OECONOMIA
COPERNICANA

VOLUME 15 ISSUE 3 SEPTEMBER 2024

p-ISSN 2083-1277, e-ISSN 2353-1827
www.oeconomia.pl

ORIGINAL ARTICLE

Citation: Noguera-Méndez, P., Molera, L., & Semitiel-García, M. (2024). Integrating sustainability in the economics curriculum: Challenges and impact on future decision-makers. *Oeconomia Copernicana, 15*(3), 871–923. https://doi.org/10.24136/oc.3084

Contact to corresponding author: María Semitiel-García, mariase@um.es

Article history: Received: 30.03.2024; Accepted: 20.08.2024; Published online: 30.09.2024

Pedro Noguera-Méndez
CEIR Campus Mare Nostrum (CMN), Campus de Espinardo, 30100, Murcia
University of Murcia, Spain
orcid.org/0000-0003-2637-9920

Lourdes Molera
CEIR Campus Mare Nostrum (CMN), Campus de Espinardo, 30100, Murcia
University of Murcia, Spain
orcid.org/0000-0003-2463-4588

María Semitiel-García
CEIR Campus Mare Nostrum (CMN), Campus de Espinardo, 30100, Murcia
University of Murcia, Spain
orcid.org/0000-0002-7571-6666

Integrating sustainability in the economics curriculum: Challenges and impact on future decision-makers

JEL Classification: *A22; I25; O44; Q01; Q56; Q57*

Keywords: *sustainability; sustainable development; economics education; education for sustainable development; pro-environmental policies*

Abstract

Research background: Scientific evidence has shown the impact of environmental degradation on human well-being, demanding that political and economic decision-makers address the challenge of reversing this process. In this context, the economic education provided to future policymakers and business managers is crucial, because it can accelerate or impede the transition towards sustainability. What is taught in university economic courses, particularly introductory ones, shapes the ideas and the worldview of economic agents, influencing the decisions they will take in their professional activities.
Purpose of the article: The main objective of this paper is to determine how sustainability is addressed in introductory economics courses, where the foundations of the discipline are laid. Specifically, the goal is to uncover what ideas are conveyed about sustainability in these courses, how they are taught, and whether there have been any changes in the last decades.
Methods: Text Mining and Reflexive Thematic Analysis are applied to examine data from university syllabi and the most commonly used economic textbooks through the lens of a deconstruction of the complex concept of sustainability.
Findings & value added: The main contribution of this paper is a proposal for a deconstruction of the complex concept of sustainability that guides the empirical analysis. The results reveal that sustainability is practically absent from introductory economics courses; notably, no progress has been made on ethical issues or in addressing the impact of nature and environmental degradation on human well-being. Moreover, certain conceptions and models that work against the understanding of sustainability are conveyed in the most used textbooks. Although the role of economics discipline in understanding sustainability and in designing and implementing policies for an equitable sustainable transition is key, the teaching of economics offers resistance to change, remaining part of the problem of unsustainability. The integration of sustainability into the university economic courses still represents a major challenge with implications for future decision-makers.

Introduction

In the last decades, science has highlighted the severity of the problem of unsustainability and pointed to the role that the economic system plays in environmental degradation and planetary transformation (Moranta *et al*., 2021; Rockström *et al*., 2009; Steffen *et al*., 2015). It has also been recognized the importance of the economic discipline in designing and implementing policies for a sustainable transition (Dasgupta, 2021; Polasky *et al*., 2019; Stern, 2022). Moreover, the multidimensional character of the environmental challenge and the key role of economic actors in addressing it have been underlined in numerous and diverse international initiatives, many of which are coordinated by the United Nations, including the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC), the Millennium Ecosystem Assessment, the Intergovernmental Science-Policy Platform on Biodiversity

and Ecosystem Services (IPBES), and the 2030 Agenda for Sustainable Development (Convention on Biological Diversity [CBD], 2022; IPCC, 2022; Millennium Ecosystem Assessment, 2005; Pörtner *et al*., 2021; United Nations General Assembly, 2015).

Dealing with this problem requires a multifaceted approach, with education standing out as an essential element for the transition to sustainability, as pointed out in Sterling (2013). In this respect, several initiatives have been prompted, such as the United Nations Decade of Education for Sustainable Development (ESD) (2005–2014), which introduced changes to move towards an education that promotes values, behaviors, knowledge and skills that contribute to Sustainable Development (SD) (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2005, 2017). Some other remarkable educational initiatives are the Talloires Declaration in 1990, the COPERNICUS Alliance, and the Aichi-Nagoya Declaration on ESD 2014. These international commitments have recently been updated in target 7 of Sustainable Development Goal 4 (SDG 4) of the 2030 Agenda, highlighting the role that ESD plays in ensuring the acquisition of SD knowledge and skills.

In this context, it is noteworthy the role undertaken by Higher Education Institutions (HEI), as they hold the responsibility for shaping the minds of future generations. This explains the growing attention given to ESD in HEI over the two last decades, which is evidenced by the publication of specialized scholarly journals and by the growing number of review articles focused on this topic (Abad-Segura & González-Zamar, 2021) and also papers that have studied the impact of HEIs on SD (Findler *et al*., 2019) and examined the strategies followed, or to be followed, by HEIs to foster pro-environmental behavior and climate justice among students (Bertossi & Marangon, 2022; Kinol *et al*., 2023).

In particular, there are compelling reasons to argue in favor of the economic discipline addressing sustainability within the context of higher education. These reasons are related to the position economics and economists hold in society (Christensen, 2017; Maesse, 2022). Economists, as well as other professionals — like business managers and lawyers- who study the discipline of economics as part of their university education, play a crucial role in the SD of societies (Ogutu *et al*., 2023). In fact, there is a broad consensus on the power of teaching economics to shape some attitudes and values and how those professionals view the world. In this regard, Stigler (1959) asserts that the professional study of a discipline influ-

ences personal beliefs and attitudes, and there is ample discussion in the literature about whether economics' students are different from students in other fields, and whether this observed difference is the result of indoctrination or a selection effect (Carter & Irons, 1991; Frey *et al*., 1993; Marwell & Ames, 1981). What is of key interest to consider here may seem obvious but is not trivial: what is taught matters. The economics that students learn influences their worldviews and their understanding of problems and solutions. This is particularly relevant in the case of sustainability, because it is a complex and normative concept (Baumgärtner & Quaas, 2010b; Vucetich & Nelson, 2010) that entangles facts and values, knowledge and ethical attitudes (Putnam, 2002).

The need to update what students learn in economics courses during their first year at university, where the foundations of the discipline are laid, has led to the publication of remarkable papers focused on Econ 101, including argued and detailed proposals, notably Bowles and Carlin (2020), but also Green (2012) and Røpke (2020), which focus their attention on the teaching of sustainability. It is important to decide whether sustainability should be incorporated into the curriculum of introductory university economics courses. This consideration is not only about fulfilling international and moral commitments that can be made but also with the commitment of the discipline of economics to scientific progress. Achieving sustainability is a real, extremely important challenge, which concerns the field of economics, and it seems necessary to remember that the central task of a "science such as economics is to provide a general understanding of events in the real world, and ultimately all of its theories and techniques must be instrumental to that task" (Stigler, 1983, 533).

There is growing evidence of the anthropic origin of ecosystem degradation and its negative impact on well-being, human health and economic activity (CBD, 2022; IPCC, 2022; Meierrieks, 2021; Millennium Ecosystem Assessment, 2005; Pörtner*et al*., 2021; Rockström *et al*., 2009; Romanello *et al*., 2022; Steffen *et al*., 2015). Human beings, in the Anthropocene, have become agents of geological change (Head *et al*., 2022; Steffen *et al*., 2004) which has led some to question the distinction between natural history and human history (Chakrabarty, 2009). "The global extraction of fossil and mineral materials as well as of biomass has multiplied in the 20th century", demonstrating human effect on the surrounding natural environment (Krausmann *et al*. 2018, p. 13). Nevertheless, the key role of nature as the source of the material basis, and also as a sink, for global economic growth

has not been adequately considered up to now (IPCC, 2022; Rockström *et al*., 2021). However, at the same time, the central role of the field of economics in understanding and analyzing SD is recognized: "Economics, combined with earth system sciences, is crucial for understanding both positive and negative impacts of alternatives and the trade-offs involved. Economics, combined with other social and behavioral sciences, is crucial for understanding how it might be possible to shift human behavior toward achieving sustainable development. The application of economic principles and empirical findings should be a central component in the quest to meet the aspirations of humanity for a good life given the finite resources of the earth" (Polasky *et al*., 2019).

In this regard, the growing attention to sustainability in the disciplines of environmental and natural resource economics is noteworthy (Halkos & Managi, 2023). Additionally, there is a pressing need for economists to engage more in interdisciplinary research to increase understanding of the complex relationships between society and nature (Jaeger *et al*., 2023). The discipline of economics provides perspective, knowledge and tools to the design and assessment of interventions, influencing our relationship with nature and the way we think and act to achieve sustainability. It also contributes through the role of economic incentives in promoting environmentally friendly behavior and technologies (Su *et al*., 2023; Wang *et al*., 2023). This responsibility affects different areas including, prominently, economic institutions, private firms, markets, production and consumption processes, and also the notions of progress and well-being (Dasgupta, 2021; United Nations Development Programme [UNDP], 2020).

Integrating sustainability into the curricula of the economics discipline, in the higher education context, is a challenge that, if addressed, would have an impact through today's students and future decision-makers. The main objective of this paper is to explore what the economics discipline teaches about sustainability, more specifically Environmental Sustainability (ES), and how it does so at the university level, in introductory economics courses, and whether there have been changes that demonstrate adaptation to and increased interest in ES. Specifically, the paper examines how sustainability is addressed in first-year economic theory courses in Economics, Business Administration and Law degrees at Spanish public universities (hereafter Econ1) based on an analysis of their curricula, syllabi, and textbooks for the 2021–22 academic year.

While there are other approaches to evaluating the incorporation of sustainability into curricula, such as analyzing the perceptions of students and lecturers collected through surveys (Badea *et al*., 2020), interviews (Green, 2013, 2015), or focus groups (Winter *et al*., 2022), this paper focuses on course syllabi and the textbooks listed as fundamental bibliography in them, because the subject matter in the syllabi is contingent upon these selected textbooks. Although the process of teaching economics and what happens in the classroom in relation to learning is not limited by textbook content, they are clearly important, because they generally evidence a consensus and a shared vision of what is taught in economics. In this respect, Mankiw (2020, 216) is very clear in answering the question "What perspective should textbooks take?" He asserts that textbooks in introductory and intermediate courses "should faithfully represent the views shared by the majority of professional economists." In fact, the degree to which economics textbooks are standardized internationally (Bäuerle, 2022) points to the existence of a dominant vision, which is also expressed in the content of university syllabi and, therefore, reflects what is taught.

There is some previous research that analyses syllabi and/or textbooks to assess the presence and scope of sustainability in economics curricula. In a broader study, Chuvieco *et al*. (2022) examined the syllabi of all degree programs at the University of Alcalá (Spain) to extract environmental sustainability concepts and keywords using in-house software. They concluded that only 5.5% of the courses, many of which were not mandatory, explicitly include environmental sustainability content, mainly focusing on general environmental issues. Economics, along with Environmental Sciences, Biology, Tourism, and Pharmacy degrees, offered most of these courses. Green (2012) conducted a content analysis of 12 standard introductory economics textbooks and found that they contained insufficient material to foster students' understanding of sustainability, often ignoring or misrepresenting the connections between the economy and the environment. Charmetant *et al*. (2024) undertook quantitative and content analysis of 57 introductory economics textbooks authored by US, French, and Indian scholars to evaluate the attention given specifically to climate change, rather than to sustainability more broadly, concluding that it is either null or marginal.

However, to the best of our knowledge, this paper represents the first study to propose a deconstruction of sustainability — integrating concepts from various scientific fields and considering its complexity, constituent

elements, and relationships — that has been applied to empirical analysis. This deconstruction serves as a conceptual framework for analyzing syllabi and most used textbooks, employing both quantitative and qualitative methodologies, including text mining and reflexive thematic analysis. It encompasses all Spanish public universities and presents a novel approach by comparing the first and last editions of the selected textbooks to study their evolution. This research and their findings are intended to contribute to shaping a collective vision that supports more effective and purposeful pro-environmental policy designs and actions.

The results suggest that Econ1, in its present state, may not effectively contribute to sustainability education. They are currently of great relevance for society, considering the key role of the field of economics in the sustainable transition, as well as the importance of graduates in Economics, Business Administration and Law in terms of employment and decision-making responsibility. Moreover, the significance of economics graduates is also observed in other countries, such as China (Winter *et al*., 2022) and the USA (Green, 2012). Although the empirical analysis is conducted in the Spanish context, the results and proposals are of more general interest due to the high level of standardization of these subjects, the far-reaching international distribution of the textbooks reviewed, and the ample evidence provided in the literature in line with our results.

The paper is structured as follows. The next section examines the central concept of sustainability and its deconstruction. The third section discusses the context of this study: the relevance of Economics, Business Administration, and Law degrees to the university and political systems and employment in Spain. Also, information on the economic theory courses in the first year of the selected degrees (Econ1) is offered. The fourth section details the research questions and the quantitative and qualitative methods applied. Section five is devoted to the analysis and the results. In the Discussion section, some reflections and proposals are addressed, followed by the Conclusion section.

Conceptual framework: deconstructing the concept of sustainability

This section focuses on the concept of sustainability and identifies its interrelated elements. Deconstructing this concept allows us to highlight its complex, interdisciplinary, and normative features. Our analysis is based

on Vucetich and Nelson (2010), which has been related to the 'Levels of Knowing' in Sterling (2013). Approaching the concept in this way (Figure 1) makes it also possible to identify the difficulties, limitations, and opportunities for economic theory courses to contribute to the teaching of sustainability.

The most widely recognized definition of SD refers to it as the ability to ensure that humanity "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 24); often emphasizing its social, economic and environmental pillars. It is important to note that this paper focuses on ES, although the social and economic pillars are mentioned where deemed necessary. This narrow approach was chosen to ensure the study was manageable, and this decision is justified by the hierarchical relationship between the three domains: economic sustainability is subordinate to social sustainability and social sustainability to environmental sustainability (Green, 2012).

