Studia Periegetica no. 3(31)/2020
DOI: 10.5604/01.3001.0014.5963

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Interactive exercises and games for sustainable development goals: How to develop sustainability competencies in higher education?

Abstract. The article is dedicated to the idea of including Sustainable Development Goals (SDGs) in any discipline in higher education for the development of sustainability competences. The article analyses possible interactive exercises and games for all 17 SDGs. It also includes the analysis of sustainability competences provided by each game or exercise, as well as disciplines in which it can be used. This author recommends using interactive exercises and games for SDGs in higher education as effective and powerful instruments for promoting sustainability issues and developing students' competencies.

Keywords: education for sustainable development (ESD), Sustainable Development Goals (SDGs), interactive exercises and games, sustainable competencies

JEL Codes: I20, Q01

1. Introduction

The numerous challenges we have been faced with in recent years have given the impulse for a change of perspective and prompted a search for alternative ways of development. One such way is known as sustainable development, which is perhaps the only way forward. Sustainable development aims to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (Bruntland et al., 1987).

There are a lot of descriptions of what a sustainable society could look like (Brown, 1982; Cortese, 2003; Ellyard, 2011; Umeda et al., 2009). In 2015 UN

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Member States adopted 17 Sustainable Development Goals (SDGs) and 169 associated targets (UN, 2015), which demonstrate the ambition to reach sustainable development in global level, but many questions are still open. Many people realize that human well-being depends on nature and ecosystems and some are convinced that the human race is the main cause of environmental degradation, but many others still have not really realized that each of us are responsible for that. The ecological footprint of each person is mainly invisible, but the ecological footprint of the entire human civilization is devastating. Unfortunately, most people do not want to change their habits to save nature and reduce their ecological footprint. However, sustainable development cannot be achieved until every member of society feels responsible and lives by the principles of sustainability in day by day. So, the question raised in this article is how to make people feel responsible for sustainable development and how to make it clear to everyone that each one of needs to contribute to sustainable development?

There has been a lot discussion concerning all the above-mentioned problems (Annan-Diab & Molinari, 2017; Cortese, 2003; Crespo et al., 2017; Mensah & Ricart Casadevall, 2019; Vladimirova & Le Blanc, 2016; UN, 2015), but the conclusion is the same: sustainable development cannot be achieved without education. Therefore, education for sustainable development is a key tool in this respect. Some questions, however, remain open.

There are a lot of instruments, methods, approaches and recommendations concerning education for sustainable development, so one naturally wonders which of them is the most effective, how it can be used and in which disciplines, which competences it develops? There is no definitive answer to such questions. The aim of this article is to fill this gap by analyzing possible interactive exercises and games relating to all 17 SDGs. The article provides an analysis of sustainable competences developed by each game or exercise and a list of disciplines in which they can be used.

2. Key issues in education for sustainable development

In the last decades it has become increasingly obvious that traditional approaches to education are not effective any more. It is not enough to acquire and generate knowledge but one also has to reflect on behaviors and decisions that are required to solve the challenges facing humanity (Barth et al., 2007). "We need a fundamental, transformative shift in thinking, values, and action by all of society's leaders and professionals, as well as the general population" (Cortese, 2003, p. 16). "Interdisciplinarity can increase the ability to understand the complex challenges the world currently faces" (Eagan, Cook, & Joeres, 2002, p. 51). We need a shift in

education from competitive approach to cooperative and collaborative (Cortese, 2003). Eventually, we need to develop competencies that enable and "empower individuals to reflect on their own actions by taking into account their current and future social, cultural, economic and environmental impacts from both a local and a global perspective" (UNESCO, 2017, p. 7).

Many authors emphasize the importance of developing sustainability competences, which can help to bridge the gap between knowledge and action (Brundiers et al., 2020; de Haan, 2010; Glasser & Hirsh, 2016; Rieckmann, 2012; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015). Although different approaches to the selection of key competencies of sustainability have been developed, different researchers agree on the same ideas.

In this article the following key competences will be used as most relevant in future-oriented higher education (Brundiers et al., 2020; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015):

1. Systems thinking: the ability to analyze complex systems across different domains (society, environment, economy, etc.) and across different scales (local to global), considering the interconnectedness of all system elements and understanding importance of relationship (UNESCO, 2017; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015).

