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Education for Sustainable Development – An Evaluation of Students' Perceptions within the Bucharest University of Economic Studies

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Abstract

Education for sustainable development (ESD) is a key component of sustainable university. The complex issue of ESD raised a great amount of interest among scholars and stakeholders. The body of studies published so far highlight that even though ESD seems well defined from a theoretical level, there are still numerous gaps and missing links between university policies and strategies. In this context, the present study explores how business students, as recipients of ESD, perceive their own level of knowledge acquired about sustainable development. Using statistical and econometric methods on a sample (N = 1249) of students from Bucharest University of Economic Studies (which is the most important university in Romania on the economic field), the study shows a heterogeneous perception among observed population. Bucharest University of Economic Studies (BUES) was chosen due to the fact that it is the most prestigious university in Romania, ranking 801-1000 in the world in the Times Higher Education World University Ranking 2020 and thus being ranked first in Romania. Also, the significant number of students enrolled in the bachelor's degree (27,598) places BUES among the largest universities with economic and business profile in the South-East of Europe. The results of the research show a heterogeneous perception in the analyzed sample and reveals university studies potential to develop ESD (the students in the final year report a higher level of knowledge on sustainable development than those in the first year). At the same time, students perceive a level of knowledge acquired about sustainable development below average, which suggests that ESD among business students is still at an early stage. Finally, the analysis shows that, frequently, students are not fully aware that the information gained during university studies is relevant to the issue of sustainable development.

Keywords: education for sustainable development, sustainable university, objectives of sustainable development, Bucharest University of Economic Studies

JEL Classification: Q01, I25, A20

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Introduction

Taking into account that the educational level of the leaders directly influences the achievement of the sustainable development goals, one can easily observe that the educational standards of a society have the most significant impact on promoting sustainable development (Kolb et al., 2017). Quality education aims not only to provide inclusive and equitable education, but also to promote learning opportunities (UN, 2018). The enactment of the 2030 Agenda for Sustainable Development marked a major change in the priorities in the field of education. Strengthening the international movement for sustainable development, in coordination with the Global Compact – Principles for Responsible Education Management (PRME) it has only been clearly defined starting with 2007 (Starik et al., 2010; Borges et al., 2017). Thus, at the beginning of the 1970s the Stockholm Conference on the Human Environment (1972) was organized, this being the first to formally identify the role of higher education in the progress of sustainable development at international level. The Belgrade Chart (1975), the Tbilisi Declaration (1977) and the United Nations Conference on Environment and Development (1992) followed, all distinguishing the prominence of education and higher education in achieving sustainability. The role of education for sustainable development (ESD) has been restated over the years in numerous events and declarations (see Agenda 21 in 1992, UN Decade for Education for Sustainable Development – DESD in 2005, UN Sustainable Development Goals 2015 -2030, UNEP Greening Universities Toolkit etc.) (Aleixo et al., 2018). In 2015, the UN projected a new global agenda involving governments, businesses, academia and civil society, featuring 169 goals on sustainable development (UN, 2018).

Based on such considerations, the present paper aims to explore how students as beneficiaries of the teaching act perceive an improvement in the knowledge they have accumulated on the issues of sustainable development. Thus, the analysis focuses in particular on the ESD results directly perceived by the students who are pursuing a university education in the field of economics and business. This research is determined by the insufficiency of the studies carried out over time in the field of university education with economic and business profile, as well as by the necessity of applying suitable research methods to analyze the investigated problem. The empirical results outline a clearer picture of how sustainability-specific issues are addressed in the case of economic education. These results can be used later in universities with economic and business profile to improve the curriculum and teaching strategies.

In order to carry out the empirical study, data provided by the students from the bachelor's degree from the Bucharest University of Economic Studies (BUES) were collected. We consider this research to be representative as the BUES is the most important university in Romania in terms of economic studies, ranking 801-1000 in the world in the Times Higher Education World University Ranking 2020 and ranking first in Romania. BUES ranks 501+ in the Business & Economics field, at the level of universities in the world, according to the Times Higher Education World University Rankings by Subject 2020. QS World University Rankings 2018 ranked BUES in the top 301-350 in the world in the sub-domain of Economics and Econometrics, being the first one among the Romanian universities (QS World University Rankings, 2018). In addition, the significant number of students enrolled in the bachelor's degree (27,598) places BUES among the largest universities with economic and business profile in the Southeast of Europe.