Starting from the definition of sustainability as meeting human needs in a socially just manner without depriving ecosystems of their health, Vucetich and Nelson (2010, p. 539) note its normative character, stating "most of the words in its definition are normative or value laden". "Sustainability is a normative notion about the way [sic] how humans should act towards nature, and how they are responsible towards one another and future generations" (Baumgärtner & Quaas 2010b, p. 445). Sustainability, like other concepts such as development or poverty, contains 'facts' and 'values' that are entangled: the 'facts' cannot be understood or evaluated without considering the 'values' (Putnam, 2002), because they are interdependent (van de Laar & Peil 2009, p. 377).

Figure 1 outlines sustainability and its relation to levels of knowing. The dotted circle represents the biosphere, including society which, in turn, embeds the economic system, referring to all economic actors and their linkages. The relationship between society, as part of nature, and the environment determines ES (left side on Figure 1). There is a physical dimension to this relationship: exploitation of the environment. There also exists an ethical aspect concerned with our understanding of ourselves in relation to other living beings, nature in general terms, and our relationships with others, including those of the present, even distant, and future generations (Palmer *et al.*, 2014).

According to Figure 1, exploitation of environmental resources is affected by technology (a), understanding the environment (b), and understand-

ing how this exploitation affects both society (c) and the environment (d). The relationship between society and the environment is also affected by the ethical attitudes (e), that is, by normative issues. This conceptualization of sustainability, based on Vucetich and Nelson (2010), emphasizes the key role ethical attitudes play in determining human behavior. Ethics determines, among others, what technology is used and how it is used, what levels of exploitation are acceptable, as well as perceptions of ecosystem health. The loop going to and from society aims to highlight ethical attitudes which create commitments to present and future generations (f) and affect ethical attitudes towards the environment (e), the use of technology (a) and the exploitation of the environment (b, d). An expanded version of Figure 1 is provided in Figure A.1, available online.

The different levels of knowing, from deep knowing (metaphysics/cosmology) to actions, which are represented on the right side in Figure 1, are implicit in the learning process related to sustainability (Sterling, 2013). Influence is more intense as you move upwards from the deep levels (thick vertical arrow on the right) than downwards. Differences in metaphysics, cosmology, and worldviews entail differences in how we perceive the real world, how we understand it, what ideas and theories we assume, and how we act. These levels of knowing can also be associated with the relationship between society and nature (h, i). In this case, the higher levels of knowing (ideas/theories/actions) have been linked to the relationship between society and the exploitation of nature (h), while the deep levels of knowing (metaphysics/beliefs/values) have been linked to ethical attitudes (i). The existence of a diversity of ethical positions with respect to nature helps to explain differences in the rights, obligations, and values we attribute to other living beings, a landscape, or an ecosystem. In addition to their instrumental value, natural beings and goods have, or may have, intrinsic value, which is independent of the service they may provide (Brenan & Lo, 2020). This is important from a practical point of view, as the recognition of the intrinsic value of nature can influence decision-making processes (Steg, 2016; Vucetich *et al*., 2015). Consequently, and according to Figure 1, moral feelings about nature matter, because they have consequences for the law, human action, and the level of commitment to sustainability (Steg, 2016). These ethical perspectives also condition relationships between human beings, whether close and present, distant, or future generations. The ethical notion of universalism (all human lives are endowed with equal human rights) is noteworthy in this regard. It is a fundamental principle of sus-

tainable human development (Anand & Sen, 2000) and requires ensuring intra- and intergenerational equity. According to this principle, when considering moral feelings, we are compelled to maintain a careful, respectful, and responsible relationship with nature and with present and future generations.

It is common to distinguish between anthropic and non-anthropic ethical positions in this normative context (Goralnik *et al*., 2014). From non-anthropic positions, the moral community is extended to non-human beings and can also include natural entities (Palmer *et al*., 2014). Leopold (1949) and Vucetich *et al*. (2015) assert that acknowledging the intrinsic value of some aspects of nature is a step forward in expanding moral rights. Ethical attitudes are, therefore, diverse and evolve. They can change to suit the context, such that what is considered 'acceptable' at a particular time may be considered 'repugnant' in another period. Morality is context-sensitive: "the morality of an act is a function of the state of the system at the time it is performed" (Hardin, 1968, p. 1245). Putnam (2003) also stresses the practical nature of ethics, which evolves with real problems and, as Mearman (2009) points out, emerges out of practice. Indeed, UNESCO (2017) recognizes that the normative competency, which refers to the development of "abilities to understand and reflect on the norms and values that underlie one's actions; and to negotiate sustainability values" is crucial for ESD. This idea also connects with the understanding that learning involves and affects different levels of knowing and consciousness (Sterling, 2013). Learning and teaching about sustainability, within the framework of ESD, means considering not only conceptual elements, but also the necessary changes to individual and collective action to achieve sustainability, which in turn requires deeper changes that affect our worldview, beliefs, and values. It involves thinking critically about our ethical values and attitudes, as well as about changes to the regulatory framework that can promote pro-environmental attitudes and behavior.

The relationship in Figure 1 between the ethical and the physical dimensions of sustainability was highlighted decades ago by Aldo Leopold, when called for the extension of ethics to land, animals, and plants. He was firmly convinced of the need to substantially change how we see and feel nature — our ethical attitudes — in order to change our relationship with the environment and to ensure it is conserved. Leopold (1949, p. 207) pointed out that conservation progresses very slowly and underlined: "The usual answer to this dilemma is 'more conservation education.' No one will

debate this, but is it certain that only the volume of education needs stepping up? Is something lacking in the content as well?" Education today still lacks a land ethic that creates an intimate bond with nature in the form of values and attitudes that seek harmony and value the existence of biodiversity and healthy ecosystems and wildlife. This link must involve the acknowledgment that nature is not just a resource. Sustainability must be conceived as a mental state that underlies "the notion of a right relationship with nature which both conditions our attitudes towards the environment and our sense of our own identity" Bonnett (2002, p. 9).

Context: the discipline of economics at Spanish public universities

Our empirical study focuses on three Spanish public university degrees (Economics, Business Administration and Law). These degrees are extremely important in the context of higher education and employment, accounting for one fifth of the students in Spanish public universities in the 2021–22 academic year (Ministerio de Educación y Formación Profesional, 2022; Ministerio de Universidades, n.d., 2022). Detailed information is provided in Table B.1, available online (see Appendix).

The data provided by the National Statistics Institute, the Ministry of Labor and Social Economy, and the National Agency for Quality Assessment and Accreditation (Agencia Nacional de Evaluación de la Calidad y Acreditación [ANECA], 2005; Instituto Nacional de Estadística [INE], n.d.; Ministerio de Trabajo y Economía Social, 2022) allows us to deduce that the jobs, academic requirements, and professional profiles for graduates with degree in Economics stand out because of their connection to all sectors of the economy (detailed data have been included in Table B.2, available online). This is even more obviously the case for graduates in Business Administration, as they work in all economic sectors and have an influence on the economy as a whole through the companies where they are employed. Business Administration is the most popular degree in Spain, with the highest hiring rates in 2016 (Fundación Everis, 2018). Moreover, information on the individuals with the greatest responsibility (CEOs or Managing Directors) in the 50 Spanish companies with the highest operating revenues reveals that 60% of them hold degrees in Economics, Business Administration or Law, while 33% of them are engineers (Bureau Van Dijk,

n.d.). Additional information can be found in Tables B.3 and B.4, available online.

Graduates with degrees in Economics, Business Administration and Law have a significant influence on the present and future situation of Spanish society through the professional activities they perform and the positions of responsibility they hold. In Spain, the Law degree is particularly relevant, because 52% of the people who are or have held a position as a minister in any of the Spanish democratic governments or a president in any of its 17 regional governments, through the forty-six years of the country's democratic period, have a Law degree (Tables B.5 and B.6, available online, provide detailed information).

The curricula for these university degree programs contain compulsory economics content, including economic theory courses. For Economics degrees these are present throughout the curriculum, whereas for Business Administration they are only in the first and second years. The content covered in the economics course for Law degrees is critical, as there is only one compulsory economics course, as it is also the case in Political Science, Sociology, Tourism, and Architecture, among others. The same applies to the economics course in the first year of Economics and Business degrees, as it is the first contact students have with economic theory, and lays the foundations for subsequent learning; likewise, it conditions students' training not only in terms of knowledge and conceptions, but also attitudes and values.

Methods

The conceptual framework provided in the second section, which examined and deconstructed the concept of sustainability and discussed its interconnected dimensions and elements (Figure 1), is the organizational foundation for the empirical research contained in this paper. The main research questions outlined in this paper, connecting the dimensions of sustainability to the content taught in Econ1, aim to a) determine how the analysis of the economic system takes into consideration its interactions with the environmental system; b) determine how nature in general, living beings, ecosystems, and the goods and services nature provides, both for production and human well-being, are viewed, as well as to examine the understanding of how society is affected by exploiting nature; c) examine

the understanding of how nature is affected by being exploited, and how human activity affects nature; d) examine how the normative dimension of sustainability is addressed, that is, the ethical attitudes involved in society's relationship with nature and with society itself, including future generations; e) examine how sustainability and sustainable development are taught, analyzing critiques and reflections on both to ascertain to what extent efforts are devoted to this field and, in particular, how challenges, dilemmas, conflicts, and contradictions are approached; and f) examine how environmental constraints and sustainability measurement have been addressed.

Considering the arguments developed in the previous sections, our analysis will now focus on the contents of an introductory economics course, Econ1 (Table 1), related to the internationally known Econ101: Introductory Economics, although the one analyzed here is broader. The questions posed in the paragraph above were addressed by analyzing the syllabi and the textbooks listed in the basic bibliography section for Econ1 courses (all public universities in Spain, academic year 2021–22). Our analysis involved a total of 127 degree programs and 190 syllabi. The basic bibliography section of all syllabi was examined including an initial analysis of all the textbooks (detailed information is provided in Tables B.7–B.9, available online). The edition of the textbooks was considered because it provides insight into how updated the content is. In a second stage, some of the basic textbooks were selected for an in-depth content analysis according to the following process:

1. Ranking of all textbooks in the basic bibliography based on their relative quantification, identifying the most frequent ones.
2. Significance of the single-use textbooks: we compiled a list with the textbooks that were included in the basic bibliography section of the syllabi with only one textbook (single-use textbooks) and we quantified the frequency of the single-use textbooks considering all the syllabi.
3. Relative quantification of the first authors, identifying the most frequent ones.

The original English language versions of the two finally selected textbooks, both in their first and most recent editions (four textbooks in total), which have identical content and page numbering as the Spanish ones, were analyzed even if almost all the syllabi include just the Spanish edition. These textbooks, as will be shown in the next section, are also widely used around the world, giving our study relevant international value.

All the syllabi and the selected textbooks were analyzed through a search for words and expressions classified, on the basis of the deconstruction of the concept of sustainability, into six groups, also related to our research questions: 1. Nature and the environment; 2. How nature affects society; 3. How human activity affects nature; 4. Ethical attitudes; 5. Sustainability; 6. Indicators and institutions (Table 2). Green's work (2012) and the reviewed literature for the deconstruction of the concept of sustainability (Figure 1) were the starting point for an initial version of the list of terms. The analyses carried out served as feedback for a more complete list of expressions selected and grouped to refer to aspects of the physical (groups 1-3 and b, c and d in Figure 1), and ethical (group 4 and e in Figure 1) dimensions of sustainability and including terms with a more general sustainability content (groups 5 and 6). A definitive version, with additional explanations, can be founded in Table B.10, available online.

The methods used to analyze the textbooks were text mining (Feldman & Sanger, 2007; Silge & Robinson, 2017) and Reflexive Thematic Analysis (RTA), based on Braun and Clarke (2012, 2019, 2021), Nowell *et al*. (2017) and (Byrne, 2022). Text mining and RTA are complementary methods, allowing for joint quantitative and qualitative analyses.

Text mining is a broad field of techniques used to extract valuable information from texts, in particular patterns and trends. First, the text data have to be read from their original format and converted into suitable structures to carry out further analysis. Later, a pre-processing step is performed to clean the texts. This cleaning step involved converting the text to lower case and removing numbers, punctuation marks, extra white space, and stopwords. These are the most frequent words in a language, which, therefore, provide no relevant information, such as articles, conjunctions, prepositions, and pronouns. Finally, some specific techniques, like term frequency analysis, topic modelling, sentiment analysis, text clustering, text classification, or keyword network analysis, among others, are applied to obtain meaningful information.

In this paper, text mining was performed using the open source software R (R Core Team, 2018), specifically, the tm (Feinerer *et al*., 2008), and tidytext (Silge & Robinson, 2017) packages together with other complementary packages to organize and visualize the information (more details on the methods in C appendix, available online). The statistical analyses were based on term frequency (words or longer expressions, like bigrams or trigrams); in some cases, to simplify the results stemming was performed

initially. This procedure considers only the root of the word and disregards any suffixes (for example, the frequency of the words product, production and productivity are added to the root product).

RTA is purely qualitative, inductive and deductive, and it requires reflection, critique, and interpretation of semantic and latent content, considering their depth, precision, and completeness. While quantitative information is useful and facilitates a valuable exploratory analysis of the data, it is not sufficient to achieve the purposes of this study. RTA facilitates understanding of the knowledge being transmitted, not only what and how much is said but also how and how deeply it is said. Moreover, it enabled us to delve into the latent content and missing themes and concepts. RTA is a method that centers on researcher subjectivity; deep reflection and engagement with data are remarkably important (Braun & Clarke, 2019). Theoretical flexibility and interpretation are two main aspects of RTA. Time and reflection are required to reveal meanings from the explicit and implicit content and for the themes and ideas to materialize (Braun & Clarke, 2021). In RTA, themes are generated on the basis of the information and the theoretical framework examined. These themes should be closely linked to each other and to the data under study, allowing for the structured construction of an analysis that offers answers to the research questions (Byrne, 2022).

Figure 2 provides an outline of the research process. Firstly, we analyzed the Econ1 syllabi and selected the textbooks. The content of the syllabi was analyzed with a focus on sustainability and SD. Next, we identified and analyzed in the textbooks, with text mining, the words and expressions organized in the six groups in Table 2. Lastly, we applied RTA to analyze this content in the textbooks, examining both explicit and latent content to address the research questions.

