

ROMANIAN STUDENTS' KNOWLEDGE, ATTITUDES AND BEHAVIORS REGARDING SUSTAINABILITY. TESTING AN ASSESSMENT INSTRUMENT

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Abstract: *Universities' role in promoting sustainability and the sustainable development goals (SDGs) is increasingly highlighted in the recent years. The high number of academic papers published in this field stands as proof of the attention received by these subjects. The integration of sustainability in education implies the transmission of principles, values and practices in teaching-learning activities, research and in institutional operations. While studies focus on the type of educational and extracurricular actions that universities may promote in order to develop more sustainability aware students, less attention is devoted to the actual impact of these practices. The Education for Sustainable Development (ESD) approach starts with the assessment of the current state: what is being done in universities and what is the level of sustainability awareness among the main actors, mainly students. Having a concrete picture regarding the students' level of sustainability literacy, we can identify opportunities to develop new implementation practices that address the sustainability issue within higher education. Currently, there is no consensus over a tool to evaluate the knowledge, attitudes as well as behaviors of students regarding sustainability and the SDGs. Nevertheless, efforts were made in this line of research. Our study focuses on the methodologies to assess these aspects. Based on previously used tools, we developed and tested a questionnaire on Romanian student population. The tested scales for sustainability knowledge, attitudes and behaviors highlight the different pillars of sustainable development, namely: social, economic and environmental, revealing that more focus is given to the latter.*

Keywords: Education for Sustainable Development (ESD), Higher education (HE), SDGs, students knowledge, attitudes and behaviors.

JEL Classification: Q01, Q56, A20, I21, I23, I25

Introduction

The responsibility of universities to engage with the overall society development go beyond their traditional roles of teaching and research. This is the "third mission" of higher education and involves activities such as innovation, knowledge transfer, community outreach and

contributing to economic and social development by fostering engagement with community partners and building capabilities for mutually beneficial interactions (Compagnucci & Spigarelli, 2020). This mission also includes the responsibility that universities have in ensuring sustainable development. Universities should play a key role as active contributors to the progress and well-being of society that goes beyond the boundaries of their campuses and act like a crucial tool for local responsibility and transformative change.

Towards this aim, University of Oradea took an active role in the *EU Green Alliance*, a nine European universities' alliance promoting the partners' contribution to sustainability from education and research areas to developing sustainable campus, community engagement and many more areas (<https://eugreenalliance.eu/bitacora/>).

1. Theoretical overview

1. 1. Education for Sustainable Development (ESD) in Higher Education (HE)

While there are many layers of universities' involvement in implementing sustainable development, many studies emphasize the importance HE has in at least promoting and teaching of SDGs at University level (Zamora-Polo et al., 2019). Consequently, concepts such as education for sustainable human development, sustainability literacy or education for sustainable development gained more and more attention both from policy makers, practitioners and academics.

Education for Sustainable Development (ESD) refers to a structured approach directed towards developing students' knowledge, skills, values, behaviors and attitudes to confront the challenges of sustainability (UNESCO, 2017). Within universities, the implementation of ESD involves the infusion of sustainability principles across academic curricula, the cultivation of a sustainable ethos within the institution's culture, and active participation in practical experiences such as Service-Learning. The main actions for universities include incorporating sustainable management practices, integrating sustainability policies into teaching, learning, research, and outreach activities, and developing key competencies for sustainability among students. The main actors involved in ESD are teachers, who lead in incorporating ESD pedagogies and curricula, students, who demand and take forward a sustainability focus, and sector-wide higher education organizations that provide support and guidance for ESD initiatives.

"ESD aims at developing competencies that empower individuals to reflect on their own actions, taking into account their current and future social, cultural, economic and environmental impacts, from a local and a global perspective. Individuals should also be empowered to act in complex situations in a sustainable manner, which may require them to strike out in new directions; and to participate in socio-political processes, moving their societies towards sustainable development" (UNESCO, 2017, p. 7). The main role of ESD is to provide students the knowledge and the competencies that enables them to actively involve in the achievement of the sustainable development goals in all areas (UNESCO, 2017, p. 8).

The benefits of Education for Sustainable Development (ESD) for students and universities are significant. For students, ESD promotes critical thinking, problem-solving skills, environmental awareness, responsibility, and social and economic equity. It equips learners with the knowledge, skills, values, and attitudes necessary to understand the interconnections between social, economic, and environmental systems and take action towards a more sustainable world. Additionally, ESD can help cultivate a new generation of leaders who are prepared to address complex sustainability challenges. However, before designing action plan relevant for HEIs, assessment is needed on the current level of knowledge, along with the attitudes and behavior of students regarding SD (Chen et al., 2022).