In the paper, the first section is dedicated to a synthesis of the current state of knowledge, which highlights the efforts made to understand the specific aspects of ESD, highlighting the continued existence of the need for further explanations, the lack of universally accepted methods of evaluation of ESD or of reliable instruments to measure students' perception of ESD. Based on the analysis of the specialized literature and the problems identified, Section 2 presents methodological aspects of the analysis performed within the study. In this section are presented and discussed the research questions, hypotheses tested, the sample analyzed, as well as the structure and methods of administration of the survey. Section 3 focuses on the empirical results of the research, being structured according to the three hypotheses defined in the methodology. Finally, the concluding section summarizes the main results obtained, their practical applications and methodological limitations of the studies.

1. Literature review

There is a strong political commitment to integrate sustainable development education (ESD) at all educational levels (Wals, 2012). When the United Nations Decade for Education for Sustainable Development (DESD) (2005-2014) has been created the importance of ESD has been recognized globally. In this context, UNESCO defined sustainable development education as "a learning process of decision making that takes into account the long-term future of the economy, ecology and equity of all communities" (UNESCO, 2005). The numerous definitions of ESD relate to socio-cultural, organizational, political and historical contexts (Novo-Corti et al., 2018). The definition and implementation of specific ESD principles vary not only between countries, but also within the same country. However, the consensus has been reached around the idea that ESD aims to help people develop attitudes, skills and knowledge to make informed decisions for their own and others present and future benefit and to act on them (UNESCO, 2012).

Studies on higher education for sustainable development (HESD) are not as abundant as one would expect. A recent research of Avelar et al. (2019) reveals that the number of papers that concentrate on ESD is not very high, as between 2015-2018 there are only 193 articles published in WoS that focus on the association of the two major themes – education and sustainable development. These findings emphasize the interest for this topics and the need for further clarification (Avelar et al., 2019). The existing literature explores sustainability in higher education through a wide range of perspectives: specific case studies (Warwick, 2016; Radinger-Peerand and Pflitsch, 2017), sustainability assessments (Stough et al., 2018), attitudes and perceptions (Niculae et al., 2017; Adams et al., 2018; Dagiliute et al., 2018), sustainable entrepreneurship and innovation (Avila et al., 2017), barriers and opportunities in the case of ESD (Higgins și Thomas, 2016; Avila et al., 2017), elements regarding the curriculum and information of the actors directly involved (Lozano și Young, 2012; Trencher et al., 2014). Wu and Shen (2016) observed that in recent years an integrated understanding of sustainable development has emerged in higher education programs (beyond environmental and engineering issues) (Wu and Shen, 2016).

At the same time, there is a widely accepted approach that ESD allows students to understand the limits of traditional business models focused on process efficiency and profit maximization, and to learn how to creatively contribute to a more sustainable world (Fukukawa et al., 2013). For this reason, some scholars contemplate on the need to implement

sustainability issues in the curriculum of economic and business faculties as a prerequisite for rethinking studies and business models in general (Figueiro and Raufflet, 2015).

The study and application of ESD must also address the recent trends in society and technology, which implies, on the one hand, the integration of new and modern subjects and methods into curricula, and on the other, the application of innovative learning technologies. In addition, in order to implement the issue of sustainable development into teaching and research processes, an interdisciplinary approach is needed to stimulate interaction and interdependence between disciplines and, consequently, between people (Kolb et al., 2017).