Results: the teaching of sustainability in Econ1

The implementation of the methodological process outlined in Figure 2 has enabled to present the results in this section with due consideration to the explanatory arguments and contextualization elaborated in prior sections. Complementing the quantitative analysis, the application of RTA has afforded for a deeper understanding of the findings, organized around five themes.

Analysis of the syllabuses

After a systematic review of the university syllabuses, searching for sustainability-related terms in all their sections, they are scarcely found and mostly in sections that might be seen as peripheral, like in the subject presentation, as a general comment, or as a simple recommendation. The commitment shows when sustainability is part of the main content and of what teachers are expected to cover. The inspection of the titles of the units and sub-units in the section contents shows that only 6 of the syllabi, from 3 of the 50 universities analyzed, included an explicit reference to sustainability, and even in these few cases the coverage is partial (see details in Table B.11, available online).

All the syllabi included both a basic bibliography section and a recommended bibliography section. The former indicates which textbooks must be studied in the course. The total number of different textbooks used in the basic bibliography section, from all the syllabi, is quite high (67 in Economics, 73 in Business Administration and 86 in Law). However, only a few authors and books, including different editions, were most frequently used (Table 3). The most common situation was the use of 1 or 2 textbooks for degrees in Economics (60% of syllabi), 1-3 textbooks for degrees in Business Administration (78% of syllabi) and 1-6 textbooks for degrees in Law (82% of syllabi). Detailed information is provided in Tables B.9, B.12 and B.13, available online.

The textbook authored by Pindyck and Rubinfeld is a microeconomics textbook that was only selected for the degree in Business Administration. The textbook authored by Blanchard is a macroeconomics textbook that was only selected for the degree in Economics. The textbook by Krugman *et al*. was selected for all three degrees: first most used in general and as a single-use textbook in the three degrees. Mankiw and Mankiw and Taylor, both come just after Krugman *et al*. in Economics and in Business Administration, and Mankiw in Law (second position); both (Economics), the first (Law) or the second (Business Administration) stand out as single-use textbooks. Taking into account this information, the figures in Table 3, and that we intend to investigate the evolution of textbooks that are used overall, the selected ones have been *Essentials of Economics* by Krugman *et al*. (various editions) and *Principles of Economics* by Mankiw (various editions and coauthors). These introductory textbooks by Krugman *et al*. and Mankiw are widely regarded as among the most popular and commonly

used not only in Spain but globally (Bowles & Carlin, 2020; Depro, 2022; Sepulveda, 2020), allowing our analysis to be more generalizable and have a broader impact.

There was significant variety regarding the editions of the textbooks used in the basic bibliography, ranging from 1986 to 2021 (Figure 3). Only between 2% (Economics) and 6% (Business Administration) correspond to editions published in the last 3 years, considering that in many cases they are reprints of previous editions. More remarkable is the fact that between 66% and 73% correspond to editions 7 or more years old. For the two textbooks that have been analyzed in depth (Krugman *et al*. and Mankiw), the issue of editions is noticeable because editions as old as 2006 are used in some cases. This information is very relevant as it is more likely that updated books cover topics on sustainability and, therefore, so do the lessons included in the syllabi. In light of this, we compared the first and last published editions of both textbooks (Krugman *et al*., 2007 and Krugman & Wells, 2020; Mankiw, 1998 and 2021) to identify any updates related to sustainability, taking into account that 13 years elapsed in the first case and 23 in the second case.

Text mining of the textbooks

The four selected textbooks were pre-processed, ensuring that the information to be analyzed was homogeneous and comparable (see details in Appendix C, available online). The resulting clean text for the two older manuals had similar length, and the same occurred with the newer ones, which were longer. Then some count analysis and comparisons were performed on the clean texts.

First, stemming was applied and the most frequent roots in each textbook were determined (see Table B.14, available online) and represented by wordclouds using the tidytext and the wordcloud packages. Figure 4 depicts the wordclouds with the 100 most frequent roots in the last editions of the two textbooks (whereas Figure A.2, available online, corresponds to the first editions). The most frequent root by far in all the books is *price*, followed by *cost*, *demand*, *supply*, *quantity*, *good*, and *curve* (in different orders for each textbook); and only in Krugman and Wells (2020) there is root related to sustainability, specifically *nature*, *gas* and *pollute*, although not all mentions correspond to the context of interest (for instance, "gas station" or natural monopoly").

Figures 5, 6, A.3 and A.4, the last two available online, compare the relative frequencies of the common roots for pairs of clean books on a logarithmic scale. Roots close to the diagonal have similar relative frequencies in both books, whereas roots far from the diagonal have a higher relative frequency in one of them. Moreover, differences in the smallest frequencies are magnified in the graph by the logarithmic scale. These scatter plots include about 3200–4300 data points (common roots in each pair of textbooks), so only a few labels are automatically displayed to avoid overlapping. As the focus of this study is on words related to sustainability, their roots were highlighted in orange, and added where necessary, even if this resulted in some overlapping. Although the dots in the graph correspond to the roots common to both textbooks, the roots *greenhouse* and *gase* — which do not appear in some editions of Mankiw — are added in Figures 5, A.3 and A.4, available online, to visualize their zero frequency in one of the compared books. On the other hand, the location of the expression *environment*+ corresponds to the sum of the frequencies of the roots *environ*, *environment* and *environmentalist*. Finally, it should be noted that all references to emission(s) in the four textbooks correspond to pollution.

Figures 5 and 6 show the evolution of each textbook from its first to last edition; Figure A.3, available online, compares the first editions of both textbooks, and Figure A.4, available online, the last ones. As the textbooks have different lengths, a root may present a higher absolute frequency in one book but actually have a lower relative frequency. For example, Mankiw's last edition is a bit longer than his first, and the root *emiss* has a lower relative frequency in 2021 despite its higher absolute frequency (but only by one unit); as such, *emiss* is located below the diagonal in Figure 5. And something similar happens with acid, which appears only once in each textbook (*acid rain*) but has a higher relative frequency in Mankiw (1998) due to its shorter length.

In Figure 6, we can see that sustainability-related terms had higher relative frequencies in Krugman's last edition than in his first (due particularly to the increase in the frequencies of *pollution*, *emission(s)*, *polluter(s)*, *climate change*, *greenhouse gas(es)*, *environment*, *environmental* and *natural resources*). However, this evolution is not clearly observed in Mankiw's textbooks in Figure 5, where the expressions *climate change* and *natural resources* appear more often in the 2021 edition, but the word *pollution* is more frequent in 1998. Moreover, *environment*, *environmental* and *emission(s)* have similar

absolute frequency in both editions, so their relative frequency is higher in the 1998 edition, which is a little shorter.

On the other hand, sustainability-related terms are clearly more present in Krugman and Wells (2020) than in Mankiw (2021); notwithstanding, quite the opposite can be seen when comparing the initial editions (Figure A.3 and A.4, available online).

The above analysis was performed on words, more specifically, their roots. However, as shown in Section 4, our main objective was to identify the frequency of a list of single words and composite expressions that represent different aspects of sustainability, as a broad and complex concept (Table 2, and Table B.10, available online). In this case, stemming was not used. The frequencies of single words were calculated using the tm package, whereas the frequencies of composite expressions were obtained using the tidytext package, specifically via bigrams (pairs of words) or trigrams (word triplets), considering the removed stopwords. Moreover, words and expressions are only counted when they correspond to the meaning we are interested in, related to sustainability, and the inspection necessary to do this can be seen as the starting point for the RTA carried out in the following section. Figure 7 compares the four texts based on the relative frequency of words in each of the six groups listed in Table 2 (in relation to the total number of words in the corresponding clean text). The comparison in absolute terms is presented in Figure A.5, available online.

From the first to the last edition of Mankiw, both the absolute and relative frequency of group 1 (Nature) increases, and the same occurs in groups 5 (Sustainability) and 6 (Indicators and institutions), though to a lesser extent, especially in the last case, which is why it is not visible in the graph. On the contrary, both the absolute and relative frequency of group 3 (Effects on nature) decreases (essentially because the word *pollution* is used more in 1998). In the case of Krugman's textbooks, the absolute and relative frequencies are higher for groups 1, 3, 5, and 6 in the later edition (2020). The largest growth occurs for group 3, mainly due to the increased use of the words *pollution*, *emission(s)* and *environmental*. In fact, group 3 is the only one where the Krugman and Wells (2020) is clearly superior to any of Mankiw's editions. Words and expressions not appearing in any of the textbooks are listed in Table B.15, available online. Particularly noteworthy is that no terms related to group 2 (Society) or group 4 (Ethical attitudes) have been identified in either edition of the two textbooks. There-

fore, the corresponding points overlapped on 0 in Figure 7 (and in Figure A.5, available online).

Reflexive thematic analysis of the textbooks

In alignment with the research approach outlined in prior sections, the quantitative textbook analysis has been complemented by applying RTA, offering a deeper exploration of the meaning of the words and expressions representing the complex concept of sustainability. Integrating this analysis with the sustainability concept studied from the second section has led to the emergence of five themes; four of them are directly related to the fundamental dimensions of sustainability described in Figure 1. The first theme concerns the conception of the economy as a self-contained system, completely isolated from the environment and society ('Exploitation' and c and d in Figure 1). The second theme focuses on the narrow view that the economics discipline takes of the value and functions of nature. That is, nature is just a resource that does not impose limits on economic growth (mainly b, but also c and d). Theme three deals with human selfishness and lack of moral obligations towards nature and fellow human beings ('Ethical attitudes' and e and f). The fourth theme considers the relationship between the normative and physical dimensions by posing the fact-value dichotomy. Finally, theme five deals with the unimportance of sustainability in economics teaching.

Theme 1: The economy is a self-contained system, neither embedded in the social system nor in the biosphere

Economic activity is taught as a self-contained system, even while it is known that it is embedded in the social system (Granovetter, 1985, 2005), which is itself embedded in the biosphere. Thus, the economics discipline is taught as if the economic system were independent and disconnected from society and the environment. However, the literature is very clear on the relevance of interactions between the socio-economic system and the biosphere, the loss of biodiversity, the deterioration of ecosystems and climate change, as well as the unequivocal influence of human activity on all these changes at the planetary level (Carpenter & Millennium Ecosystem Assessment, 2005; Crutzen & Stoermer, 2000; Folke *et al*., 2021; IPCC, 2022; Pörtner *et al*., 2021; Rockström *et al*., 2009; Steffen *et al*., 2015). The intense

dependence of economic activity and human well-being on finite ecosystem resources and services is also widely accepted (Carpenter *et al*., 2006; Meadows *et al*., 2004; Steffen *et al*., 2015; Wackernagel & Rees, 1996). There is also growing evidence of the consequences of climate change on the economy. For all these reasons, it is impossible to understand socioeconomic reality without considering the economic system's embeddedness.

Yet, the first model that students of economics are presented is still a schematic representation of the organization of the economy, the circular-flow, which does not consider connections with the biosphere. In this simple model, households and firms interact in the markets for goods and services, and in the markets for the factors of production, where the monetary and physical flows of those exchanges are shown. This is justified in the following way: "This circular-flow diagram is one simple model of the economy. It leaves out various details that, for some purposes, are significant. A more complex and realistic circular-flow model would include, for instance, the role of government and international trade. Yet, these details are not crucial for a basic understanding of how the economy is organized" (Mankiw 1998, p. 21). Mankiw (2021, pp. 20–21), Krugman *et al*. (2007, pp. 30–32) and Krugman and Wells (2020, p. 33) state much the same thing, but they include connections with government, financial markets, and the rest of world when the model is revised and expanded. There is no further mention, either in the main text or in the activities proposed in these textbooks, of the limitations of this model or of the relationship between the economy and the biosphere. The economy is represented as a self-contained system, where economic activities, such as production and consumption, do not make significant demands on environmental resources and services, nor do they affect ecosystem health. In this way, the economics teaching is unable to contribute to the understanding of, or learning about, sustainability, fostering a misunderstanding and inaccurate worldview among students. The circular-flow model restricts the scope of the discipline of economics as it does not consider how exploitation affects the environment (d, in Figure 1) and how exploitation contributes positively or negatively to the present and future health and well-being of society (c, in Figure 1).

Theme 2: Nature is just an economic resource that does not impose limits on economic growth

In the economics textbooks analyzed, nature is characterized by its scarce presence and because it is only a resource that is, moreover, an undervalued resource, and no significant changes to this conception were detected between the first and last editions. Krugman and Wells (2020, p. 415) indicate that although the countries that are richest in natural resources have higher real GDP per capita, in the modern world, natural resources are a much less important determinant of productivity than human or physical capital. Mankiw (2021) raises the question of whether natural resources are a limit to growth, and the answer given is that technological progress has made previously essential natural resources less necessary, and that the trend for the prices of natural resources, notwithstanding short-term fluctuations, "are stable or falling. It appears that our ability to conserve these resources is growing more rapidly than their supplies are dwindling. Market prices give no reason to believe that natural resources are a limit to economic growth" (Mankiw 2021, p. 510). It is also stressed that there is no scarcity of resources, nor is any foreseen, when evaluating the progression of prices. According to Mankiw (2021, p. 512), together with the decisive role technical progress plays in efficiency gains and in the search for alternative resources, this makes it possible to affirm that there is no reason to believe that natural resources pose a limit to economic growth. Krugman and Wells (2020, pp. 427–428) also reject the idea that resource scarcity is a problem limiting long-run economic growth, arguing skepticism about supply scarcity, and claiming that even geologists do not agree. Furthermore, the textbook expresses optimism about the ability of engineers to find substitutes for natural resources, and of economic professionals to manage their scarcity. However, in Krugman and Wells (2020, p. 416) the message is not clear, since the existence of limits to growth are recognized in another section: "It remains true, however, that we live on a finite planet, with limited supplies of resources such as oil and limited ability to absorb environmental damage." Furthermore, the relationship between long-term economic growth and environmental degradation is addressed, referring to climate change, to the agreements to limit greenhouse gas emissions, and to the scarcity of natural resources. The following question arises: "How do scarcity of natural resources and environmental degradation pose a challenge to sustainable long-run economic growth?"

(Krugman & Wells 2020, p. 405). The answer given is that the economy is able to manage scarcity, but is less able to deal with the problem of environmental degradation.