2. Futures thinking (or anticipatory): the ability to understand and evaluate multiple futures – possible, probable and desirable – and to create one's own visions for the future (UNESCO, 2017; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015).

3. Values thinking (or normative): "the ability to understand and reflect on the norms and values that underlie one's actions and to negotiate sustainability values, principles, goals and targets" (UNESCO, 2017, p. 44).

4. Strategic thinking (or action-oriented): "the ability to collectively develop and implement innovative actions" (UNESCO, 2017, p. 44).

5. Collaboration: the ability to learn from others; understand and respect the needs, perspectives and actions of others (empathy); deal with conflicts in a group; and facilitate collaborative and participatory problem-solving (UNESCO, 2017; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015).

6. Integrated problem-solving: the overarching ability to apply different problem-solving frameworks to complex problems and develop viable, inclusive and equitable solution (UNESCO, 2017; Wiek, Withycombe, & Redman, 2011; Wiek et al., 2015).

Therefore, the development of competences of sustainability in education is one of the key requirements in achieving sustainable development. There are still some practical questions to solve. How should these competences be developed? What instrument and approaches can be effectively used to develop sustainability competences?

3. Active learning in education for sustainable development

Among different educational approaches, active learning is considered to be the most powerful and effective instrument, which is best suited in the context of education for sustainable development. There are many definitions of active learning, but, generally, it can be defined as any instructional method that engages students in the learning process (Prince, 2004). As such, it seems to be the best way of developing sustainability competencies.

Among many different techniques of active learning that are used in different disciplines, interactive games and exercises seem to be particularly useful for promoting sustainability themes in higher education because they can create an interactive learning experience by transforming inactive learning material into learning episodes, where learners become active players and participants (Ritzko & Robinson, 2006; Sugar & Takacs, 1999). Simple, interactive games and exercises can help students to understand complex challenges and find possible solutions.

4. Interactive exercises and games for SDGs

SDGs are "transformative steps which are urgently needed to shift the world on to a sustainable and resilient path" (UN, 2015). SDGs are complex and interrelated (ICSU, 2017; Nilsson et al., 2018) and cover all areas of human life, including social, economic and environmental aspects. It means that sustainability issues should be included in any discipline in higher education. Therefore, the SDGs can only be achieved by adopting a systematic, holistic and interdisciplinary approach. The development of sustainability competences of students and other members of society can help to achieve the SDGs. Active learning and interactive games and exercises in particular are best suited for this purpose.

Table 1 lists various interactive games and exercises related to SDGs, with a description of specific sustainability competences developed by each game or exercise and disciplines in which they can be used. Most of the games and exercises can be used in several disciplines or can be adapted to any needs. The number of manuals on interactive games and exercises is constantly growing, which shows their relevance in education. Interactive games are aimed at promoting systems, futures and values and strategic thinking. In addition to various other advantages (Den Haan & Van der Voort, 2018; Stanitsas, Kirytopoulos, & Vareilles, 2019), they help students to develop many other interpersonal skills, which are so important in our changing world and necessary to achieve sustainability.

Table 1. Interactive games and exercises for the SDGs

Name	Short descriptions	SDGs	Sustainability competences	Themes	Disciplines	Reference
Privilege walk	The game develops empathy and emotional intelligence; raises awareness of unequal opportunities in society; contributes to the understanding of the possible personal consequences of belonging to certain social minorities or cultural groups; allows us to understand that each person is the creator of his own destiny.	1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender Equality, 8. Decent work and economic growth, 10. Reduced inequalities, 16. Peace, justice, and strong institutions	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • collaboration, • integrated problem-solving	• different types of inequalities, • inclusiveness, • human rights	• social sciences, • business, • humanities, • natural sciences, • applied sciences	Young (2006)
Lifecycle of things	The game shows the importance of conscious and responsible consumption, focuses on how irresponsible consumption affects our well-being and prosperity, how consumption is related to the conservation of natural resources and ecosystems.	6. Clean water and sanitation, 9. Industry, Innovation, and Infrastructure, 11. Sustainable cities and communities 12. Responsible consumption and production 13. Climate action 14. Life below water 15. Life on land	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • collaboration, • integrated problem-solving	• circular and green economy, • environmental management, • natural conservation • responsible behavior and habits	• social sciences, • business, • humanities, • natural sciences, • applied sciences	Posibnyk “Ministerstvo klimatychnoyi mahiyi” (2017)
Crossed arms	This is an exercise about our habits and the need to change them depending on the conditions. The exercise warns us about some of the consequences of our habits and their changes.	All 17th SDGs	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • integrated problem-solving	• environmental management, • natural conservation • responsible behavior and habits • sustainable development • personal development and growth	• social sciences, • business, • humanities, • natural sciences, • applied sciences	Sweeney, Meadows, & Mehers (2011)

