented teaching approaches. This holistic view of education, business, and technology is essential to achieving sustainable development and improved overall well-being.

### 6.1 | Theoretical implications

Integrating sustainability into entrepreneurship education has far-reaching theoretical implications, particularly regarding the concepts of the CE, health literacy, and well-being. Education that conveys sustainable values fosters the desire to develop resource-efficient business models while promoting the ability of women entrepreneurs to master long-term economic, environmental, and social challenges. The CE as a central principle allows linear production methods to be replaced with circular approaches, resulting in both ecological and economic benefits. Health education plays a central role, as entrepreneurs can build personal resilience and create a healthy work environment for employees through an understanding of physical and psychological well-being. Ultimately, these factors contribute to sustainable business growth and promote overall well-being and social responsibility.

At the same time, this analysis highlights the importance of an integrative approach to sustainability that considers the economy, education, and technology as interrelated factors. It is becoming clear that the CE is not just an economic model, but has profound effects on the social and ecological fabric. Future research and theoretical approaches should place greater emphasis on the interdisciplinary nature of the CE, paying equal attention to ecological, economic, and social dimensions. Another important theoretical contribution is the concept of “sustainable entrepreneurship education,” which highlights the need to see education as the key to change and to understand entrepreneurs as central actors in the transition to a CE. This could further advance theoretical discussions about the influence of new technologies on business models and sustainable consumption.

The theoretical implications for sustainable entrepreneurship education based on the themes of the CE, health literacy, and well-being discussed in this study demonstrate the importance of a holistic educational strategy. Integrating the CE into entrepreneurship education initiates a paradigm shift toward the minimization of waste and maximization of resource efficiency, which produces ecological benefits and promotes well-being by reducing environmental impacts and improving the quality of life. Health education is important in this process, as greater competence in dealing with health information,

especially in digital format, increases individual well-being and promotes preventive measures. The combination of health literacy and the CE principle creates a synergistic effect that strengthens entrepreneurial resilience while focusing on social and environmental responsibility. Therefore, sustainable entrepreneurship education considers economic, health, and social dimensions, which is crucial for comprehensive and sustainable development.

The COVID-19 pandemic forced the education system to adapt to digitization, which was a major challenge at the time, but which can be a benefit going forward. Education migrated to an online environment where the help and support of parents was needed at the primary levels, while the university environment adapted more easily due to the independence and flexibility of the students. This new adaptation to a health crisis was also an emotional challenge for many, and this factor should not be neglected.

Given the lessons to be learned from the crisis, this report proposed a set of recommendations for robust action at the EU level to foster a more resilient education and youth sector in Europe. The important core areas involve:

- supporting cooperative decision-making and crisis management;
- supporting improvements to the quality of and access to education;
- developing plans for complete care for students in a vast range of learning environments;
- increasing innovation through funding and digitization of the system; and
- enhancing inclusivity and flexibility in the field of education.

A major challenge in organizing and implementing digitization is securing the funding.

The development, establishment, and expansion of digital platforms are costly and generally not budgeted for by educational institutions. If higher education policy and administration prioritize digitization, funding must be ensured.

In general, the study results indicate a need to implement measures for the promotion of health literacy within the framework of the university as an educational institution.

The results indicated that digital health literacy was not wholly related to well-being, but associations were observed in individual sub-areas. Specifically, students who considered the difficulty of assessing the relevance of information on the internet as low reported significantly better well-being.

The ability to sift through the abundance of digital health information to locate data that are relevant to your situation can be an important protective factor. In this study, socioeconomic status was identified as a clear influencing factor on the individual well-being of the students, which is consistent with previous international findings (Amoah et al., 2021; Dadaczynski et al., 2022). A higher level of well-being was associated with increasing perceived social status.

In summary, negative developments are evident in the psychological well-being of students, and the potential for digital health literacy

to act as a protective resource was partially confirmed in this study; therefore, further research would be beneficial. Social status was shown to be a relevant factor that plays a key role in well-being. This connection between well-being and self-assessed social status was found in Romanian students regardless of the level of their digital health literacy.

## 6.2 | Practical implications

The practical implications of sustainable entrepreneurship education, considering the CE, health literacy, and well-being, are that educational institutions must work specifically to prepare future entrepreneurs for the challenges of a resource-efficient and socially responsible economy. The implementation of hands-on teaching promotes direct student engagement with sustainable business practices. This includes the development of business models based on CE principles such as repairing, reusing, and recycling products to minimize waste and maximize resource longevity.

In addition, the education system should place special emphasis on strengthening health literacy, as this has been shown to enhance individual student well-being and the ability to assess critical health information in the digital environment and take preventive action. The combination of these approaches helps improve business resilience while supporting public health through green practices. Educational institutions must both teach these concepts in theory and implement them in practice through concrete projects and cooperation with industry to actively promote the development of a sustainable economy.

## 6.3 | Limitations

A key limitation of this study on sustainable entrepreneurship education, particularly in relation to the CE, health literacy, and well-being, was that the sample consisted of a specific group of students in Romania. The results may not be easily transferable to other countries or educational systems, particularly as cultural, socio-economic, and educational policy frameworks may differ. Another limitation concerns self-reported data, which are susceptible to social desirability bias or inaccurate reporting by the participants. This is especially true for topics such as digital literacy in health and mental well-being, where overestimations or underestimations are possible. In addition, the influence of factors such as social status and access to digital resources could be better understood through deeper analysis, as the correlation among the variables was moderate in some cases; therefore, the complexity of the relationships was not fully reflected.

The study was based on a cross-sectional survey, meaning it provided only a snapshot. A longitudinal design tracking the development of health literacy and well-being over time could provide further insights into the causal relationships and long-term effects of the factors discussed.

## 6.4 | Perspectives

Sustainable entrepreneurship education offers numerous avenues for future investigation. One important direction could involve a more thorough analysis of the link between the CE and health literacy. In particular, the role of digitization as a catalyst for knowledge sharing and increased efficiency in the CE could be further investigated. Future studies should also include longitudinal data to examine the long-term effects of sustainability education on the well-being of women entrepreneurs and their employees. Another approach would be to extend the research to different cultural and economic contexts to test the transferability of the results, such as a focus on emerging countries where digitization and the CE are at different stages of development. In addition, a closer examination of the social and economic factors that influence well-being and health literacy is needed to develop customized educational programs.

### ORCID

Melinda Timea Fülöp  <https://orcid.org/0000-0002-8972-0826>

Javier Cifuentes-Faura  <https://orcid.org/0000-0001-6763-8525>

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## AUTHOR BIOGRAPHIES

**Melinda Timea Fülöp** holds a PhD in Economics and is a professor in the Faculty of Economics and Business Administration, Babes Bolyai University, Cluj Napoca, Romania. Her lines of research

include those related to public administration, green economics, and those related to sustainability and the education system. She has published several education articles in SSCI impact journals.

**Javier Cifuentes-Faura** holds a PhD in Business Sciences and is a member of the Department of Financial Economics and Accounting at the University of Murcia, Spain. His lines of research include those related to public administration, green economics, and those related to sustainability and the education system. He has published in impact journals, such as *Educational Review*, *International Journal of Sustainability in Higher Education* or *Environmental Education Research*. He has participated in several international conferences, being invited to some of them as keynote speaker. He has been included by the prestigious Stanford University Ranking as one of the most influential researchers in the world (Top 2% Scientists Worldwide).

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