Considering the explicit and latent content of these textbooks, how is nature understood? Likely, the conception of the economy as a self-contained system (Theme 1), inertia, and a lack of specific interest in examining the role of environmental goods and services and their interactions with the economy (Themes 1 and 2) explain why an incomplete and biased picture of nature is provided. The approach in these textbooks is profoundly anthropocentric; it is assumed that nature is subordinated to the economy, and it is believed to be nothing more than a resource, which can be substituted by physical or human capital. The position that natural resources are, at present, less important than physical capital, human capital, and technical progress in economic growth and productivity is given prominence.

It can be concluded that Mankiw's and, with nuances, Krugman's textbooks reject the existence of limits to economic growth. Students are taught that growth, as we have experienced it till now, can continue indefinitely. This is assumed without mentioning some relevant aspects. First, this ignores the evidence for the opposing argument, which asserts that the limit is unavoidable (Herrington, 2021; Meadows *et al*., 2004; Murphy, 2022; Rockström *et al*., 2009; Steffen *et al*., 2015; Wackernagel & Rees, 1996) and also ignores the fact that the debate on limits continues (Editorial Nature, 2022), though probably only in mainstream economics. Second, the limitations of market mechanisms to manage scarcity are not recognized, as there is no clear evidence of a correlation between the geological scarcity of a mineral resource and its price trend (Henckens *et al*., 2016). Moreover, the existence of negative externalities in the production and consumption of raw materials, such as petroleum, has consequences (environmental, health) that are not reflected in their price. How many times higher would the price of lithium batteries, gasoline, or airplane travel be if there were markets capable of internalizing the impacts of their production and consumption? (Sovacool *et al*., 2021). Third, there is no mention that the constraint caused by natural resources is due to the increased costs of exploiting these resources and not depletion (Meadows *et al*., 2004). Fourth, reference is made only to non-renewable resources, especially oil, with no mention of limits such as sinks: the earth's capacity to absorb pollution. In this context, it would be appropriate to use the concept of ecological footprint

(Wackernagel & Rees, 1996), because it considers how specific human actions, that affect economic activity, have different levels of impact and progression on the biophysical limits of the planet. Finally, the key problem is not addressed: limitations refer to the material foundations of economic processes, and, as a result, to the growth in production tied to the use of natural resources. In regard to sustainability, the problem is that economic growth, as we know it presently, cannot continue indefinitely. It is not sustainable. The reason is simple: economic growth depends on the planet's resources and sinks, which are limited. This does not mean that those physical limits impose, at least theoretically, limits on economic growth or progress based on ideas, innovation, and knowledge (Romer, 1990), because ideas, unlike natural resources, are nonrival goods and "this is all that is required for sustained growth in living standards" (Jones, 2019, p. 861).

All this reflects the difficulty in changing specific ideas, a sort of inertia which is particularly evident in the case of Mankiw's textbooks (1998, 2021). His analysis remains unchanged on the causes and consequences of the serious environmental crisis and how the limits of a finite planet affect growth and well-being over the 23 years that separate the two editions examined, despite the volume of evidence accumulated in that time (Carpenter & Millennium Ecosystem Assessment, 2005; IPCC, 2015; Pörtner *et al*., 2021; Romanello *et al*., 2022). Moreover, a narrow view and appreciation of nature is taught, which reduces it to material resources that 'come in' as inputs in the economy without even considering its function as a sink for the waste that is released into the biosphere. Yet, "The economics of the Earth would grind to a halt without the services of ecological life-support systems, so, in one sense, their total value to the economy is infinite" (Costanza *et al*., 1997).

It can be concluded that the textbooks analyzed reflect an inappropriately limited view of nature: "The emphasis is on our natural resources" (Soulé, 1985, p. 728), though not even these are appropriately valued. As Dasgupta (2021, p. 4) points out, nature, like education and health, transcends being merely an economic good because it "nurtures and nourishes us, so we will think of assets as durable entities that not only have use value, but may also have intrinsic worth. Once we make that extension, the economics of biodiversity becomes a study in portfolio management".

Theme 3: Humans are selfish and have no moral sentiments

The third theme reasserts many reiterated critiques of the economic modelling of human behavior, Homo economicus, who is portrayed as being individualist, rational, and self-interested (Bowles, 2008; Rodriguez-Sickert, 2009; Sen, 2003). The textbooks examined indicate that individuals maximize their well-being, which is identified with economic gain and consumption. Subject to some restrictions, the decisions of Homo economicus are characterized by rationality and two additional assumptions: the self-regardfulness of preferences and the exogeneity of preferences (Rodriguez-Sickert, 2009). In the first chapter of each textbook, the principles of economics are explained: Ten Principles of Economics in Mankiw (1998, 2021) and First Principles in Krugman *et al*. (2007) and Krugman and Wells (2020). There are no significant differences between the two authors, nor do any exist from the first to the last editions. These principles include how people make decisions and highlight the conception of the calculating individual, who responds solely to economic incentives, must choose in terms of consumption and production due to scarcity, and considers opportunity cost as well as profits and marginal costs. It is noteworthy that there is no discussion of the term Homo economicus, which is only mentioned once in Mankiw (2021) in chapter 22 (Frontiers of macroeconomics), in a section providing additional content titled 'Topics for further study'. As such, these areas are not generally considered for course content and certainly not in first-year courses.

The consequences of teaching this model can be substantial for the understanding of sustainability and pro-environmental behavior, as it not only operates on the basis of the ideas and theories being studied, but also conveys certain beliefs and values that can influence deeper levels of knowing (Figure 1). As Walsh (2009, p. 146) asserts, the construction of models means simplifying and, consequently, evaluating to select what is considered more important: "The texts do not stress that what is featured in a model is what is valued by those who pay for it. To lay bare the values implicit in a model, one should look for what is left out". As a result, how this model is applied implicitly underscores that only material goods that can be purchased are important. Services provided by nature, interaction with other forms of life, the well-being of other people (close or distant), and the well-being of future generations are all disregarded. Consequently, inasmuch as notions and theories that are learned have an impact on beliefs

and values, teaching this model may affect our students' ethical attitudes with regard to nature and society. In this respect, it is worth recalling the existence of a large scientific literature (Introduction) that has inquired into the more self-interested and the less prosocial behavior of economics students. This is in line with the conception that what is taught matters in the construction not only of ideas, theories, and actions but also of deeper levels of knowing. This includes those concerning the key aspects of sustainability, like the interpretation of the value of nature, equity, and commitment and responsibility towards humans and the rest of nature.

Theme 4: The economics discipline is able to analyze 'facts' without 'values'

Mankiw (2021, p. 26) argues that, generally, statements about the world come in two types: positive and normative. While positive statements are descriptive (they indicate how the world is), normative statements are prescriptive (they indicate how the world ought to be). Moreover, the idea is put forth that only the economics discipline that is devoid of values — positive economics — can be considered scientific. "When you hear economists making normative statements, you know they are speaking not as scientists but as policy advisers." (Mankiw 2021, p. 27). This approach limits its understanding sustainability because it assumes a fact/value dichotomy without considering it is impossible to clearly establish that distinction regarding sustainability. Ethics does not conflict with economics nor does it question its scientific nature (Putnam, 2002). The issue is simply identifying that complex concepts, such as sustainability, are not comprehensible or assessable without considering normative judgments and the values that underpin them because 'facts' and 'values' are entangled. Putnam (2002, p. 19) stresses that the fact/value dichotomy is, in truth, not a distinction but a thesis, namely the thesis that ethics is not about matters of fact. Putnam (2002, 1) criticizes the contention that positivism is facts and normativism is values, asserting that "Value judgments, according to the most extreme proponents of a sharp 'fact/value' dichotomy, are completely outside the sphere of reason…[and] these views rested on untenable arguments and on over-inflated dichotomies. And these untenable arguments had, as we shall see, important 'real world' consequences in the twentieth century".

Regarding 'sustainability', it is relatively simple to identify normative content, because it is not only a substantial part of the concept itself, as seen in section 2, but is also explicitly present in its definitions: "Sustainable

development is a normative value system…sustainable development is essentially a strong ethical, or moral, pronouncement as to what should be done.…We claim that the concept of sustainable development rests on three moral imperatives: satisfying human needs, ensuring social equity and respecting environmental limits" (Holden *et al*. 2017, p. 215). The normative (ethical attitudes) and physical (exploitation) dimensions of sustainability are strongly connected (Figure 1). However, standard economic analysis neglects the normative aspect of economics. Similarly, teaching economics neither notes nor describes normative judgments, which has negative effects on learning outcomes, the scope of analysis, and other general and specific aspects in the field. In this regard, the effects on 'how do we know what we know' must be considered: in "the social sciences, economics especially, epistemology and ethics are inextricably linked" (Fullbrook 2009, p. 123). As Amartya Sen (cited by Putnam 2002, pp. 46–48) highlights, the manner in which neoclassical economics isolates ethics reduces the scope and relevance of the welfare economics.

Theme 5: Neither sustainability nor sustainable development are issues that matter to teaching economics

Perhaps, the first and most relevant question that arises about sustainability is why it is scarcely addressed in the economics textbooks and syllabi analyzed. The thought that sustainability and sustainable development require considering the existence of dilemmas, difficulties, and restrictions on human behavior and economic activity (Holden *et al*., 2017) is not conveyed. This result is striking, as the curricula and syllabi examined are current (from 2021–2022), and we expected to find significant changes in the textbooks, especially given the length of time between the first and last editions. Several questions immediately arise: Why is sustainability not being adequately addressed? Are there arguments based on science to justify this conclusion? Or, perhaps, is it the result of inertia, of the discipline's resistance to change due to its epistemology?

In both editions of Mankiw's textbooks, the term 'sustainability' appears zero times. In Mankiw (2021) 'sustainable' or 'unsustainable' occur six times. However, none of them refer to sustainable development, but rather to population growth (p. 523), housing prices (pp. 709, 764) and fiscal policy (pp. 783, 784, 789). In Krugman *et al*. (2007) 'sustainability' is likewise missing. Notwithstanding, in Krugman and Wells (2020), 'sustainability'

appears three times and 'sustainable', in reference to development or nature, can been found ten times. Specifically, in Chapter 15 (Long-Run Economic Growth) this is stated: "We will also address questions about the environmental sustainability of long-run growth". Ultimately, however, this text does not provide an explanation of 'environmental sustainability', but rather refers to the environmental conditions and the natural resources that enable long-term growth. In chapter 1 (First Principles), a definition of sustainable long-run economic growth is provided, which highlights the possibility that economic growth can be sustainable. It also indicates that "economic analysis has a key role to play, particularly in the analysis of market failure" to achieve "the goal of balancing the production of goods and services with the health of the environment" (p. 68).

The scant and inadequate presence of the concept 'sustainability' could be partially compensated by the attention given to other closely linked concepts, such as climate change. In this sense, it is worth pointing out the greater presence of the term 'climate change' in the most recent editions of both textbooks: in Mankiw (1998, 2021) this number goes from one to seven times, while in Krugman *et al*. (2007) and Krugman and Wells (2020) it goes from zero to 38 times. Despite recognizing there is effectively an affinity, it should be noted that they are different issues, and that climate change is a more restricted concept than sustainability. In keeping with (Baumgärtner & Quaas, 2010a), climate change is used mainly as a descriptive concept whereas sustainability is a normative concept. Furthermore, climate change is a prominent consequence of unsustainable society-environment relationships, though others exist. In this way, the Stockholm Resilience Centre proposes the planetary boundaries concept as an environmental evaluation framework (https://www.stockholmresilience.org/research/planetary-boundaries.html), considering nine planetary boundaries, where climate change is just one of them (Steffen *et al*., 2015).

The shortcomings of the economics discipline in relation to learning about sustainability concern all aspects examined in the deconstruction of sustainability, in accordance with Figure 1 and the issues highlighted in section 2. In this respect, there are multiple and substantial limitations present in how economics is taught.

Discussion

The overwhelming evidence supporting the growing anthropogenic environmental degradation, coupled with the insistence of science on not delaying the implementation of the necessary actions, and the numerous international commitments to promote sustainability, have all failed to bring about changes in how the discipline of economics is taught, a key subject for society's transition to sustainability. This study identifies, analyzing syllabuses and textbooks, the persistence of important shortcomings in how Econ1 addresses the teaching of sustainability. Although significant learning processes can take place independently of the textbooks, they are without a doubt very important to teaching and decisively influence the content included in course syllabi. The results of this paper are summarized in Figure 8: the economy is considered a self-contained system, nature is merely an (undervalued) resource, modelling of human behavior only portrays Homo economicus, and normative values are not considered. Perhaps the most troubling discovery is the insignificant presence of sustainability referred to as an issue or dilemma: a deafening silence smothers sustainability in Econ1 syllabi and economic textbooks. One explanatory factor for these persistent limitations refers to the epistemological characteristics of the economic discipline. In fact, the omission or disregard of nature, which is directly linked to themes 1 and 2, and the omission of normative values, which is associated to themes 3 and 4, can be explained by reductionism and non-system thinking (Figure 8).

Previous research on Econ 101 has shown the need to make important changes to appropriately address sustainability and to contribute to a just sustainable transition (Bowles & Carlin, 2020; Green, 2012, 2013, 2015; Røpke, 2020). These results are in line with the literature regarding the high degree of international standardization of university economics programs and textbooks (Bäuerle, 2022). Moreover, attention must be given to the influence that the theoretical and epistemological bases of mainstream economics have on other levels of education, as revealed in an analysis of Spanish upper secondary school economics textbooks (Noguera-Méndez & Cifuentes-Faura, 2023). This study points out the maintenance of notions that conflict with the understanding of sustainability, which receive minimal consideration and is addressed only superficially and uncritically and, moreover, occupy a marginal position. Fortunately, there are excellent economic textbooks and reports available (Bowles & Halliday, 2022; Carlin &

Soskice, 2023; CORE Team, 2017; Dasgupta, 2021) that can facilitate the adaptation of the textbooks used to teach economic theory at universities. According to Bowles and Carlin (2020), the CORE Project (CORE Team, 2017) represents significant progress and shows that it is possible to change Econ 101 content, although it was also criticized for its limited scope and pluralism (Mearman *et al.*, 2018). These publications illustrate that it is possible to preserve key topics while adding a critical view and the study of sustainability. It is, in fact, possible to show that the economic system is a part of the biosphere and to consider social interactions and the diversity of individuals' motivations, not just self-interest. These works represent a substantial change from the conventional benchmark epitomized not just by the textbooks examined (Krugman & Wells, 2020; and Mankiw, 2021) but also by others that share their important limitations in regard to the teaching of sustainability. The few syllabi for the degrees in Business Administration and Economics analyzed that include sustainability use the CORE Team (2017) textbook. It is likely not a coincidence that these earlier adopters (Rogers, 2003) — Pompeu Fabra University and Carlos III University — are among the elites of Spanish universities (detailed information is offered in Tables B.16 and B.17, available online).