Students are main actors in ensuring education for sustainable development by actively participating, advocating, adopting sustainable behaviors, fostering innovation, collaborating, developing critical thinking skills, and embracing their role as global citizens committed to a sustainable future. One first step in ensuring the achievement of the main objectives of the ESD is the assessment of students' knowledge and awareness of sustainable development goals (Waltner, Rieß & Mischo, 2019). Students can advocate for sustainability within their educational institutions, communities, and beyond. They can raise awareness about environmental issues, encourage sustainable policies and practices, and advocate for the integration of ESD into curricula. However, first they need to be actively engaged in learning about sustainability concepts, environmental issues, and social responsibility.

For universities, integrating or extending ESD in the curriculum and student experience offers various benefits. It provides students with interdisciplinary practices, opportunities for intellectual gain, practical skills enhancement for employability, and collaboration with colleagues from different disciplines. In this line of thought it is important to remember that not only SDG number 4 – Quality education is relevant for the educational system, but equally all SDGs need to be understood by students (Zamora-Polo et al., 2019). ESD also allows academic staff to develop innovative approaches, engage in collaborative research projects, reduce environmental impact, improve community relations, and demonstrate commitment to sustainable development to current and prospective students.

1. 2. Main actions and current state

Due to their functions and fundamental role in society, universities are compelled to take concrete steps towards integrating SDGs, aiming to foster a more resilient and sustainable society. The integration of sustainable development into university frameworks has undergone several phases since the 1970s. However, the initial phase, notably in 1980, marked a clearer and official adoption of the concept. Subsequently, during the 1990s, there was a notable expansion in the inclusion of sustainable development within study programs and university activities. In the early 2000s, a new phase emerged wherein various declarations underscored the imperative of integrating sustainable development into higher education missions and structures. Despite these efforts, sustainability has yet to be fully assimilated into the fabric of university culture (González Gaudiano, Meira-Carda & Martínez-Fernández, 2015). Following the launch of Agenda 2030 and the SDGs, a fourth stage was inaugurated, leading to the institutionalization of Agenda 2030 within higher education.

To effectively assess the extent of SDGs integration within higher education institutions (HEIs), it is imperative to maintain continuous awareness of ongoing initiatives. However, the current state indicates there is still much required in this area. While scholarly literature underscores the pivotal role of universities in engaging with and implementing SDGs, there remains a dearth of scientific evidence elucidating which SDGs receive greater emphasis, the specific actions employed by universities to enact SDGs, or the dimensions that are prioritized. A literature review conducted by Alcántara-Rubio and colleagues (2022) revealed that universities often address SDGs in a general and descriptive manner, without delineating the specific SDGs incorporated into HEIs' strategies or detailing practical measures for SDG implementation. Consequently, there lacks a comprehensive approach at the institutional level within universities concerning SDGs.

Universities are pivotal in research, education, management, and social leadership, predominantly advancing Sustainable Development Goals (SDGs) through research and education (Alcántara-Rubio et al., 2022; Mallow, Toman & van't Land, 2020; SDSN, 2020). However, a unified approach across these areas is imperative (Alcántara-Rubio et al., 2022; Owens, 2017). Hence, universities must integrate SDGs into governance and management practices, incorporating them into institutional reports, aligning strategies, addressing

response disparities, fostering collaboration, and prioritizing values management (Pérez, Fernández & Aguilar, 2018).

While universities commonly raise awareness and integrate SDGs into curricula, project-based learning, co-curricular activities, leadership programs, and student-led initiatives (SDSN, 2020), true SDG implementation necessitates innovation beyond traditional actions. A five-step strategy is proposed: 1) mapping current initiatives; 2) fostering skills and commitment for SDGs; 3) determine key focus areas, potentials, and shortcomings; 4). Incorporate, execute, and integrate the SDGs; 5). track progress, assess effectiveness, and disseminate findings (SDSN, 2020; Alcántara-Rubio et al., 2022).

Recent research findings suggest that attention to social sustainability in the context of achieving the Sustainable Development Goals (SDGs) lags behind that of environmental sustainability (Manolis & Manoli, 2021). This implies a tendency to prioritize SDG implementation primarily through environmental perspectives, potentially neglecting their interconnectedness with social and economic dimensions. In essence, addressing the SDGs necessitates not only recognizing the interplay between the social, economic, and environmental dimensions but also fostering synergy among the goals themselves.

The absence of an integrated approach to the Sustainable Development Goals (SDGs) poses a barrier to their implementation within university settings. Additionally, the lack of a dynamic, participatory, and engaging approach to SDGs in higher education environments, aimed at fostering innovation, along with the failure to consider all SDGs when pursuing one, are recognized as additional barriers to SDG implementation by universities (Manolis & Manoli, 2021; Leal Filho et al., 2019; Serafini et al., 2022). These barriers manifest at personal levels, such as mindset limitations, resistance to change, time constraints, and insufficient knowledge of sustainable development, as well as organizational levels, including rigidity in processes like curriculum development and inconsistency across organizational tiers. Externally, barriers encompass social, cultural, political, and economic factors, as well as complex regulatory frameworks that universities must navigate to secure legitimacy and resources (Alcántara-Rubio et al., 2022).