ESD, however, brings new challenges for universities. It implies the need to develop pedagogical and didactic bases, which raise the question "how can the competences in higher education be developed towards a great transformation in a structurally skeptical framework with respect to the need to address them?" (WBGU, 2011)? A noteworthy issue in this context is the fact that most instructors today develop their teaching skills in a self-taught manner instead of joining professional development programs (Mulà et al., 2017). Nonetheless, although educational institutions should be in the forefront of promoting sustainable development, they are often reluctant to change, either for fear of revising their business models or the amount of required investments (Avila et al., 2017). Other barriers can also be found such as: technological approaches, government funding priorities (Trencher et al., 2014), lack of interest and institutional commitment (Shiel et al., 2016), time constraints (Disterheft et al., 2015) and cultures that obstruct cooperation. Since higher education play a very important role in shaping the future, many universities seem to understand the importance of ESD thus modifying their curriculum, introducing new modules and courses, participating in campus greening and supporting new research directions (Disterheft et al., 2015). There are also universities that have committed to reshape policies and practices (Warwick, 2016), to assume a strategy for sustainability, to develop suitable indicators for impact assessment, to use basic data and assessment and reporting procedures (Trencher et al., 2014). In recent years, universities have implemented a wide range of ESD activities and have created networks to support ESD (Barth et al., 2011). Wals (2013) concludes that, although integrating sustainability learning into universities has proved difficult due to other educational reforms pursuing sometimes different or even contrary goals, the pressure exerted by various factors has often led to a serious implementation of ESD.

Lately, the special interest raised by the problem of sustainability in the university education has produced a significant number of tools for empirical measurement of the aspects involved in this complex process. Lynch-Alexander (2017) proposed the Lynch Outreach Assessment model (LOAM) as a tool for educational institutions to assess their involvement in ESD. Carteron et al. (2014) analyzed the potential of a "literacy" test on sustainability, applicable to students as a monitoring system for monitoring the educational impact. Based on previous findings, Berzosa et al. (2017) identifies at least 30 sustainability assessment methods (Berzosa et al., 2017). Following the same research direction, a recently developed study analyzes the assessment tools from the perspective of the impact that higher education institutions have on sustainable development (Findler et al., 2019). From the authors' perspective, there are eight areas in which the impact of universities on sustainable development can be assessed: (1) social (vision and mission, dissemination / communication, employment, working conditions, public participation, community involvement);

(2) curricular (correction and scoring methods, analytical syllabus, pedagogical approach, research and scholarships, internships, training of teaching staff); (3) environmental protection (greenhouse gas emissions, waste / recycling, water, energy, transport, biodiversity and landscape, services, construction); (5) economic (financing and investments, procurement, indirect effects) (Berzosa et al., 2017). Following the same line of thought, Findler et al. (2019) analyze the evaluation tools and finds eight areas in which the impact of universities on sustainable development can be assessed: (1) institutional framework (eg organizational structure, vision and mission, staffing policies and staff development programs, institution budget, student associations); (2) education (pedagogical act, curriculum, didactic activities); (3) research (research programs, allocation of research funds, transdisciplinarity), (4) institutional cooperation (the efforts made by the university to work with third parties at regional, national and international level); (5) campus activities (environmental management, procurement policies and practices, infrastructure, safety, etc.); (6) experiences on campus (behavior of staff and students on campus); (7) evaluation and reporting (internal and external reporting and information processes); (8) the university within its scope (other elements that have not been previously surprised, such as the demographic effects determined by the mobility of students and others) (Findler et al., 2019).

The analysis of the current state of knowledge highlights, on the one hand, the main approaches in the field of ESD, and on the other hand, the need for more complex studies to fully understand this problem, especially in the area of economic and business education. In addition, when it comes to empirical investigation methods, one can notice certain heterogeneity in the instruments of evaluation of sustainability: none of the existing instruments has universal applicability, and the performance of each one depends on the particular conditions in which it is applied.

2. Research methodology

The literature review reveals that one of the means of encouraging ESD is to improve the competences and aptitudes of the students through the educational process, both by introducing in the curriculum the particular concepts of sustainable development and by insisting on the educational act. In this context, the research main objective is to assess students' awareness on how particular features of sustainable development have been delivered via teaching. In line with the main objective, the analysis is based on two major research questions: (1) To what extent do students perceive an improvement in their global understanding of the sustainable development concept? and (2) To what extent do students perceive an improvement in their knowledge of the particular issues related to sustainable development?

In this context, the study uses a metric of the overall perception of students and 15 metrics to assess perceptions on specific aspects of sustainable development. Based on previous studies, the metrics that assess curriculum from ESD perspective were classified into: (1) economic (sustainable economic growth, efficient use of resources, sustainable production, circular economy, poverty, ecological economy); (2) social (justice and cohesion, equity, diversity, human rights) and (3) environmental (global warming, greenhouse effect, resource conservation, biodiversity, pollution) (Lozano, 2010; Glover et al., 2011; Lozano and Peattie, 2011; Lozano and Young, 2012; Amaral et al., 2015; Lozano et al., 2015).