We know that, generally speaking, inertia and resistance to change characterize the educational system, particularly the curriculum content: the 'ingredients' for education (Jónasson, 2016). Inertia and disregard for disciplinary advances also characterize the teaching of introductory level of economics, which does not include approaches or content that are already firmly established in the field of economic theory even when they could facilitate understanding sustainability (Bowles & Carlin, 2020). This is the case regarding progress in behavioral economics, where developments could be adapted for teaching, as evidenced by the microeconomics textbook by Bowles and Halliday published in 2022. This inability to act in the field of economics is also apparent from the lack of a reaction to criticism that, for decades, has been directed at the epistemological principles and foundations of orthodox economic theory. A well-known example is the advertisement published in the American Economic Review in 1992, entitled a "Plea for a Rigorous and Pluralistic Economics", which was signed by 44 economists including four Nobel Prize laureates. Criticism has also been voiced by Ecological Economics (Common & Stagl, 2005; Costanza *et al.*, 2015; Costanza & Daly, 1987; Wackernagel & Rees, 1996), Institutional Economics (Hodgson, 1993, 1998), the International Confederation of Asso-

ciations for Pluralism in Economics (ICAPE) and also by prominent economists (Bowles, 2016; Rodrik, 2016; Sen, 2003), philosophers (Bunge, 1998; Putnam, 2002), and sociologists (Granovetter, 1985, 2005). More recently, economics-related errors in the diagnosis of, policies for, and forecasts related to the global financial crisis of 2007–08 resulted in much additional criticism. There were calls for the reform of economics teaching and the promotion of initiatives by entities such as the OECD (2020, p. 2), to create a new economic approach that takes into account a redefinition of "the growth narrative to put the well-being of people at the center".

However, all this reiterated and longstanding criticism, which coincides with what was identified in this paper regarding the teaching of sustainability, does not seem to have had impact. Thus, the teaching of economics remains part of the problem of unsustainability. Why is there so much resistance to make these changes? Jónasson (2016), working from a broader perspective, identifies nine categories of inertia or constraints related to educational content, some of which are recognizable in research related to economics as 'general conservatism' or 'the strength of old ideas'. Is it not clear that the need exists to provide economics teaching with a more realistic perspective consistent with scientific evidence and developments in the field, thereby contributing to sustainability? How is it possible that oversight and skepticism prevail in the face of the consequences from prolonged and growing pressure on ecosystem processes and services? For instance, how can the circular-flow model still be taught without any mention of the relationships between the economic system and the biosphere? What arguments support this position? In today's world, from a scientific, political, and moral perspective, ignoring the connections between the economy and nature is very difficult to comprehend and justify. The integration of sustainability in curricula would be necessary and represents a window of opportunity to adapt and improve the teaching of economics. Analyzing sustainability in terms of its elements and dimensions clarifies its comprehension and highlights its implications. This understanding can help resolve the dispute between the post-growth and green-growth perspectives, both representing distinct visions to policymakers and potentially causing delays in action (Editorial Nature, 2022). The policy implications of this debate, aimed at securing a just and sustainable future, are far-reaching and represent key research challenges (Hickel *et al*., 2022).

Table 4 summarizes the notions and concepts analyzed in the previous section that conflict with sustainability and are taught in Econ1. We pro-

pose incorporating some notions and concepts that would contribute to understanding sustainability. This would foster changes to Econ1 content by considering nature and the normative dimension of the economy while establishing a more critical, thoughtful, and holistic approach. Some suggestions include the ideas that the economic system is embedded within society and also within the biosphere, the intergenerational equity, the rights of unrepresented generations, the importance of social interactions, and that human behavior is not just determined by self-interest, but rather by a plurality of motivations. These suggestions also include the deliberate study of sustainability and sustainable development, taking its complexity, contradictions, and dilemmas into consideration. Critical and reflective education about the impact of concepts and theories that are most directly related to sustainability, which highlight its limitations, could significantly contribute to acquiring three key competencies for sustainability: normative competency, critical thinking competency, and systems thinking competency (UNESCO, 2017). The latter is essential to recognize and understand the relationships, networks, and embedded systems that underlie complex problems like unsustainability (Voulvoulis *et al*., 2022).

The adaptation of Econ1 would need to overcome various mental and academic resistances. In this context it is important to bear in mind that understanding processes for intellectual change (Collins, 1998) reveals the significance of interpersonal relationships and social networks. For this reason, it is essential to consider the institutional context of academia, its social structures, and the position of control it exerts. The diffusion of innovations highlights the crucial role played by the social dimension, particularly opinion leaders. "Diffusion is a very social process that involves communication relationships" (Rogers 2003, p. 19). The intuitive idea that the change can be significantly accelerated if the most prestigious actors and leaders of a network are the ones innovating, has been confirmed by numerous studies (Valente, 2012). Indeed, opinion leaders (authors of widely used economics textbooks, economics departments at prestigious universities and relevant journals) can have a powerful influence on innovation in the education system, but they also have the ability to oppose change (Valente, 2012). In fact, as Kuhn (1970) indicates, resistance and rejection by the dominant paradigm is usual in the history of new ideas and changes in science. "History suggests that the road to a firm research consensus is extraordinarily arduous" (Kuhn 1970, p. 15). Nevertheless, change has begun, albeit slowly and in a limited fashion. Without the sup-

port of prominent professors, economics departments, and universities around the world, it will be nearly impossible to achieve a wide consensus, a critical mass, to promote the necessary changes worldwide, so that the way the economics discipline is taught can contribute to sustainability in a short period of time. "The economics of climate change, and further, economics more broadly, must change to respond to the challenge of how to foster rapid transformation. It is time for economics and economists to step up" (Stern 2022, p. 1259). Now the timing for policy interventions is critical.

Conclusions

Based on the deconstruction of the concept of sustainability, this study analyzed all the syllabi of Econ1 courses in Spain, as well as a selection of key economics textbooks, with the goal of knowing what and how is taught about sustainability in introductory economic theory courses. Despite growing evidence of environmental degradation, its implications for human well-being, and various international commitments to achieve sustainable development, there has been no substantial modification to the way Econ1 is taught that would contribute to learning about sustainability. The updates related to sustainability over the last two decades are scarce and insufficient. These results indicate that the concepts of sustainability and sustainable development are virtually absent from Econ1, to the point that not even a definition is included. Sustainability as a concept, objective, or challenge seems not to be important in the teaching of this discipline. Econ1 maintains theoretical and methodological approaches that severely limit understanding sustainability, an extremely complex and normative concept. As economics education has a high level of international standardization, we posit that there is a compelling argument that our analysis and results can be generalized beyond the Spanish context. Indeed, the analysis of the textbooks could be considered worldwide in scope.

The limitations of our analysis stem from its foundation on textbooks and syllabi for introductory subjects (Econ1), two textbooks, one academic year, and a focus on one country. These constraints guide our future research endeavors. Complementary research using interviews and surveys, drawing information from both teachers and students, would permit a more comprehensive and in-depth analysis. In addition, a dynamic analysis encompassing data from academic years prior to 2021–22 would be

undertaken. Subsequent research will extend to more advanced economics subjects and expand to include a broader range of textbooks, involving a detailed examination of their evolution to evaluate the modifications introduced in each edition.

While further research would be beneficial, the analysis conducted on two globally-used textbooks shows clear shortcomings of the teaching of sustainability in introductory economic courses. Addressing them remains as an outstanding issue in the economics field, which is a challenge for academia.

From the analysis presented in this study, the following key takeaways emerge: (1) The key role of the economics discipline in understanding sustainability and in designing and implementing policies for an equitable sustainable transition is recognized by the literature and international strategies and policies; (2) The teaching of economics offers resistance to change, remaining part of the problem of unsustainability; (3) Sustainability is practically absent from the contents of introductory economics textbooks; notably, no progress has been made on ethical issues or in addressing the impact of nature and environmental degradation on human well-being, and certain conceptions and models that work against the understanding of sustainability are conveyed; (4) The integration of sustainability into the university economic courses still represents a major challenge with implications for future decision-makers. A proper understanding of sustainability would enrich the ongoing debate on this matter, fostering a more shared vision and helping to design and implement more coordinated and effective pro-environmental policies.

References

Abad-Segura, E., & González-Zamar, M.-D. (2021). Sustainable economic development in higher education institutions: A global analysis within the SDGs framework. *Journal of Cleaner Production*, *294*, 126133. https://doi.org/10.1016/j.jclepro.2021.126133.

Agencia Nacional de Evaluación de la Calidad y Acreditación [ANECA] (2005). *Libro blanco. Título de grado en Economía y Empresa*. Madrid: Agencia Nacional de Evaluación de la Calidad y Acreditación.

Anand, S., & Sen, A. (2000). Human development and economic sustainability. *World Development*, *28*(12), 2029–2049. https://doi.org/10.1016/S0305-750X(00)00071-1.

Badea, L., Serban-Oprescu, G. L., Dedu, S., & Piroșcă, G. I. (2020). The impact of education for sustainable development on Romanian economics and business students' behavior. *Sustainability*, *12*, 8169. https://doi.org/10.3390/su12198169.

Bäuerle, L. (2022). The power of economics textbooks. Shaping meaning and identity. In J. Maesse, S. Pühringer, T. Rossier, & P. Benz (Eds.). *Power and influence of economists: Contributions to the social studies of economics* (pp. 53–69). London & New York: Routledge. https://doi.org/10.4324/9780367817084.

Baumgärtner, S., & Quaas, M. (2010a). Sustainability economics—General versus specific, and conceptual versus practical. *Ecological Economics*, *69*(11), 2056–2059. https://doi.org/10.1016/j.ecolecon.2010.06.018.

Baumgärtner, S., & Quaas, M. (2010b). What is sustainability economics? *Ecological Economics*, *69*(3), 445–450. https://doi.org/10.1016/j.ecolecon.2009.11.019.

Bertossi, A., & Marangon, F. (2022). A literature review on the strategies implemented by higher education institutions from 2010 to 2020 to foster pro-environmental behavior of students. *International Journal of Sustainability in Higher Education*, *23*(3), 522–547. https://doi.org/10.1108/IJSHE-11-2020-0459.

Bonnett, M. (2002). Education for sustainability as a frame of mind. *Environmental Education Research*, *8*(1), 9–20. https://doi.org/10.1080/13504620120109619.

Bonnett, M. (2017). Environmental consciousness, sustainability, and the character of philosophy of education. *Studies in Philosophy and Education*, *36*(3), 333–347. https://doi.org/10.1007/s11217-016-9556-x.

Bowles, S. (2008). Policies designed for self-interested citizens may undermine 'the moral sentiments': Evidence from economic experiments. *Science*, *320*(5883), 1605–1609. https://doi.org/10.1126/science.1152110.

Bowles, S. (2016). *The moral economy: Why good incentives are no substitute for good citizens*. New Haven: Yale University Press.

Bowles, S., & Carlin, W. (2020). What students learn in economics 101: Time for a change. *Journal of Economic Literature*, *58*(1), 176–214. https://doi.org/10.1257/jel.20191585.

Bowles, S., & Halliday, S. D. (2022). *Microeconomics: Competition, conflict, and coordination*. Oxford: Oxford University Press.

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf & K. J. Sher (Eds.). *APA handbook of research methods in psychology, Vol. 2: Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 57–71). American Psychological Association.

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, *11*(4), 589–597. https://doi.org/10.1080/2159676X.2019.1628806.

Braun, V., & Clarke, V. (2021). Conceptual and design thinking for thematic analysis. *Qualitative Psychology*, 9(1), 3–26. https://doi.org/10.1037/qup0000196.

Brenan, A., & Lo, Y.-S. (2020). Environmental ethics. In E. N. Zalta (Ed.). *The Stanford encyclopedia of philosophy*. Stanford: Stanford University.

Brundtland, G. H. (1987). *Our common future. (A/42/427; Report of the World Commission on Environment and Development)*. New York: United Nations General Assembly document.

Bunge, M. (1998). *Social science under debate: A philosophical perspective*. Toronto: University of Toronto Press.

Bureau Van Dijk. (n.d.). Sabi Database. Iberian Balance Sheet Analysis System. Retrieved from https://login.bvdinfo.com/R0/SabiNeo.

Byrne, D. (2022). A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*, *56*(3), 1391–1412. https://doi.org/10.1007/s11135-021-01182-y.

Carlin, W., & Soskice, D. W. (2023). *Macroeconomics: Institutions, instability, and inequality*. Oxford: Oxford University Press.

Carpenter, S. R., & Millennium Ecosystem Assessment (Eds.). (2005). *Ecosystems and human well-being: Scenarios: findings of the scenarios working group, millennium ecosystem assessment*. Washington, DC: Island Press.

Carpenter, S. R., DeFries, R., Dietz, T., Mooney, H. A., Polasky, S., Reid, W. V., & Scholes, R. J. (2006). Millennium ecosystem assessment: Research needs. *Science*, *314*(5797), 257–258. https://doi.org/10.1126/science.1131946.

Carter, J. R., & Irons, M. D. (1991). Are economists different, and if so, why? *Journal of Economic Perspectives*, *5*(2), 171–177. https://doi.org/10.1257/jep.5.2.171.

Chakrabarty, D. (2009). The climate of history: Four theses. *Critical Inquiry*, *35*(2), 197–222. https://doi.org/10.1086/596640.

Charmetant, H., Casari, M., & Arvaniti, M. (2024). What do economists teach about climate change? An analysis of introductory economics textbooks. *Journal of Behavioral and Experimental Economics*, *110*, 102192. https://doi.org/10.1016/j.socec.2024.102192.

Christensen, J. (2017). *The power of economists within the state*. Stanford: Stanford University Press.