1. 3. Sustainability literacy

UNESCO defines 8 key-competences for sustainability structured on ways of thinking: systems thinking competency, anticipatory competency, critical thinking; ways of practicing: strategic competency, collaboration competency, integrated problem-solving competencies, and ways of being: self-awareness competency, normative competency (Advance HE, 2021). All these competencies are equally important and must be inter-connected to contribute to a better life (The Council of the European Union, 2018).

Universities play a key role in fostering sustainable development competences among students through both formal academic instruction and non-formal extracurricular activities (Wendlandt Amézaga et al., 2022), embedding a modern and creative approach (Aktas et al. 2014; Sibbel, 2009; Eizaguirre, García-Feijoo & Laka, 2019). This dual approach is essential in preparing individuals to address the complex challenges of sustainability in the modern world (Sady, Zak & Rzepka, 2019).

However, prior to evaluating the extent to which activities linked to sustainable development yield tangible positive outcomes among students, it is imperative to measure the concept of sustainable development itself. Although scholars have proposed diverse assessment methodologies for education for sustainable development (Michalos et al., 2015; Biasutti & Frate, 2017; Atmaca, Kiray & Pehlivan, 2019; Marcos-Merino, Corbacho-Cuello & Hernández-Barco, 2020; Wendlandt Amézaga et al., 2022; Cheng et al., 2022), there remains a lack of consensus regarding a singular instrument for measuring this construct. Michalos and colleagues have put forth, validated, and refined a standardized questionnaire aimed at assessing this construct, encompassing items on knowledge, attitudes, and behaviors concerning sustainable development among students (Michalos et al., 2011; Michalos et al., 2012; Michalos et al., 2015; Michalos et al., 2017). Their findings indicate

that tenth-grade students are inclined to adopt positive behaviors toward sustainable development when they possess stronger knowledge and favorable attitudes in this domain (Michalos et al., 2015). Furthermore, understanding of the social and environmental aspects of sustainability seems to surpass comprehension of its economic dimensions (Michalos et al., 2015).

The questionnaire proposed and developed by Michalos and colleagues (2015) served as the foundation for subsequent research endeavors on sustainable development undertaken by numerous scholars. In a recent investigation, Wendlandt Amézaga and team (2022) conducted a study involving management students at a public university in Mexico to assess their knowledge, attitudes, and behaviors regarding sustainable development. Their findings underscore the necessity for increased integration of this topic within both academic curricula and extracurricular activities.

As in other fields, there is a strong correlation between knowledge, attitudes and behaviors regarding the SDGs (Chen et al. 2022). Zamora-Polo and colleagues (2019) highlight an important distinction of the impact on SDG students may have: the professional vs. personal life style impacts. The motivations to learn about SDGs may vary depending on which impact is perceived as stronger, however in their study it was proved that when considering all SDGs students consider that there is more impact from the personal lifestyle than from future professions (Zamora-Polo, et al., 2019).

Sustainability literacy constitutes a foundational element in the pursuit of SDGs, encompassing the knowledge, competencies, and mindsets required for individuals to actively contribute to a sustainable future and make informed decisions towards this objective (Mason, 2019). The Sustainability Literacy Test (Sulitest) is a collaborative online tool that assesses awareness and knowledge of sustainability issues. It is available to any higher education institution, in any field of study and for all levels, and is now being made available to other stakeholders. Developed by a community of volunteers, Sulitest is designed to raise awareness and track the progress of sustainability literacy. After a pilot phase between 2014-2016, as of February 2017, it has been used by 553 universities and organizations from 57 countries, with 55,627 candidates taking the test (Décamps et al., 2017).

2. Methodological framework

The aim of our study was to test and validate on Romanian population instruments to assess the knowledge, attitudes and behavior of students. After a careful review of the studies conducted in this area, we selected the most used measurement scales for each of the three components: knowledge, attitudes and behaviors regarding sustainability and the SDGs. The most complex work is that of Michalos et al. 2012 who constructed scales with 24 items for knowledge, 18 for attitudes and 17 for behaviors - the number of items were reduces in consequent works to 21, 15 and 16 respectively (Michalos et al 2017). Another extended survey structured on the three components was validated on Chinese primary, secondary and high-school students, by Chen et al (2022) with 8 items for knowledge, 9 for attitudes and 11 items reflecting sustainability behaviors. Marcos-Merino and colleagues (2020) validated similar scales on Spanish students in educational sciences, using 9 items scales for each of the three components. Specifically, for the attitudes component we reflected on the 20 items scale validated on Italian students by Biasuti and Frate (2017) and the 36 items scale tested by Atmaca, Kiray and Pehlivan (2019) on Turkish students. For the elaboration of the list of items, we made sure that each of the three pillars of sustainability (economic, social, environmental) are well covered. After the analysis of all items, the overlaps and clarity of the statements, and verifications by external experts, the authors of this paper decided to validate the three scales based on 25 items for knowledge, 39 items for attitudes scales and 25 the behavior scales (the list of items are presented in the analysis section). As our tool was specifically designed to validate the scales, we kept more items under each

component specifically to be able to choose based on student responses the most relevant ones.