Bearing in mind that the population includes individuals who have not fully covered the same curriculum, and therefore do not have the same level in terms of ESD, it is expected that, in the empirical study, the students' perception will be contingent to the current year of study. In this context, the following hypotheses were tested in the research:

- H1: The students overall perception of the knowledge acquired on sustainable development is different depending on the year of study.
- H2: The students specific perception of the knowledge acquired on particular aspects of sustainable development is different depending on the year of study.
- H3: The students specific perception of the knowledge acquired on particular aspects of sustainable development is different to their overall perception.

To test these hypotheses and to analyze the influence of variables on students' perception of ESD, the following statistical methods were used: (1) to test hypothesis H1, ANOVA with *Global perception* as dependent variable and *Year of study* as factor; (2) Principal Component Analysis (PCA) in order to investigate the influence of specific aspects of sustainable development – considering the large amount of variables, PCA allows the design of more compact data which can easier highlight some fundamental structures of the inputs; (3) Based on PCA, we construct a composite index that integrates the effect of the 15 specific variables. This index has been further used as dependent variable in ANOVA to test hypothesis H2; (4) To test hypothesis H3 we applied a two-tailed t-test (99% confidence interval on the difference between means) for two independent variables, the *Global Perception* and the composite index calculated with PCA.

The data were collected via a paper and pencil questionnaire administered by an investigator to randomly selected students from all the faculties within the university. No incentives were offered and respondents were allowed to opt out of completing the questionnaire if they wished. In addition, the respondents were informed that the data provided would be used in a research that examines the students' opinions on the specific problems of sustainable development (sustainable development, environmental protection, poverty and social justice problem etc.). The total number of respondents who participated in this survey is 1249 students from the bachelor's degree cycle, which gives a maximum margin of error of 3% ($p < 0.05$) to the total reference population (27598). Also, the selection of the sample was done in such a way as to ensure a significant representativeness and at the structure level per years of study. The sample includes 518 students in the first year (total population 11153, margin of error 4%, $p < 0.05$); 384 students in the second year (total population 8197, margin of error 5%, $p < 0.05$) and 347 students in third year (total population 8194, margin of error 5%, $p < 0.05$). Bearing in mind that this study is rather exploratory and mainly aims to observe significant trends, we consider that the sample is suitable to provide an interesting insight into ESD.

To ensure comparability and easy use of data collected for all aspects evaluated in the questionnaire, it was used a 5 point Likert scale with values from 1 ("Not at all") to 5 ("To a great extent"). The confidence and internal consistency of the collected data were validated through the Cronbach alpha coefficient, whose value (0.95) is above the accepted level (0.7). Descriptive statistics of the collected data are presented in table no. 1.

Table no. 1: Summary statistics

Variable	Observations	Min	Max	Mean	SD	VAR	Skewness	Kurtosis
Global perception	1249	1.000	5.000	2.21	1.06	1.12	0.36	-0.84
Sustainable economic growth	1249	1.000	5.000	2.74	1.25	1.57	0.01	-1.07
Sustainable production	1249	1.000	5.000	2.69	1.18	1.40	0.07	-0.98
Efficient use of resources	1249	1.000	5.000	2.74	1.22	1.49	0.09	-0.99
Circular economy	1249	1.000	5.000	2.52	1.24	1.55	0.25	-1.06
Poverty	1249	1.000	5.000	2.74	1.26	1.60	0.13	-1.03
Ecological economy	1249	1.000	5.000	2.25	1.16	1.35	0.56	-0.61
Justice and cohesion	1249	1.000	5.000	2.21	1.16	1.35	0.53	-0.78
Equity	1249	1.000	5.000	2.41	1.21	1.46	0.34	-0.94
Diversity	1249	1.000	5.000	2.68	1.26	1.58	0.09	-1.11
Human rights	1249	1.000	5.000	2.93	1.26	1.60	-0.06	-1.06
Global warming	1249	1.000	5.000	2.33	1.22	1.50	0.51	-0.80
Greenhouse effect	1249	1.000	5.000	2.10	1.19	1.42	0.81	-0.35
Eesources conservation	1249	1.000	5.000	2.36	1.23	1.51	0.46	-0.87
Biodiversity	1249	1.000	5.000	2.10	1.16	1.36	0.75	-0.42
Pollution	1249	1.000	5.000	2.57	1.33	1.76	0.34	-1.08