Chuvieco, E., Carrillo-Hermosilla, J., López-Mújica, M., Campo-López, E., Lazo-Vitoria, X. A., Macias-Guarasa, J., Petre-Bujan, A. L., Perdigón-Melón, J. A., Guardiola-Soler, J., & Salado-García, M. J. (2022). Inventory and analysis of environmental sustainability education in the degrees of the University of Alcalá (Spain). *Sustainability*, *14*, 8310. https://doi.org/10.3390/su14148310.

Collins, R. (1998). *The sociology of philosophies: A global theory of intellectual change*. Cambridge, MA: Belknap Press of Harvard University Press.

Common, M., & Stagl, S. (2005). *Ecological economics: An introduction*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511805547.

Convention on Biological Diversity [CBD] (2022). *Convention on biological diversity.* Conference of the Parties to the Convention on Biological Diversity. CBD/COP/15/2. UN Environment Programme.

CORE Team (2017). *The economy*. Oxford: Oxford University Press.

Costanza, R., & Daly, H. E. (1987). Toward an ecological economics. *Ecological Modelling*, *38*(1–2), 1–7. https://doi.org/10.1016/0304-3800(87)90041-X.

Costanza, R., Cumberland, J., Daly, H., Goodland, R., Norgaard, R. B., Kubiszewski, I., & Franco, C. (2015). *An introduction to ecological economics*. Boca Raton, FL: CRC Press, Taylor & Francis Group.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, *387*(6630), 253–260. https://doi.org/10.1038/387253a0.

Costanza, R., de Groot, R., Braat, L., Kubiszewski, I., Fioramonti, L., Sutton, P., Farber, S., & Grasso, M. (2017). Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosystem Services*, *28*, 1–16. https://doi.org/10.1016/j.ecoser.2017.09.008.

Crutzen, P. J., & Stoermer, E. F. (2000). The anthropocene. *Global Change Newsletter*, *41*, 17–18.

Dasgupta, P. (2021). *The economics of biodiversity: The Dasgupta review: full report*. London: HM Treasury.

Depro, B. (2022). Making introductory economics more relevant: Using personalized connections to introduce environmental economics. *International Review of Economics Education*, *39*, 100230. https://doi.org/10.1016/j.iree.2021.100230.

Editorial Nature (2022). Are there limits to economic growth? It's time to call time on a 50-year argument. *Nature*, *603*(7901), 361–361. https://doi.org/10.1038/d41586-022-00723-1.

Feinerer, I., Hornik, K., & Meyer, D. (2008). Text mining infrastructure in *R*. *Journal of Statistical Software*, *25*(5), 1–54. https://doi.org/10.18637/jss.v025.i05.

Feldman, R., & Sanger, J. (2007). *The text mining handbook: Advanced approaches in analyzing unstructured data*. Cambridge: Cambridge University Press.

Findler, F., Schönherr, N., Lozano, R., Reider, D., & Martinuzzi, A. (2019). The impacts of higher education institutions on sustainable development: A review and conceptualization. *International Journal of Sustainability in Higher Education*, *20*(1), 23–38. https://doi.org/10.1108/IJSHE-07-2017-0114.

Folke, C., Polasky, S., Rockström, J., Galaz, V., Westley, F., Lamont, M., Scheffer, M., Österblom, H., Carpenter, S. R., Chapin, F. S., Seto, K. C., Weber, E. U., Crona, B. I., Daily, G. C., Dasgupta, P., Gaffney, O., Gordon, L. J., Hoff, H., Levin, S. A., Lubchenco, J. Steffen, W., & Walker, B. H. (2021). Our future in the anthropocene biosphere. *Ambio*, *50*(4), 834–869. https://doi.org/10.1007/s13280-021-01544-8.

Frey, B. S., Pommerehne, W. W., & Gygi, B. (1993). Economics indoctrination or selection? Some empirical results. *Journal of Economic Education*, *24*(3), 271–281. https://www.jstor.org/stable/1183127.

Fullbrook, E. (2009). Epistemology. In J. Peil & I. van Staveren (Eds.). *Handbook of economics and ethics* (pp. 123–129). Cheltenham: Edward Elgar.

Fundación Everis (2018). *III Ranking Universidad-Empresa Fundación Everis. Encuesta a las empresas españolas sobre la empleabilidad de los recién titulados*. Madrid: Fundación Everis.

Goralnik, L., Nelson, M. P., & Vucetich, J. A. (2014). Sustainability ethics. In D. Rowe (Ed.). *Achieving sustainability: Visions, principles, and practices* (pp. 319–327). Farmington Hills, MI: Macmillan Reference USA.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, *91*(3), 481–510. https://doi.org/10.1086/228311.

Granovetter, M. (2005). The impact of social structure on economic outcomes. *Journal of Economic Perspectives*, *19(1)*, 33–50. https://doi.org/10.1257/0895330053147958.

Green, T. L. (2012). Introductory economics textbooks: What do they teach about sustainability? *International Journal of Pluralism and Economics Education*, *3*(2), 189. https://doi.org/10.1504/IJPEE.2012.049198.

Green, T. L. (2013). Teaching (un)sustainability? University sustainability commitments and student experiences of introductory economics. *Ecological Economics*, *94*, 135–142. http://doi.org/10.1016/j.ecolecon.2013.08.003.

Green, T. L. (2015). Lecturers' perspectives on how introductory economic courses address sustainability. *International Journal of Sustainability in Higher Education*, *16*(1), 44–56. https://doi.org/10.1108/IJSHE-03-2013-0020.

Halkos, G., & Managi, S. (2023). New developments in the disciplines of environmental and resource economics. *Economic Analysis and Policy*, *77*, 513–522. https://doi.org/10.1016/j.eap.2022.12.008.

Hardin, G. (1968). The tragedy of the commons. *Science*, *162*(3859), 1243–1248. https://doi.org/10.1126/science.162.3859.1243.

Head, M. J., Steffen, W., Fagerlind, D., Waters, C. N., Poirier, C., Syvitski, J., Zalasiewicz, J. A., Barnosky, A. D., Cearreta, A., Jeandel, C., Leinfelder, R., McNeill, J. R., Rose, N. L., Summerhayes, C., Wagreich, M., & Zinke, J. (2022). The great acceleration is real and provides a quantitative basis for the proposed Anthropocene Series/Epoch. *Episodes*, *45*(4), 359–376. https://doi.org/10.18814/epiiugs/2021/021031.

Henckens, M. L. C. M., van Ierland, E. C., Driessen, P. P. J., & Worrell, E. (2016). Mineral resources: Geological scarcity, market price trends, and future generations. *Resources Policy*, *49*, 102–111. https://doi.org/10.1016/j.resourpol.2016.04.012.

Herrington, G. (2021). Update to limits to growth: Comparing the World3 model with empirical data. *Journal of Industrial Ecology*, *25*(3), 614–626. https://doi.org/10.1111/jiec.13084.

Hickel, J., Kallis, G., Jackson, T., O'Neill, D. W., Schor, J. B., Steinberger, J. K., Victor, P. A., & Ürge-Vorsatz, D. (2022). Degrowth can work—Here's how science can help. *Nature*, *612*(7940), 400–403. https://doi.org/10.1038/d41586-022-04412-x.

Hodgson, G. M. (1993). *Economics and evolution: Bringing life back into economics*. Ann Arbor, MI: University of Michigan Press. https://doi.org/10.3998/mpub.14010.

Hodgson, G. M. (1998). The approach of institutional economics. *Journal of Economic Literature*, *36*(1), 166–192.

Holden, E., Linnerud, K., & Banister, D. (2017). The imperatives of sustainable development. *Sustainable Development*, *25*(3), 213–226. https://doi.org/10.1002/sd.1647.

Instituto Nacional de Estadística [INE] (n.d.). Encuesta de inserción laboral de titulados universitarios. Resultados. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176991&menu=resultados&idp=1254735976597#!tabs-1254736195727.

Intergovernmental Panel on Climate Change [IPCC] (2015). Climate change 2014: Synthesis report. Retrieved from https://www.ipcc.ch/report/ar5/syr/.

Intergovernmental Panel on Climate Change [IPCC] (2022). *Climate change 2022: Impacts, adaptation, and vulnerability. Contribution of working group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. https://doi.org/10.1017/9781009325844.

Jaeger, W. K., Irwin, E. G., Fenichel, E. P., Levin, S., & Herziger, A. (2023). Meeting the challenges to economists of pursuing interdisciplinary research on human–natural systems. *Review of Environmental Economics and Policy*, *17*(1), 43–63. https://doi.org/10.1086/723835.

Jónasson, J. T. (2016). Educational change, inertia and potential futures: Why is it difficult to change the content of education? *European Journal of Futures Research*, *4*(1), 7. https://doi.org/10.1007/s40309-016-0087-z.

Jones, C. I. (2019). Paul Romer: Ideas, nonrivalry, and endogenous growth. *Scandinavian Journal of Economics*, *121*(3), 859–883. https://doi.org/10.1111/sjoe.12370.

Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., & Schmelzer, M. (2018). Research on degrowth. *Annual Review of Environment and Resources*, *43*(1), 291–316. https://doi.org/10.1146/annurev-environ-102017-025941.

Kinol, A., Miller, E., Axtell, H., Hirschfeld, I., Leggett, S., Si, Y., & Stephens, J. C. (2023). Climate justice in higher education: A proposed paradigm shift towards a transformative role for colleges and universities. *Climatic Change*, *176*(2), 15. https://doi.org/10.1007/s10584-023-03486-4.

Krausmann, F., Lauk, C., Haas, W., & Wiedenhofer, D. (2018). From resource extraction to outflows of wastes and emissions: The socioeconomic metabolism of the global economy, 1900–2015. *Global Environmental Change*, *52*, 131–140. https://doi.org/10.1016/j.gloenvcha.2018.07.003.

Krugman, P., & Wells, R. (2020). *Essentials of economics*. New York: Worth Publishers.

Krugman, P., Wells, R., & Olney, M. L. (2007). *Essentials of economics*. New York: Worth Publishers.

Kuhn, T. S. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Leopold, A. (1949). The land ethic. In *A sand county almanac and sketches here and there* (pp. 201–226). New York: Oxford University Press.

Maesse, J. (Ed.). (2022). *Power and influence of economists: Contributions to the social studies of economics*. London: Routledge.

Mankiw, N. G. (1998). *Principles of economics*. Fort Worth, TX: Dryden Press.

Mankiw, N. G. (2020). Reflections of a textbook author. *Journal of Economic Literature*, *58*(1), 215–228. https://doi.org/10.1257/jel.20191589.

Mankiw, N. G. (2021). *Principles of economics*. Boston, MA: Cengage Learning, Inc.

Marwell, G., & Ames, R. E. (1981). Economists free ride, does anyone else?: Experiments on the provision of public goods, IV. *Journal of Public Economics*, *15*(3), 295–310. https://doi.org/10.1016/0047-2727(81)90013-X.

Meadows, D. H., Randers, J., & Meadows, D. L. (2004). *Limits to growth: The 30-year update*. New York: Chelsea Green Publishing.

Mearman, A. (2009). Realism. In J. Peil & I. van Staveren (Eds.). *Handbook of economics and ethics* (pp. 433–440). Cheltenham: Edward Elgar.

Mearman, A., Guizzo, D., & Berger, S. (2018). Whither political economy? Evaluating the CORE Project as a response to calls for change in economics teaching. *Review of Political Economy*, *30*(2), 241–259. https://doi.org/10.1080/09538259.2018.1426682.

Meierrieks, D. (2021). Weather shocks, climate change and human health. *World Development*, *138*, 105228. https://doi.org/10.1016/j.worlddev.2020.105228.

Millennium Ecosystem Assessment (Ed.) (2005). *Ecosystems and human well-being: Synthesis*. Island Press.

Ministerio de Educación y Formación Profesional (2022). EDUCAbase. Retrieved from http://estadisticas.mecd.gob.es/EducaDynPx/educabase/index.htm?type=pcaxis&path=/Universitaria/EUCT/2021/Titulaciones/&file=pcaxis.

Ministerio de Trabajo y Economía Social (2022). Perfiles de la oferta de empleo 2022. Retrieved from https://www.sepe.es/HomeSepe/que-es-el-sepe/observatorio/perfiles-de-la-oferta-de-empleo/documentacion-perfiles/ver-documentacion-perfiles.html?perfilType=perfilesCompletos&.

Ministerio de Universidades (2022). Datos y cifras del Sistema Universitario Español. Publicación 2021-2022. Retrieved from https://www.universidades.gob.es/publicaciones-e-informes/.

Ministerio de Universidades (n.d.). Clasificaciones estadísticas universitarias. Retrieved from https://www.universidades.gob.es/clasificaciones-estadisticas-universitarias/.

Moranta, J., Torres, C., Murray, I., Hidalgo, M., Hinz, H., & Gouraguine, A. (2021). Transcending capitalism growth strategies for biodiversity conservation. *Conservation Biology*, *36(2)*, e13821. https://doi.org/10.1111/cobi.13821.

Murphy, T. W. (2022). Limits to economic growth. *Nature Physics*, *18*(8), 844–847. https://doi.org/10.1038/s41567-022-01652-6.

Noguera-Méndez, P., & Cifuentes-Faura, J. (2023). Environmental sustainability in economics teaching: Analysing Spanish upper secondary economics textbooks. *Environmental Education Research*, *29*(9), 1221–1238. https://doi.org/10.1080/13504622.2022.2069680.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847.

OECD (2020). *Beyond growth: Towards a new economic approach*. Paris: OECD Publishing. https://doi.org/10.1787/33a25ba3-en.

Ogutu, H., El Archi, Y., & Dénes Dávid, L. (2023). Current trends in sustainable organization management: A bibliometric analysis. *Oeconomia Copernicana*, *14*(1), 11–45. https://doi.org/10.24136/oc.2023.001.

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, *325*(5939), 419–422. https://doi.org/10.1126/science.1172133.

Palmer, C., McShane, K., & Sandler, R. (2014). Environmental ethics. *Annual Review of Environment and Resources*, *39*(1), 419–442. https://doi.org/10.1146/annurev-environ-121112-094434.

Peil, J., & van Staveren, I. (Eds.). (2009). *Handbook of economics and ethics*. Cheltenham: Edward Elgar.

Polasky, S., Kling, C. L., Levin, S. A., Carpenter, S. R., Daily, G. C., Ehrlich, P. R., Heal, G. M., & Lubchenco, J. (2019). Role of economics in analyzing the environment and sustainable development. *Proceedings of the National Academy of Sciences*, *116*(12), 5233. https://doi.org/10.1073/pnas.1901616116.