The information comprised in these three scales were complemented with more general questions regarding the sources of information on sustainability and the SDGs, the access to such information from school, self-assessment regarding the knowledge of SDGs and similar aspects. The final questionnaire comprised of 20 questions, however only the three scales are the object of the current paper.

The questionnaire was sent online, using google forms, to students from management, marketing and social science fields from bachelor and master level from Faculty of Economy Science and Faculty of Social Science from University of Oradea. Data collection took place in March 2024. There was a total of 114 valid responses recorded (54 from economic sciences and 60 from social sciences). The sample included 77% females, students with ages from 18 to 59.

The data was analyzed used SPSS software, by the authors of the paper.

3. Analyses

3.1. Knowledge, attitudes and behavior of Romanian students regarding sustainability

In this section we first describe the scales with all the initial items, while in subsequent analyses we will discuss which items we propose to exclude from the final scales.

All initial scales have a good internal consistency, with Cronbach Alpha above threshold, presented in Table no. 1.

Table 1: Validity test of the three scales

Scale	Cronbach's Alpha	N of Items
KNOW	.960	24
ATTIT	.966	39
BEHAV	.908	25

In the annexed tables all items from each scale are listed.

Based on the dimensionality of the scales, we propose, by exploring the internal validity, to identify those items that have a significant contribution in measuring the overall constructs.

3.2. Dimensionality and scale reduction

3.2.1. Analysis of Knowledge scale

To verify the dimensionality of the Knowledge scale, we conducted a factor analysis, using principal component method with rotation Varimax and Kaiser normalization. Data shows three scale dimensions. The total variance explained for each component is: 42.8% for the 1st factor, 19.1% for the 2nd one and 7.1% for the 3rd one.

Results suggest that items *KNOW.4. Cell phone production and usage does not consume a lot of resources* and *KNOW.18. SD is not dependent on gender equality* distance themselves from the overall construct. In the case of these two items, we changed the direction of the Likert scale, generating the version with the positive meaning. However, the low values for these two items, respectively their distance from the rest of the items, led us to exclude them from the scale analysis. We mention that precisely the inverted meaning of the items may have generated such differences regarding the reporting of answers.

Further factor analysis shows two dimensions of the Knowledge scale, with 44.9% explained variance for the 1st component and 23% for the 2nd one.

In order to reduce the size of the scale and to be able to identify the items that have a great similarity, with small distance between them, we performed the hierarchical cluster analysis. Dendrogram and Proximity matrix shows that items 12, 13, 7, 10, that belong to the 1st dimension of Knowledge scale, have high similarity (proximity matrix includes values below 50 between these items). The 4 items address the environmental issue about sustainability: *KNOW. 12. 'Maintaining biodiversity' means maintaining the number and variety of living organisms. This is necessary for SD*; *KNOW. 13. SD requires shifting to the use of renewable*

Items 20, 22, 21, 23, 17 (included in the 1st dimension) also prove that are proximate to each other (with lower values than 50 in the proximity matrix). All items refer to the social pillar of sustainability: *KNOW.20. SD requires access to good quality education for everyone; KNOW.22. SD requires respect for human rights; KNOW.21. Respect for cultural diversity is necessary for SD; KNOW.23. SD requires people to reflect on what it means to improve the quality of life. KNOW.17. Improving people's opportunities for long and healthy lives contributes to SD.* The improvement of quality of life includes access to good education, opportunities for healthy lives and respect for human rights and cultural diversity. We concluded that item 23 is more inclusive and somehow covers the themes addressed by the other items, therefore we kept this one in our final proposed scale. As the Dendrogram show, regarding items included in the 2nd factor (item 6, 5, 1, 2, 11, 9, 3), we proposed to exclude items 9 and 11, as they belong to different cluster than the other ones. This decision was taken based also on the value of the average factor loading (with the items 9 and 11 included, this value is below .700).



3.2.2. Analysis of Attitudes scale

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use of packaging and disposable articles and ATT.24. *Use of fuel-efficient vehicles should be encouraged by governments* have lower values than .500, for a second round of factor analysis, we excluded these two items. New data shows that items ATT.9. *I think migrants should have all the same rights as the local people* and ATT.33. *People should sacrifice more to reduce economic differences between populations* together are included in one component, with low percentage of variance explained and also with low value of average factor loading. In this case, we excluded these items from the factor analysis. After a third round of factor analysis, we excluded also items ATT.15. *Individuals should shop in the direction of their desires* and ATT.38. *The production of high-tech products for economic development should be supported* based on the same arguments. Therefore, data shows 3 dimensions for the Attitudes scale: with 30.31% of variance for the 1st component, 28.9% for the 2nd one and 10% for the 3rd one.