3. Results and discussions

The results reveal that the global perception is below average, while perceptions on some particular aspects of sustainable development are above average. Furthermore there is a strong positive correlation between economic components of sustainable development, such as: *Sustainable production* and *Sustainable growth* (0.81), *Sustainable resources* and *Sustainable production* (0.80), *Sustainable Resources* and *Sustainable Growth* (0.73). These correlations suggest that, in general, the economic perspective on sustainable development seems to be treated unitarily from the perspective of its components in the educational act, and the students perceive, to a greater extent, the connection between these components. There is also a strong positive correlation between the ecological and environmental components of sustainable development, while between the social aspects of sustainability there are only moderate positive correlations. A primary analysis of these results allows us to rank the attention given in the educational process to the specific aspects of sustainable development. As expected, considering the university profile, the economic component of sustainable development seems to be most important, followed by the environment component and social justice.

The detailed analysis of the data led to the investigation of how the perception of ESD changes once the students go through several stages in their educational development within the bachelor's cycle. Since students acquire more information as they learn, it is expected that their perception of their knowledge about sustainable development to change. Thus, student's perception will vary dependent to the year of study. In this context, the research investigated whether students overall perception of the knowledge acquired on sustainable development is different depending on the year of study (H1). In this context, the analysis focus on testing the following assumption "The students from the third year claim to know more about sustainable development as a general concept compared to the rest of the students".

The analysis of the Pearson correlation between *Global Perception* and *Year of study* reveals a moderate positive correlation between *Global Perception* and the group of

students belonging to year 3 (0.304) and a lack of correlation to the group of students from year 1 (-0.164) and 2 (-0.120). Furthermore an ANOVA test with *Global Perception* (global_sust) as dependent variable and *Year of study* as factor has been applied in order to investigate if there are differences in the influence of the year of study on the perception of students regarding the extent to which they studied the problem of sustainability. The analysis of variance (ANOVA) of *Global Perception* is summarized in Table no. 2.

Table no. 2: Analysis of the variation corresponding to the variable *Global Perception*

Source	DF	The sum of the squares	The average of the squares	F	Pr > F
Model	2	129.015	64.507	63.545	< 0.0001
Error	1246	1264.862	1.015		
Total corrected	1248	1393.877			

The ANOVA test led to the following model equation, corresponding to the variable *Global Perception*:

$$\text{global_sust} = 2.249 - 0.247 * \text{year_1} - 0.231 * \text{year_2} + 0.477 * \text{year_3}. \quad (1)$$

The model equation and standardized coefficients values (see Table no. 3) confirm the hypothesis that third year students claim to know more about sustainable development compared to first and second year students from years.

Table no. 3: Standardized coefficients for the *Global Perception*

Source	Value	Standard Error	t	Pr > t	Min limit (95%)	Max limit (95%)
Year_1	-0.247	0.039	-6.396	< 0.0001	-0.323	-0.171
Year_2	-0.231	0.041	-5.563	< 0.0001	-0.312	-0.149
Year_3	0.477	0.043	11.217	< 0.0001	0.394	0.561

Figure no. 1 shows *Global perception* corresponding to each of the three years of study.