Pörtner, H.-O., Scholes, R. J., Agard, J., Archer, E., Arneth, A., Bai, X., Barnes, D., Burrows, M., Chan, L., Cheung, W. L. (W.), Diamond, S., Donatti, C., Duarte, C., Eisenhauer, N., Foden, W., Gasalla, M. A., Handa, C., Hickler, T., Hoegh-Guldberg, O., Ichii, K., Jacob, U., Insarov, G., Kiessling, W., Leadley, P., Leemans, R., Levin, L., Lim, M., Maharaj, S., Managi, S., Marquet, P. A., McElwee, P., Midgley, G., Oberdorff, T., Obura, D., Osman, E., Pandit, R., Pascual, U., Pires, A. P. F., Popp, A., Reyes-García, V., Sankaran, M., Settele, J., Shin, Y. J., Sintayehu, D. W., Smith, P., Steiner, N., Strassburg, B., Sukumar, R., Trisos, C., Val, A. L., Wu, J., Aldrian, E., Parmesan, C., Pichs-Madruga, R., Roberts, D. C., Rogers, A .D., Díaz, S., Fischer, M., Hashimoto, S., Lavorel, S., Wu, N., & Ngo, H. (2021). *Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change* (Version 5). *Zenodo*. https://doi.org/10.5281/zenodo.4659158.

Putnam, H. (2002). *The collapse of the fact/value dichotomy and other essays*. Cambridge, MA: Harvard University Press.

Putnam, H. (2003). For ethics and economics without the dichotomies. *Review of Political Economy*, *15*(3), 395–412. https://doi.org/10.1080/09538250308432.

R Core Team (2018). *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing. Retrieved from https://www.r-project.org.

Rockström, J., Beringer, T., Hole, D., Griscom, B., Mascia, M. B., Folke, C., & Creutzig, F. (2021). We need biosphere stewardship that protects carbon sinks and builds resilience. *Proceedings of the National Academy of Sciences*, *118*(38), e2115218118. https://doi.org/10.1073/pnas.2115218118.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. & Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472–475. https://doi.org/10.1038/461472a.

Rodriguez-Sickert, C. (2009). Homo economicus. In J. Peil & I. van Staveren (Eds.), *Handbook of economics and ethics* (pp. 223–229). Cheltenham: Edward Elgar.

Rodrik, D. (2016). *Economics rules: The rights and wrongs of the dismal science*. New York: W. W. Norton & Company.

Rogers, E. M. (2003). *Diffusion of innovations*. New York: The Free Press.

Romanello, M., Di Napoli, C., Drummond, P., Green, C., Kennard, H., Lampard, P., Scamman, D., Arnell, N., Ayeb-Karlsson, S., Ford, L. B., Belesova, K., Bowen, K., Cai, W., Callaghan, M., Campbell-Lendrum, D., Chambers, J., van Daalen, K. R., Dalin, C., Dasandi, N., Dasgupta S., Davies M., Dominguez-Salas P., Dubrow R., Ebi, K. L., Eckelman, M., Ekins, P., Escobar, L. E., Georgeson, L., Graham, H., Gunther, S. H., Hamilton, I., Hang, Y., Hänninen, R., Hartinger, S., He, K., Hess, J. J., Hsu, S. C., Jankin, S., Jamart, L., Jay, O., Kelman, I., Kiesewetter, G., Kinney, P., Kjellstrom, T., Kniveton, D., Lee, J. K. W., Lemke, B., Liu, Y., Liu, Z., Lott, M., Batista, M. L., Lowe, R., MacGuire, F., Sewe, M. O., Martinez-Urtaza, J., Maslin, M., McAllister, L., McGushin, A., McMichael, C., Mi, Z., Milner, J., Minor, K., Minx, J. C., Mohajeri, N., Moradi-Lakeh, M., Morrissey, K., Munzert, S., Murray, K. A., Neville, T., Nilsson, M., Obradovich, N., O'Hare, M. B., Oreszczyn, T., Otto, M., Owfi, F., Pearman, O., Rabbaniha, M., Robinson, E. J. Z., Rocklöv, J., Salas, R. N., Semenza, J. C., Sherman, J. D., Shi, L., Shumake-Guillemot, J., Silbert, G., Sofiev, M., Springmann, M., Stowell, J., Tabatabaei, M., Taylor, J., Triñanes, J., Wagner, F., Wilkinson, P., Winning, M., Yglesias-González, M., Zhang, S., Gong, P., Montgomery, H., & Costello, A. (2022). The 2022 report of the Lancet countdown on health and climate change: Health at the mercy of fossil fuels. *Lancet*, 400(10363), 1619–1654. https://doi.org/10.1016/S0140-6736(22)01540-9.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5), S71–S102. http://www.jstor.org/stable/2937632.

Røpke, I. (2020). Econ 101—In need of a sustainability transition. *Ecological Economics*, *169*, 106515. https://doi.org/10.1016/j.ecolecon.2019.106515.

Sen, A. (2003). *On ethics and economics* (Reprinted). Oxford: Blackwell.

Sepulveda, C. F. (2020). Explaining the demand and supply model with the cost-benefit rule. *International Review of Economics Education*, *35*, 100194. https://doi.org/10.1016/j.iree.2020.100194.

Silge, J., & Robinson, D. (2017). *Text mining with R: A tidy approach*. Sebastopol, CA: O'Reilly.

Soulé, M. E. (1985). What is conservation biology? *BioScience*, *35*(11), 727–734. https://doi.org/10.2307/1310054.

Sovacool, B. K., Kim, J., & Yang, M. (2021). The hidden costs of energy and mobility: A global meta-analysis and research synthesis of electricity and transport externalities. *Energy Research & Social Science*, *72*, 101885. https://doi.org/10.1016/j.erss.2020.101885.

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 1259855. https://doi.org/10.1126/science.1259855.

Steffen, W., Sanderson, A., Tyson, P., Jäger, J., Matson, P., Moore, B., Oldfield, F., Richardson, K., Schellnhuber, H. J., Turner, B. L. I., & Wasson, R. J. (2004). *Global change and the earth system: A planet under pressure*. Berlin: Springer-Verlag.

Steg, L. (2016). Values, norms, and intrinsic motivation to act proenvironmentally. *Annual Review of Environment and Resources*, *41*(1), 277–292. https://doi.org/10.1146/annurev-environ-110615-085947.

Sterling, S. (2013). The sustainable university—Challenge and response. In S. Sterling, L. Maxey, & H. Luna (Eds.). *The sustainable university—Progress and prospects* (pp. 1–34). London: Routledge/Earthscan. https://doi.org/10.4324/9780203101780.

Stern, N. (2022). A time for action on climate change and a time for change in economics. *Economic Journal*, *132*(644), 1259–1289. https://doi.org/10.1093/ej/ueac005.

Stigler, G. J. (1959). The politics of political economists. *Quarterly Journal of Economics*, *73*(4), 522–532. https://doi.org/10.2307/1884301.

Stigler, G. J. (1983). Nobel Lecture: The process and progress of economics. *Journal of Political Economy*, *91*(4), 529–545. http://www.jstor.org/stable/1831067.

Su, C. W., Liu, F., Stefea, P., & Umar, M. (2023). Does technology innovation help to achieve carbon neutrality? *Economic Analysis and Policy*, *78*, 1–14. https://doi.org/10.1016/j.eap.2023.01.010.

United Nations Development Programme [UNDP] (2020). *The next frontier: Human development and the Anthropocene*. New York: United Nations Development Programme.

United Nations Educational, Scientific and Cultural Organization [UNESCO] (2005). United Nations decade of education for sustainable development (2005-2014): International implementation scheme. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000148650.

United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2017). Education for sustainable development goals: Learning objectives. https://unesdoc.unesco.org/ark:/48223/pf0000247444.

United Nations General Assembly (2015). Transforming our world: The 2030 Agenda for sustainable development (A/RES/70/1). Retrieved from https://www.refworld.org/docid/57b6e3e44.html.

Valente, T. W. (2012). Network interventions. *Science*, *337*(6090), 49–53. https://doi.org/10.1126/science.1217330.

van de Laar, E., & Peil, J. (2009). Positive versus normative economics. In J. Peil & I. van Staveren (Eds.). *Handbook of economics and ethics* (pp. 374–382). Cheltenham: Edward Elgar.

Voulvoulis, N., Giakoumis, T., Hunt, C., Kioupi, V., Petrou, N., Souliotis, I., Vaghela, C., & binti Wan Rosely, W. (2022). Systems thinking as a paradigm shift for sustainability transformation. *Global Environmental Change*, *75*, 102544. https://doi.org/10.1016/j.gloenvcha.2022.102544.

Vucetich, J. A., & Nelson, M. P. (2010). Sustainability: Virtuous or vulgar? *BioScience*, *60*(7), 539–544. https://doi.org/10.1525/bio.2010.60.7.9.

Vucetich, J. A., Bruskotter, J. T., & Nelson, M. P. (2015). Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation: Nature's intrinsic value. *Conservation Biology*, *29*(2), 321–332. https://doi.org/10.1111/cobi.12464.

Wackernagel, M., & Rees, W. (1996). *Our ecological footprint: Reducing human impact on the Earth*. Philadelphia: New Society Publishers.

Walsh, V. (2009). Fact/value dichotomy. In J. Peil & I. van Staveren (Eds.). *Handbook of economics and ethics* (pp. 144–151). Cheltenham: Edward Elgar.

Wang, J.-Z., Feng, G.-F., Yin, H.-T., & Chang, C.-P. (2023). Toward sustainable development: Does the rising oil price stimulate innovation in climate change mitigation technologies? *Economic Analysis and Policy*, *79*, 569–583. https://doi.org/10.1016/j.eap.2023.06.034.

Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press. https://www.degruyter.com/isbn/9780674045231.

Winter, J., Zhai, J., & Cotton, D.R.E. (2022). Teaching environmental sustainability in China: Opportunities and challenges for business and economics faculty in higher education. *Environmental Education Research*, 28(2), 318–332. https://doi.org/10.1080/13504622.2021.2012560.

Compliance with ethical standards

This article does not contain any studies with human participants or animals performed by the authors. Extracting and inspecting publicly accessible files (scholarly sources) as evidence, before the research began no institutional ethics approval was required.

Data availability statement

All data generated or analyzed are included in the published article. The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation. The raw anonymized data can be provided by emailing the primary author.

Author contributions

All listed authors have made a substantial, direct and intellectual contribution to the work, and approved it for publication. The authors take full responsibility for the accuracy and the integrity of the source analysis.

Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Annex

Table 1. Econ1 in Economics, Business Administration and Law degrees at Spanish public universities, academic year 2021–2022

Degrees and subjects		Degree			Name of the subject
		Economics	Business Administration	Law	
Subject	Introductory Economic Theory	39%	41%	100%	- Economics - Introduction to Economics - Principles of Economics - Introduction to Microec. and Macroec. - Political Economy - Economic Context - Economic Theory - Essentials of Economics - Principles of Political Economy - Economics and Business - Economics for Lawyers - Econo. and Analytical Instrum. for the Study of Law - Economics and Public Financial Administration - Political Economy and Public Financial Administ.
	Microeconomics	40%	44%	0%	- Microeconomics - Microeconomics I - Microeconomics II - Introduction to Microec. - Principles of Microec. - Intermediate Microec.
	Macroeconomics	21%	15%	0%	- Macroeconomics - Macroeconomics I - Macroeconomics II - Introduction to Macroec. - Principles of Macroec.
	Total[(a)]	67	79	44	

Source: Own elaboration based on all public universities web pages that offer degree programs in Economics, Business Administration, and Law. (a) 67 is the total number of economic theory courses included in the first year of Economics degrees at the 36 public universities offering this degree in Spain; 79 is the total number of economic theory courses included in the first year of Business Administration degrees at the 47 public universities offering this degree in Spain; 44 is the total number of economic theory courses from the 44 public universities offering a degree in Law in Spain.

Table 2. Classification of terms for empirical analysis based on sustainability deconstruction

Classification Groups	Number of terms	Examples of the selected terms
1. Nature (b)	17	Biodiversity, Ecosystems, Environment, Natural capital, Natural resources
2. Society (c)	8	Ecosystems and health, Ecosystems and human well-being, Well-being/Welfare effects of environmental degradation
3. Effects on nature (d)	82	Acidification, Climate change, Contamination, Ecological crisis, Environmental effects, Global warming, Pollution
4. Ethical attitudes (e)	32	Animal rights, Anthropocentric, Biospheric values, Climate justice, Interests of future generations/nonhuman beings
5. Sustainability	16	Circular economy, Economic development, Green economy, Human development, Sustainable development
6. Indicators and institutions	11	Carrying capacity, Ecological/environmental footprint, Ecological limits, Limits to growth, Planetary boundaries

Note: The connection between the four first groups and the deconstruction of the concept of sustainability was addressed in the dimensions of sustainability shown in Figure 1: (b), (c), (d) and (e).

Table 3. Analysis of basic bibliography section and textbook selection, Econ1, academic year 2021–2022

	Degree		
	Economics	**Business Administration**	**Law**
Syllabi with just one basic textbook	42%	36%	18%
Single-use textbooks	15 (out of 67)	15 (out of 73)	6 (out of 86)
Single-use textbooks repeated in more than one syllabus	6 (out of 15)	5 (out of 15)	2 (out of 6)
Most used textbooks[a]	Krugman *et al.*[b] (21%) Blanchard (19%)[f] Mankiw and Taylor[c] (18%) Mankiw[d] (16%)	Pindyck and Rubinfeld[e] (26%) Krugman *et al.*[b] (21%) Mankiw[d] (19%) Mankiw and Taylor[c] (19%)	Krugman *et al.*[b] (55%) Mankiw[d] (45%)
Most repeated first authors [g]	Mankiw (43%) Krugman (36%)	Mankiw (55%) Krugman (53%)	Krugman (41%) Mankiw (39%)

Source: Own elaboration from the web pages of all public universities with degrees in Economics, Business Administration and Law. (a) Percentages over the total of Econ1 syllabi: 67 in Economics, 79 in Business Administration and 44 in Law (Table 1); (b) Krugman, Wells and Olney, Krugman, Wells and Graddy, or Krugman and Wells (different Spanish and Catalan editions), *Essentials of Economics*, Worth Publishers-Reverté; (c) Mankiw and Taylor (different Spanish and English editions), *Economics*, Dryden-Cengage-Paraninfo; (d) Mankiw (several Spanish and English editions), *Principles of Economics*, Dryden-Cengage-Paraninfo; (e) Pindyck and Rubinfeld (several Spanish and English editions), *Microeconomics*, Pearson-Prentice Hall; (f) Blanchard or Blanchard and Sheen or Blanchard, Amighini and Gavazzi, (several Spanish and English editions), *Macroeconomics*, or *Macroeconomics. A European perspective*, Pearson-Prentice Hall; (g) Percentages over the total number of first authors: 56 in Economics, 55 in Business Administration and 69 in the degree of Law.