In order to reduce the numbers of items in the Attitudes scale, we performed the hierarchical cluster analysis. Dendrogram and Proximity matrix analysis show that items 19, 20, 25, 26, 39 (that belong to the 1st factor) place themselves close to each other (with lower values than 50 in the proximity matrix). These items refer to: ATT.19. *I think destruction of the environment is a threat to biodiversity*; ATT.20. *I think global warming poses a serious threat to the future of our world if cautions are not taken*; ATT.25. *The use of renewable energy sources needs to be widespread to leave a livable world*; ATT.26. *Environmental protection and people's quality of life are directly linked*; ATT.39. *Investments in agriculture and livestock sectors should be supported for economic development*. Items 19, 20 and 25 refer to the environment issues. Item 26 links environmental and social components of sustainability and item 39 addresses the economic development part. Global warming is one of the most acknowledged threats regarding our future world which also covers the risk regarding biodiversity. As well, the transition to renewable energy is one of the most important strategies to fight against global warming. Protecting the environment by taking measures in order to reduce global warming will ensure a future where people will have a good quality of life. Global warming has effects poses challenges to economic development, especially regarding agriculture and life stock sectors. However, we need to stress out that, in the case of item 39, it could have been a problem of misunderstanding the meaning of it, and also, because it is the final item in a very complex scale, it is possible that the subjects gave desirable answers. Taking this into account, we proposed to keep item ATT.20. *I think global warming poses a serious threat to the future of our world if cautions are not taken* in our final scale.

The 1st factor included also items 34, 37, 32, 35 that, according to Dendrogram and Proximity matrix analysis, are placed at small distance to one another (with lower values than 50 in the proximity matrix). All items address the crucial role of government economic policies in boosting the economy and sustainable production sector: ATT.34. *For economic investments, environments where life and property safety are provided must be established*; ATT.32. *Government economic policies should increase sustainable production even if it means spending more money*; ATT.37. *Government economic policies should increase fair trade*; ATT.32. *Government economic policies should increase sustainable production even if it means spending more money*; ATT.35. *Government economic policies should act if a country is wasting its natural resources*. Even if item 34 refers to a safe environment for economic investments, this actually makes a reference to government economic policies that need to tackle the safety of property and life. On another hand, item 32 addresses in an extensive manner the importance of government economic policies in a broader context of sustainable economy and production. Therefore, in order to reduce the dimension of the scale, we decided to keep item 32.

The hierarchical cluster analysis shows items 1 and item 2 form the 2nd factor: ATT.1. *Every person should receive education that teaches the knowledge, values and skills necessary for sustainable living in a community*; ATT.2. *I think that we who are living now should make sure that people in the future enjoy the same quality of life as we do today*, with a lower

distance between them (according to the Dendrogram and with values lower than 50 in the proximity matrix), which indicate their high similarity. Item 2 was kept further in the compenence of the scale because a good quality of life is fostered by an education that creates a more sustainable, equitable, and fulfilling world for current and future generations. As well, item 6 (*ATT.6. Governments should adopt SD as a national priority*) and item 11 (*ATT.11. Individuals should be provided with environments where they feel safe while living*) are situated to a small distance to one another, showing their great similarity. A safe environment for the people is assured by good strategical policies, and governments play one of the most important roles in this regard. Therefore, we decided to keep item 6 further for the Attitude scale. All items (16, 23, 18, 13) forming the 3rd dimension according to the factor analysis and the Dendrogram were kept in the scale: *ATT.16. Green areas can be dispensed with for urbanization and industrialization*; *ATT.23. Understanding and addressing the problems of climate change is not important*; *ATT.18. As long as resources are available, using more than we need now does not threaten the health and welfare of future generations*; *ATT.13. I think my behavior have no impact on people from other countries*.

A second round of hierarchical cluster analysis shows another grouping of the items. Items 10, 27, 4 became close to one another: *ATT.10. The society should provide free basic health services for everyone*; *ATT.27. I think everyone must have the access to clean drinking water*; *ATT.4. It is important to find ways to reduce poverty*. All items refer to aspects that are interlinked in a cycle that affects health, economic stability, and social development. Ensuring access to clean water and basic health services can lead to better social and economic opportunities, ultimately contributing to poverty reduction and sustainable development. Therefore, taking this into account its relevance, we kept item 4 in the Attitudes scale. According to the Dendrogram and the proximity matrix, another group is formed by items 14, 20, 5, 6: *ATT.14. Each country can do a lot to keep the peace in the world*; *ATT.20. I think global warming poses a serious threat to the future of our world if cautions are not taken*; *ATT.5. The society should take responsibility for the welfare of individuals and families*; *ATT.6. Governments should adopt SD as a national priority*. Items are characterized by great similarity (the proximity matrix shoes values lower than 50). We decided to reduce the Attitudes scale by keeping only items 5 and 20 because they collectively represent a broad spectrum of sustainability concerns as they offer a comprehensive coverage of core sustainable development principles. This focus allows for a more in-depth understanding of respondents' attitudes towards these essential elements of sustainability.