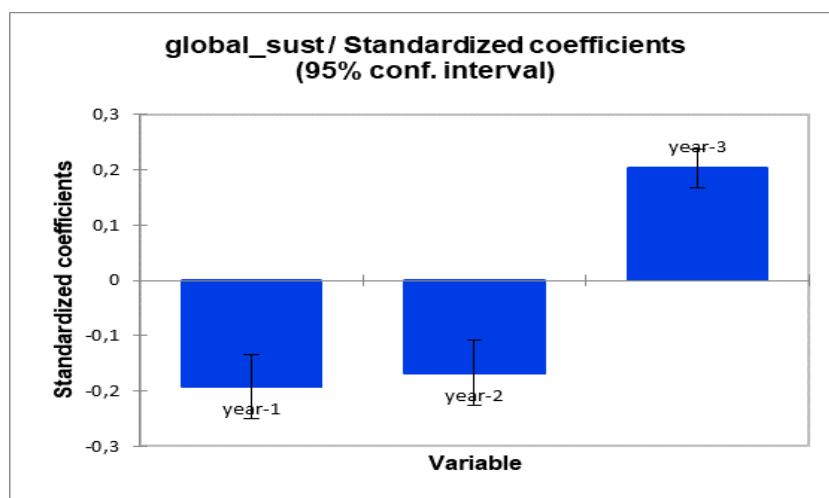


Figure no. 1. Variable *Global Perception*, representation according to the year of study

In the next stage, a Principal Component Analysis is conducted in order to investigate the influence of the 15 variables which measure specific aspects regarding sustainable development: sustainable economic growth (sust_growth), sustainable production (sust_prod), efficient use of resources (sust_res), circular economy (circ), poverty, ecological economy (ecology), justice and cohesion (justice), equity, diversity (div), human rights (rights), global warming (warm), greenhouse effect (greenhouse), resource conservation (res_cons), biodiversity (biodiv), pollution (pol). Table no. 4 shows the mean values of the items (I1-I15) divided on years.

Tabel no. 4: Mean values divided on years

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15
Year 1	2.6	2.6	2.6	2.5	2.5	2.1	2.1	2.1	2.5	2.9	2.2	1.9	2.2	1.9	2.4
Year 2	2.5	2.5	2.6	2.4	2.7	2.1	2.1	2.4	2.5	2.7	2.2	1.9	2.2	2.0	2.4
Year 3	3.2	3	3.2	2.7	3.2	2.6	2.6	2.9	3.1	3.3	2.7	2.6	2.8	2.5	3.0

The data set can be represented as a numerical entity table, which displays the values of a number of p characteristics (in our case $p = 15$ corresponding to the considered indicators, measured on n entities (represented by $n = 1249$ students). By using PCA, the data set is reduced to a more compact form, which enables highlighting some fundamental structures of the input data. The result of Kaiser–Meyer–Olkin (KMO) test (0.951), which provides information on the adequacy of the sample is above the minimum recommended value (0.5). The result confirms the adequacy of the sample and the reliability of the PCA. As a result of applying PCA method, several relevant factors, denoted by F1-F15, are revealed. The eigenvalues, variability and cumulated variability corresponding to each principal factor are displayed in table no. 4. As displayed, the first two factors together explain 70% of the total information. According to the Principal Component Analysis results, the factor F1 is strongly positive correlated with all the 15 indicators. We could call this factor *General sustainable development*. F2 is moderately positive correlated with the following topics: Sustainable economic growth, Sustainable production, Efficient use of resources and Circular economy. We could call this factor *Economic sustainable development* (Table no. 5).

Table no. 5: Eigenvalues, variability and cumulated variability corresponding to the principal factors resulted by Principal Component Analysis

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
Eigenvalue	9.0	1.3	0.9	0.6	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Variab. (%)	60.2	8.9	6.0	3.9	3.3	2.9	2.5	2.1	1.9	1.8	1.7	1.5	1.2	1.1	1.1
Cumul. %	60.2	69.1	75.2	79.1	82.4	85.3	87.7	89.8	91.7	93.5	95.1	96.6	97.9	99.0	100.0

By considering only the first two principal factors resulted from Principal Component Analysis, F1 (*General sustainable development*) and F2 (*Economic sustainable development*), which explain together almost 70% from the total variation and by considering different combinations between positive and negative values of factors F1 and F2, the data set can be divided into four clusters as revealed in figure no. 2. We can easily notice that observations are approximately uniformly divided between these clusters. Având în vedere că principalii doi factori se referă la sustenabilitate în general și, respectiv sustenabilitate economică în special, analiza PCA confirmă faptul că grupul analizat este reprezentat de studenți cu profil economic și de afaceri. Since the two main factors refer to sustainability in general and economic sustainability in particular, the PCA analysis confirms that the sample comprises economics and business students.