Table 4. Notions in Econ1 that undermine understanding sustainability versus notions that enable the learning of sustainability

Conventional notions	New notions	References
Circular-flow model The economy as a self-contained system	The economy is embedded in the social structure and in the biosphere	Common and Stagl 2005; Costanza *et al.* 2015; Dasgupta 2021; Granovetter 1985; Ostrom 2009; Wackernagel and Rees 1996.
Nature is just a resource	Ecosystem services Transcendent nature The land ethic Intrinsic value Biophilia	Bonnett 2017; Costanza *et al.* 2017; Dasgupta 2021; Leopold 1949; Vucetich *et al.* 2015; Wilson 1984.
Behavioural economics and Homo economicus	Homo sapiens Motivational pluralism	Bowles 2008, 2016; Bowles and Halliday 2022; CORE Team 2017; Peil and Staveren 2009; Sen 2003.
Positive and normative economics Fact/value dichotomy	Entangled concepts Normative values Ethical attitudes Anthropocentrism, Biocentrism	Goralnik *et al.* 2014; Peil and Staveren 2009; Putnam 2002, 2003; Vucetich and Nelson 2010.
Economic growth paradigm and economic growth as development	Sustainability Sustainable development The hierarchy of the pillars of sustainability Human development Limits to material growth Degrowth, Post-growth, Green-growth Well-being	Anand and Sen 2000; CORE Team 2017; Dasgupta 2021; Editorial Nature 2022; Hickel *et al.* 2022; Holden *et al.* 2017; Kallis *et al.* 2018; Meadows *et al.* 2004; Vucetich and Nelson 2010.

Figure 1. Sustainability and levels of knowing. Adapted from Vucetich and Nelson (2010) and Sterling (2013)

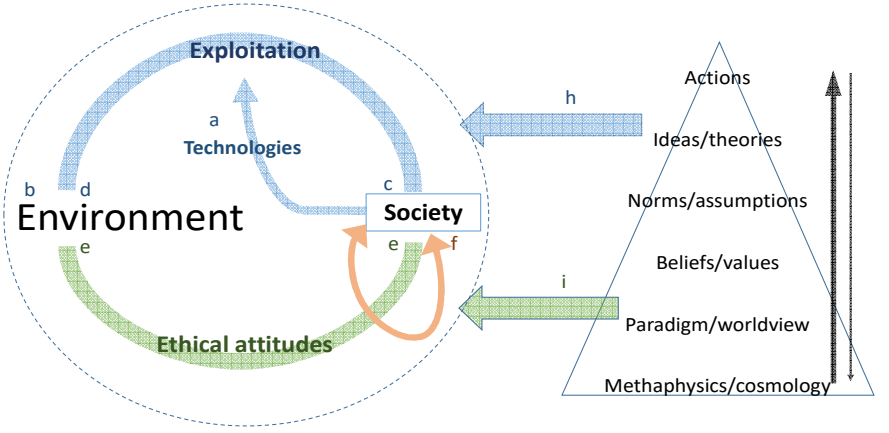


Figure 2. Outline of the research process

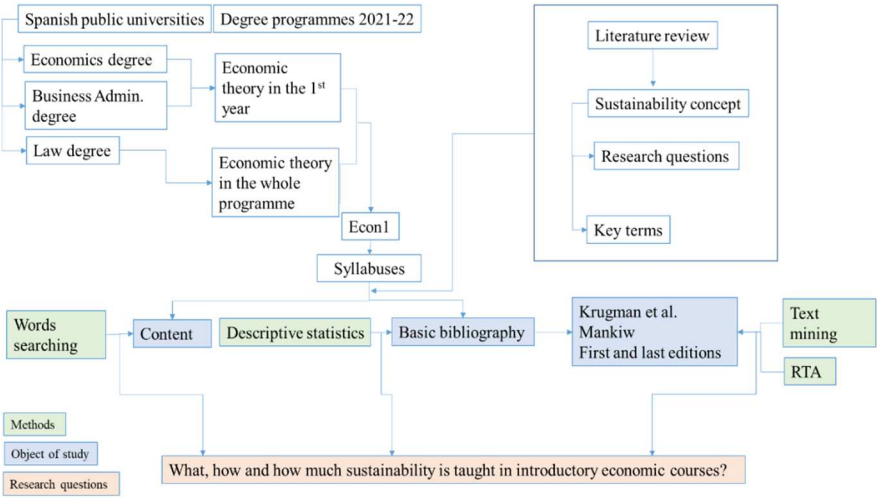


Figure 3. Editions of the textbooks (%) used in the syllabi of Econ1 courses, academic year 2021–2022. Source: Own elaboration from the web pages of all public universities with degrees in Economics, Business Administration and Law

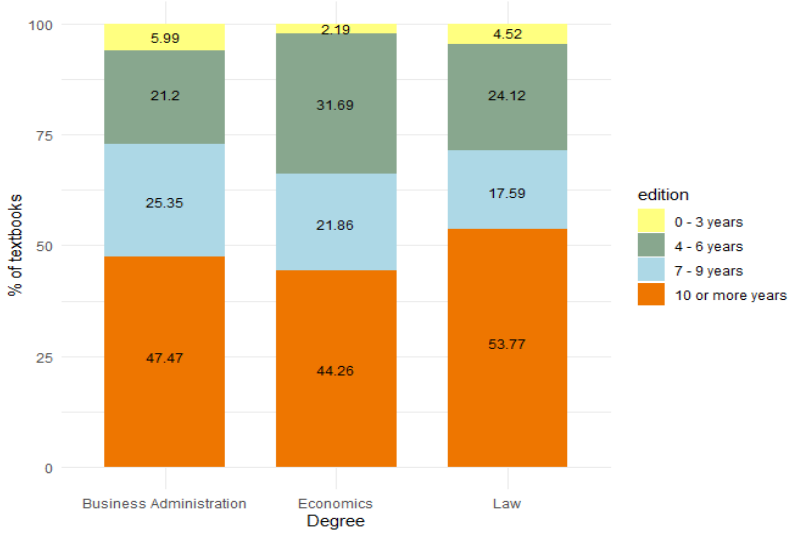


Figure 4. Wordclouds of last editions using stemming (100 most frequent roots): Mankiw (2021 edition, left) and Krugman & Wells, 2020 (2020 edition, right)

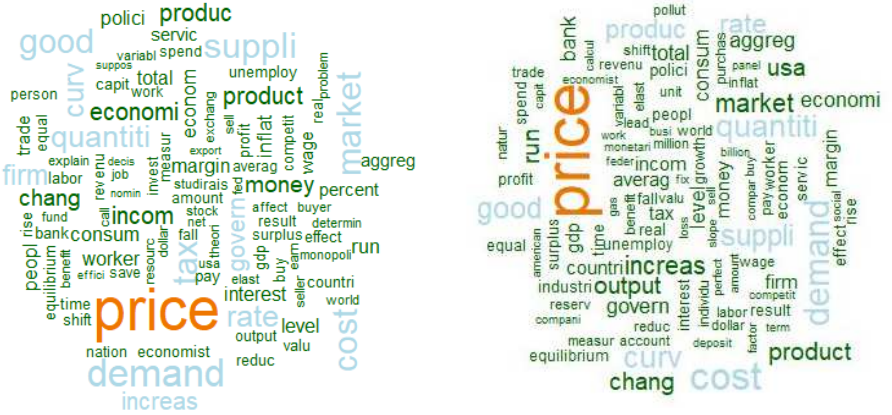


Figure 5. Comparison of Mankiw's first and last editions: Mankiw 1998 versus Mankiw 2021 (sustainability-related roots in orange)

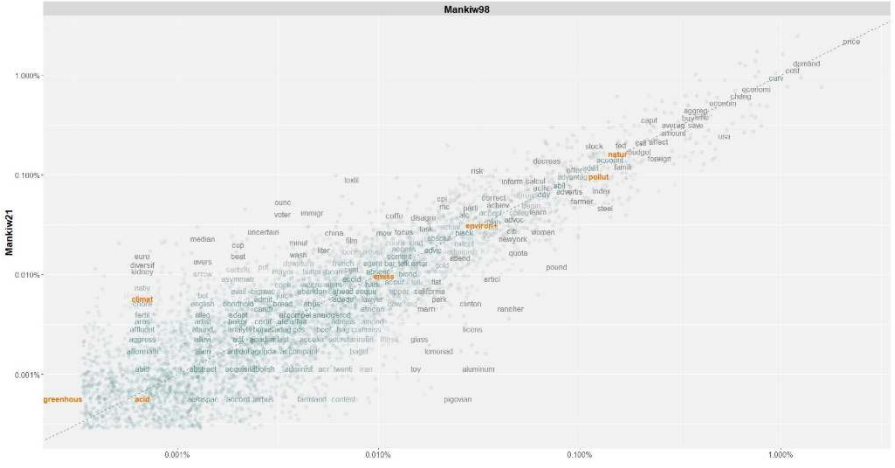


Figure 6. Comparison of Krugman's first and last editions: Krugman *et al.* 2007 versus Krugman & Wells, 2020 (sustainability-related roots in orange)

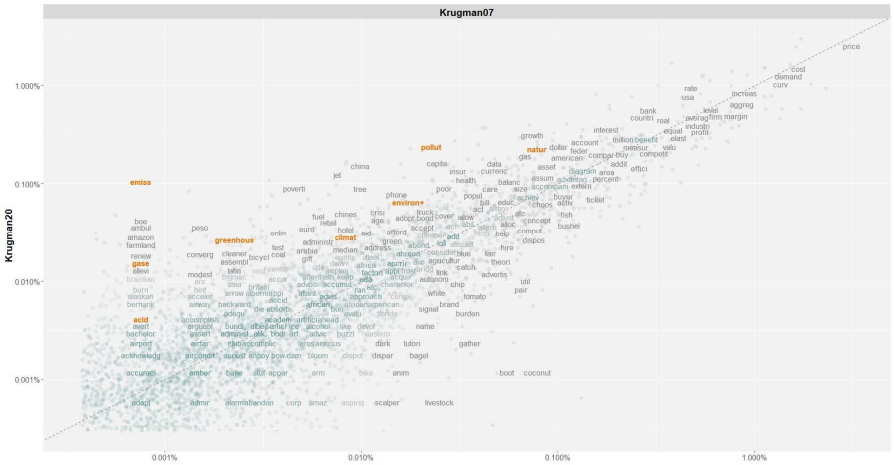


Figure 7. Relative frequency of selected groups of terms from the four textbooks

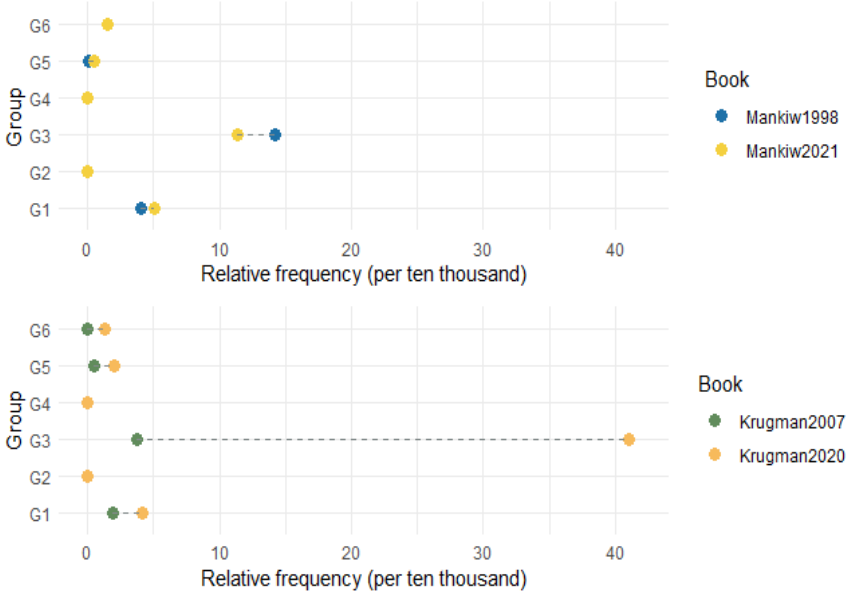
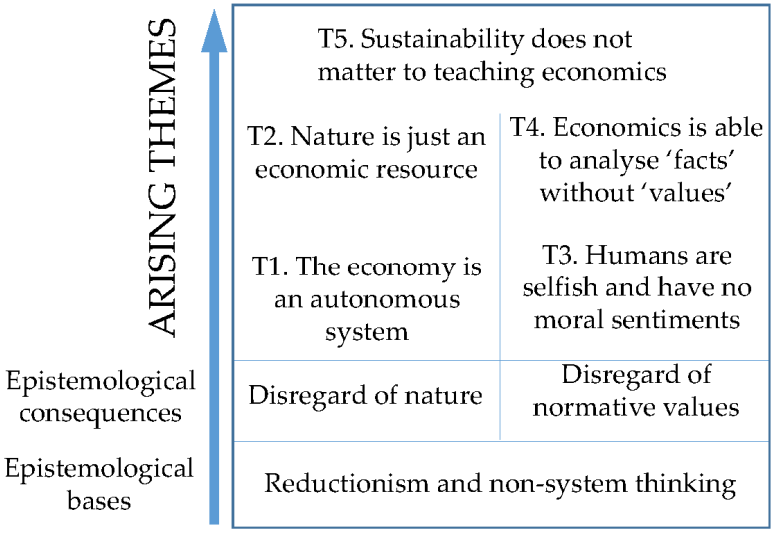


Figure 8. The methodological perspective underlying Econ1 on sustainability



Appendix

Openly accessible files:

https://digitum.um.es/digitum/handle/10201/141106