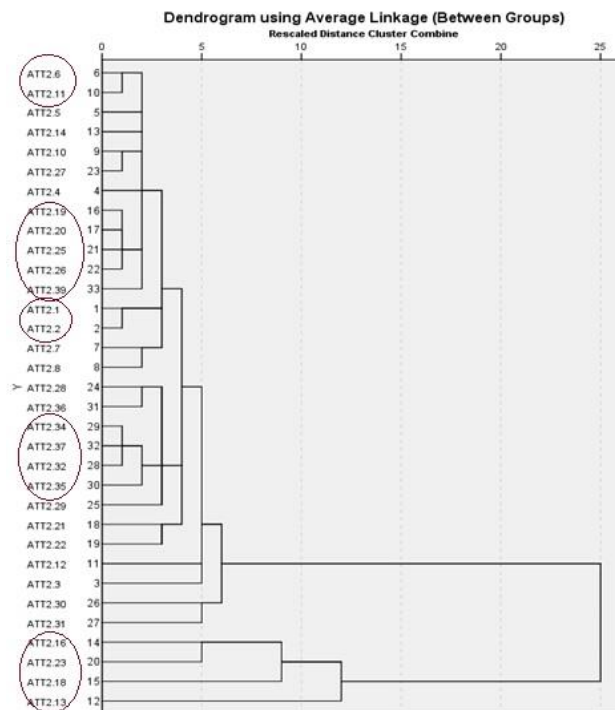


Figure 2: Dendrogram for Attitude scale items

After reducing the scale for more clarity and focus, we performed another factor analysis, using principal component method with rotation Varimax and Kaiser normalization, and we obtained a three-dimensional scale (Cronbach's Alpha = .916): 1st dimension regards the social pillar of SD, the 2nd one refers to the economic pillar of SD, while the 3rd dimension tackles attitudes of disengagement regarding sustainability.

3.2.3. Analysis of Behaviors scale

Initially, the Behaviors scale was composed of 25 items (Cronbach's Alpha value = .908). For further refinement and development of the Behavior scale we conducted a factor analysis, using principal component method with rotation Varimax and Kaiser normalization. The analysis shows that items group into 6 factors. After other three sets of factor analysis we decide to: exclude item 2 (*BHV2. I choose certain products for ethical or environmental reasons, even if they are a bit more expensive*), and 1 (*BHV1. I am actively involved in SDG*) because they have values less than .500; reduce item 8 (*BHV8. I do not think about how I might be damaging the natural environment*) and item 14 (*BHV14. I treat people respectfully, except those who have racial or ethnic backgrounds different from my own*) because they separately form one component and, while their meaning is reversed (negative content of the items), they could not have been accurately perceived by respondents; we deleted items 21 (*BHV21. I avoid buying goods from companies with a bad reputation for looking after their employees and the environment*), and item 22 (*BHV22. I often purchase second-hand goods*) as they had values lower than .500. The last round of factor analysis indicates 4 dimensions for the Behavior scale. The total variance explained for each component is: 19.5% for the 1st factor, 19% for the 2nd one, 16.7% for the 3rd one, and 14.1% for the 4th component.

In order to see the underlying structure of the Behaviors scale and reduce the number of items in the scale, we performed the hierarchical cluster analysis. Dendrogram and Proximity matrix analysis show that items 13 and 15 (that belong to the 1st factor) place themselves at

a small distance one from another. We choose to retain item *BHV15. I give men and women, boys and girls the same level of respect over item BHV13. When I use the computer or phone for social networking or gaming I always treat everyone as respectfully as I would in person* because it emphasizes a critical and universally relevant aspect of respect and equality that extends across all areas of interaction, both online and offline.

The component of the 2nd factor recalls item *BHV5. I avoid excessive food purchases, and item BHV11. I reduce the energy I use at home to protect the environment*. The Dendrogram and proximity matrix reveals the high degree of similarity between these two items. Therefore, we kept item 11 because addresses a more measurable and practical action that aligns with broader environmental goals and can lead to substantial benefits. Further, items *BHV17. I participate in democratic activities related to student life at my university, and item BHV18. I volunteer in social or environmental organizations* form the 3rd factor, and are also situated at small distance to one another, leading us to the decision to retain item 18. Retaining this item is more relevant because it encompasses a broader scope of activities, applies to a wider audience, not only students, and has the potential for greater and more sustained impact on social and environmental issues. Eventually, factor 4 is formed by item *BHV19. I get informed on environmental issues in web pages and media, and item BHV20. I get informed on international social issues in web pages and media* situated very close to one another. Both items refer to information about sustainability issues, however we decided to retain item 20 because it refers to a broader and more general spectrum of issue. Moreover, there could have been a problem of misunderstanding the content of the item among respondents.