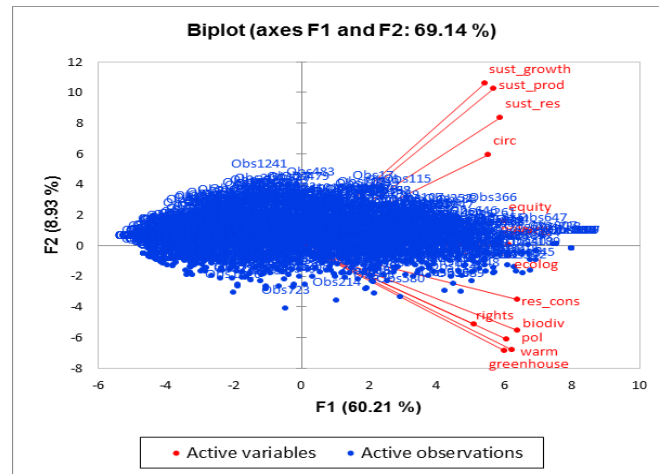


Figure no. 2: The clusters corresponding to various combinations of positive and negative values of F1 and F2

Via PCA, four broad categories can be identified: (1) students familiar with both sustainability in general and its economic components, (2) students who are familiar with the economic components of sustainability, but they are not familiar with the general concept of sustainable development, (3) students who know the general concept of sustainable development, but they are not familiar with the economic components of sustainability and (4) those who are not familiar with sustainability in general or its economic aspects.

Considering that one of the research assumption argues that "students specific perception of the knowledge acquired on particular aspects of sustainable development is different depending on the year of study" (H2), the research further focus on the analysis of the variance by performing an ANOVA test on the 15 items as dependent variables and Year of study as factor. To investigate whether there are differences in the influence of the year of study on the students' perception of the extent to which they studied specific items regarding sustainability, the following hypothesis was specifically tested: the third year students claim to know more about particular problems of sustainable development compared to the rest of the students.

The Pearson correlation analysis between 15 variables related to the curricula and the year of study reveals strong positive correlations between each of the 15 variables related to the curricula and the third year students and weak negative correlations between each of the 15 variables related to the curricula and the group of students belonging to years 1 and 2. In order to model the relationship between 15 variables related to the curricula and the year of study we use the results obtained by PCA to build a composite index which incorporates the effect of these variables. The composite index is computed as follows:

$$I = \sum_{i=1}^8 w_i F_i \quad (2)$$

where F_i , $i = \overline{1,8}$ denote the first eight principal factors obtained by PCA, which explain almost 90% from the total information and w_i , $i = \overline{1,8}$ represent the weights associated to the factors, given by the percentage of information contained in the corresponding factor.

The Pearson correlation analysis between the composite index of sustainable development and the year of study shows that the composite index I is positively correlated with the third year students (0.266) and negatively correlated with first year students (0.145) and second year students (0.103). The ANOVA test (table no. 6) with dependent variable I and *Year of study* as factor investigates whether third year students claim to know more about the specific particular of sustainable development compared to the rest of the students.

Table no. 6: ANOVA for I

Source	DF	Sum of squares	Mean squares	F	Pr > F
Model	2	62.257	31.128	47.366	< 0.0001
Error	1246	818.865	0.657		
Corrected Total	1248	881.121			

The ANOVA test led to the following model equation, corresponding to the composite index I :

$$I = 2.522 - 0.196 \cdot \text{year}_1 - 0.179 \cdot \text{year}_2 + 0.375 \cdot \text{year}_3. \quad (3)$$

The model equation and standardized coefficients values (see table no. 7) confirm the hypothesis according to which the third year students claim to know more about particular problems of sustainable development compared to the rest of the students..

Table no. 7: Standardized coefficients for I

Source	Value	Standard Error	t	Pr > t	Min limit (95%)	Max limit (95%)
Year_1	-0.196	0.035	-5.595	< 0.0001	-0.265	-0.127
Year_2	-0.179	0.038	-4.764	< 0.0001	-0.253	-0.105
Year_3	0.375	0.039	9.713	< 0.0001	0.299	0.451

Figure no. 3 displays the composite index I corresponding to each of the three years of study.