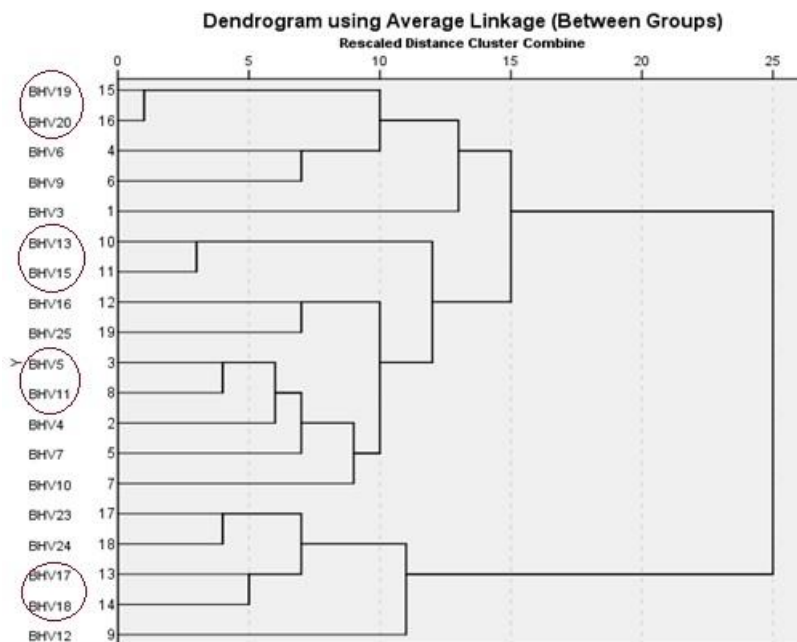


Figure 3: Dendrogram for Behaviors scale items

After reducing the number of items and dimensions of the Behaviors scale, the factor analysis (Cronbach's Alpha = .871) indicated that items grouped in three dimensions: the 1st dimension is formed by items that refer to general sustainability behaviors, the 2nd one addresses an environment-oriented behavior, while the 3rd dimension shows participation and a pro-active behavior.

4. Conclusion and future prospects

In this paper we reviewed the literature regarding education for sustainability, focusing on the concepts of sustainability literacy and sustainability awareness. There are several studies that seek to clarify the actions and directions that universities take in order to promote sustainable development, respectively studies that aim to capture the current level of students' training in terms of sustainability. In order to have a consistent and overall picture of the role of higher education in the formation of literate individuals regarding sustainability, it is recommended to start with an assessment of the current state, with the identification of the actions carried out by the universities and also analysis of students' knowledge, attitudes and behaviors related to sustainability.

Our study aimed to develop and test scales for measuring knowledge, attitudes and behaviors for Romanian students. The scales were constructed based on several international studies, and through the statistical analyses we proved the internal consistency of the measurements and also reduced the number of items in each scale. The results presented are an intermediary phase within a larger study. Future research will validate these reduced scales on large samples, which will also allow more detailed analyses to explain the sustainability and SDGs related behaviors in higher education.

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ANNEX. Lists of initial items used in the three scales.

Items in KNOWLEDGE scale (1-5 point Likert scale)
KNOW. 1. Economic development is necessary for sustainable development (SD)
KNOW. 2. SD requires businesses to behave responsibly to their employees, customers and suppliers
KNOW. 3. SD results in fair distribution of goods and services to all people around the world
KNOW. 4. Cell phone production and usage does not consume a lot of resources
KNOW. 5. SD requires that people understand how the economy works
KNOW. 6. SD allows the environment to be radically altered in order to create/maintain jobs
KNOW. 7. Protecting the environment is necessary for SD
KNOW. 8. Human actions are contributing to changes in our atmosphere and climate systems
KNOW. 9. SD requires individuals to reduce all kinds of waste
KNOW. 10. Conservation of fresh water is necessary for SD
KNOW. 11. For sustainable development, people need to be educated in how to protect themselves against natural disasters
KNOW. 12. ‘Maintaining biodiversity’ means maintaining the number and variety of living organisms. This is necessary for SD
KNOW. 13. SD requires shifting to the use of renewable resources as much as possible
KNOW. 14. A culture of peace where people settle conflicts by discussion is necessary for SD
KNOW. 15. Good citizenship is necessary for SD
KNOW. 16. Sustainable development requires global partnership
KNOW. 17. Improving people’s opportunities for long and healthy lives contributes to SD
KNOW. 18. SD is not dependent on gender equality
KNOW. 19. The elimination of poverty is necessary for SD
KNOW. 20. SD requires access to good quality education for everyone
KNOW. 21. Respect for cultural diversity is necessary for SD
KNOW. 22. SD requires respect for human rights
KNOW. 23. SD requires people to reflect on what it means to improve the quality of life
KNOW. 24. Sustainable development requires ending hunger and malnutrition in all its forms

Items in ATTITUDES scale (1-5 point Likert scale)
ATT.1. Every person should receive education that teaches the knowledge, values and skills necessary for sustainable living in a community
ATT.2. I think that we who are living now should make sure that people in the future enjoy the same quality of life as we do today
ATT.3. I feel I have the responsibility to do something about the problems of the world
ATT.4. It is important to find ways to reduce poverty
ATT.5. The society should take responsibility for the welfare of individuals and families
ATT.6. Governments should adopt SD as a national priority
ATT.7. Citizens should be well-informed and actively participate in democratic processes like voting
ATT.8. The society should further promote equal opportunities for males and females
ATT.9. I think migrants should have all the same rights as the local people.
ATT.10. The society should provide free basic health services for everyone
ATT.11. Individuals should be provided with environments where they feel safe while living

ATT.12. Household tasks should be equally shared among members of the household regardless of gender
ATT.13. I think my behavior have no impact on people from other countries
ATT.14. Each country can do a lot to keep the peace in the world
ATT.15. Individuals should shop in the direction of their desires
ATT.16. Green areas can be dispensed with for urbanization and industrialization
ATT.17. I think that companies have the responsibility to reduce the use of packaging and disposable articles
ATT.18. As long as resources are available, using more than we need now does not threaten the health and welfare of future generations
ATT.19. I think destruction of the environment is a threat to biodiversity
ATT.20. I think global warming poses a serious threat to the future of our world if cautions are not taken
ATT.21. Biodiversity should be protected at the expense of industrial agricultural production
ATT.22. People who pollute our land, air or water should pay for damage done to communities and the environment
ATT.23. Understanding and addressing the problems of climate change is not important
ATT.24. Use of fuel-efficient vehicles should be encouraged by governments
ATT.25. The use of renewable energy sources needs to be widespread to leave a livable world
ATT.26. Environmental protection and people's quality of life are directly linked
ATT.27. I think everyone must have the access to clean drinking water
ATT.28. Environmental protection is more important than industrial growth
ATT.29. SD will not be possible until wealthier nations stop exploiting workers in poorer nations
ATT.30. I think it is right to boycott companies that are known to provide poor workplace conditions for their employees.
ATT.31. It is possible to protect the environment and create jobs even when the economy is doing poorly
ATT.32. Government economic policies should increase sustainable production even if it means spending more money
ATT.33. People should sacrifice more to reduce economic differences between populations
ATT.34. For economic investments, environments where life and property safety are provided must be established
ATT.35. Government economic policies should act if a country is wasting its natural resources
ATT.36. Reducing poverty and hunger in the world is more important than increasing the economic well-being of the industrialized countries
ATT.37. Government economic policies should increases fair trade
ATT.38. The production of high-tech products for economic development should be supported.
ATT.39. Investments in agriculture and livestock sectors should be supported for economic development.

Items in BEHAVIORS scale (1-5 point Likert scale)
BHV1. I am actively involved in SDG
BHV2. I choose certain products for ethical or environmental reasons, even if they are a bit more expensive
BHV3. I choose to walk, bike or use public transport vehicle to places instead of using a motor vehicle
BHV4. I never waste water
BHV5. I avoid excessive food purchases
BHV6. I don't use plastic bags to wrap things
BHV7. At home I recycle as much as I can
BHV8. I do not think about how I might be damaging the natural environment
BHV9. I have changed my personal lifestyle to reduce waste
BHV10. I pick up litter when I see it in a park or a natural area
BHV11. I reduce the energy I use at home (e.g., by turning the heating down or turning the air conditioning up or down or by turning off the lights when leaving a room) to protect the environment

BHV12. I report environment and social issues to authorities
BHV13. When I use the computer or phone for social networking or gaming I always treat everyone as respectfully as I would in person
BHV14. I treat people respectfully, except those who have racial or ethnic backgrounds different from my own
BHV15. I give men and women, boys and girls the same level of respect
BHV16. I try to do things that will help people living in poverty
BHV17. I participate in democratic activities related to student life at my university
BHV18. I volunteer in social or environmental organizations
BHV19. I get informed on environmental issues in web pages and media
BHV20. I get informed on international social issues in web pages and media]
BHV21. I avoid buying goods from companies with a bad reputation for looking after their employees and the environment
BHV22. I often purchase second-hand goods
BHV23. I participate in activities promoting equality between men and women
BHV24. I participate in activities in favor of environmental protection.
BHV25. I convey the importance of protecting the environment to my family members