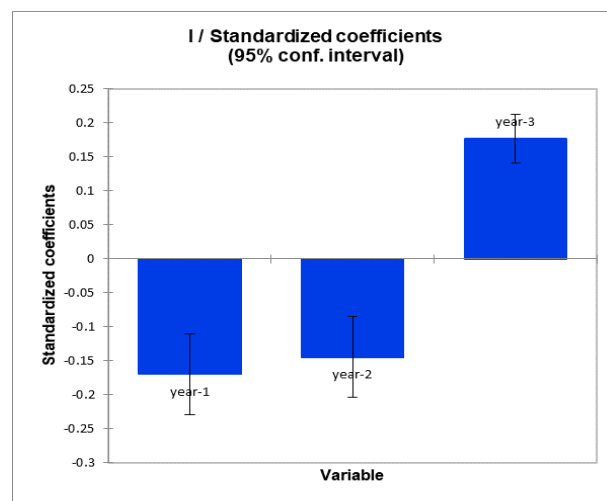


Figure no. 3: Composite index I , representation according to the year of study

Table no. 8 shows descriptive statistics of *Global perception* and composite index *I*.

Table no. 8: Descriptive statistics of *Global perception* and composite index *I*

Variable	Observations	Min	Max	Mean	SD
global_sust	1249	1.000	5.000	2.208	1.057
I composite	1249	1.000	5.000	2.490	0.948

To test H3 (the students' specific perception of particular sustainable development issues is different from their general perception) we have conducted a t-test for two independent samples. The first independent variable is General perception while the second variable is Sustainable development issues composite index *I*. The two-tailed test (99% confidence interval on the difference between the means) allows us to verify the following hypotheses: H0: The difference between the means is equal to 0; Ha: The difference between the means is different from 0.

As the computed p-value is lower than the significance level $\alpha=0.01$, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha. This means that H3 (the students' specific perception of particular sustainable development issues is different from their general perception) is confirmed. This result is further discussed in the following section.

Conclusions

The issue of ESD, as noted in the previous sections, is a complex one, which has aroused and will still arouse interest in the academic world and not only. At present, sustainability appears as a concept outlined at the theoretical level, but until the implementation, the road is quite difficult, since, even at the level of the policies of the educational institutions and at the teaching strategies level there are gaps in this regard. In this context, our research aimed to highlight what is the perception of the economics and business students regarding the way in which the general and specific concepts related to sustainable development were instilled in them. The results of our study show a heterogeneous perception in the analyzed sample. As expected, students in the final year of the bachelor's degree report a higher level of knowledge about sustainable development than those at the beginning of university studies. This phenomenon demonstrates that university studies have the capacity to develop education for sustainable development. However, students perceive a level of general knowledge gained about sustainable development below the average level, which leads to the idea that education for sustainable development among economics students is at an early stage. Things are a little better when it comes to the perception of particular aspects of sustainable development. In general, students report a perceived level of this knowledge slightly above average, and the highest values are reported for those components that belong to the economic dimension of sustainable development. This phenomenon can be explained in the context in which, given the economic and business specificity of the curriculum, most of the disciplines studied take into account the economic aspects of sustainable development. Moreover, the analysis of the main components allowed the outline of four uniform categories of students who participated in the study. The four categories are differentiated according to the general perception they have regarding the problems of sustainable development and the specific perception related to the economic aspects of the phenomenon studied. Another interesting result of the study shows that there

is a significant difference between how students generally perceive the accumulated knowledge about sustainable development and the specific perception of the knowledge developed in relation to each particular aspect of sustainable development. This result reveals that, often, students are not fully aware that the information obtained is relevant to the issue of sustainable development. In this context, the main recommendation that emerges from this analysis is that, within the teaching process, more emphasis should be placed on highlighting the influence of particular aspects studied and the problem of sustainable development.

As can easily be seen, the analysis focused in particular on students' perceptions of the knowledge gained regarding sustainable development specific concepts, following a future study to show how students apply these concepts in everyday life, starting from the examples given by the university and the teaching staff. The research focused on the interpretation of data collected from undergraduate students, one of the limitations of our study being that the data from students in the master and doctoral level could not be easily collected. At the same time, the research was carried out only within Bucharest University of Economic Studies, not taking into account the economics students from other universities. A future study that extends the sample to ensure the inclusion of more diverse groups of students could provide comparative analysis between these groups.

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