Table 1 – cont.

Name	Short descriptions	SDGs	Sustainability competences	Themes	Disciplines	Reference
Biodiversity	This game was created by Dennis Meadows on a panel at the 2009 World Science Forum in Budapest. It is an analogy to biodiversity loss: biodiversity includes not only species diversity but also structural diversity, so by losing one species we can lose others, because in nature everything is closely interconnected, and sometimes ecosystem relationships are much more important than some elements (species).	14. Life below water 15. Life on land	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • collaboration, • integrated problem-solving	• biodiversity, • ecosystem services, • environmental management, • natural conservation, • emergence in system	• natural sciences, • applied sciences	Sweeney, Meadows, & Mehers (2011)
Harvest	This game is about the importance of rational use of natural resources, as well as equal access to resources and taking into account the interests of all stakeholders. Natural resources are not limitless, and therefore need rational and fair use, otherwise everyone will lose	1. No poverty, 2. Zero hunger, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • collaboration, • Integrated problem-solving	• biodiversity, • ecosystem services, • environmental management, • natural conservation, • tragedy of commons, • limited resources, • natural resources policy	• social sciences, • business, • humanities, • natural sciences, • applied sciences	Sweeney, Meadows, & Mehers (2011)
Carbon cycle	The game simulates the movement of a carbon molecule in the carbon cycle. In an interesting and active way students get acquainted with the carbon cycle and evaluate carbon stocks and their sources. During the game, its participants will travel through the main flows of carbon and its reservoirs in various forms (part of plants, animals, ocean, soil, atmosphere, fossil fuels). This process helps them to understand the relationship between disruption in carbon cycle, increased carbon dioxide in the atmosphere and climate change.	7. Affordable and clean energy, 13. Climate action, 14. Life below water, 15. Life on land	• systems thinking, • futures thinking, • values thinking, • strategic thinking, • integrated problem-solving	• carbon cycle, • climate change, • renewable and clean energy, • carbon footprint	• business, • natural sciences, • applied sciences	*Carbon Connection…* (n.d.)

Web of life	The game shows that in nature everything is connected to everything else. This activity addresses the issues of the global food web. The game shows how eating habits and diet affect global environmental challenges, as well as the loss and degradation of natural ecosystems.	1. No poverty, 2. Zero hunger, 3. Good health and well-being, 10. Reduced inequalities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land	• systems thinking, • future thinking, • value thinking, • strategic thinking, • collaboration, • integrated problem-solving	• natural wealth and resources, • right to life, liberty and personal security • ecosystem services, • footprints • food resources	• social sciences, • business, • natural sciences, • applied sciences	Brander et. al. (2015)
The World's Future	It is a simulation game about the main global challenges facing humanity. The game shows how the main environmental, social and economic problems are interconnected, and what is the role of different stakeholders in solving them.	All 17th SDGs	• systems thinking, • future thinking, • value thinking, • strategic thinking, • collaboration, • integrated problem-solving	• environmental management, • natural conservation, • responsible behavior and habits, • sustainable development, • personal development and growth, • circular and green economy	• social sciences, • business, • humanities, • natural sciences, • applied sciences	Games4Sustainability (n.d.)

Source: own research.

5. Conclusions

Education plays a key role in achieving sustainable development, but it needs to be changed by the inclusion of effective tools and instruments. As one of the existing educational approaches, active learning is considered to be among the most powerful and effective instruments. Interactive games and exercises are a particularly powerful tool for active learning, which can be used to develop sustainability competencies in higher education. After analyzing eight games and exercises from six sources, it was found that such games and exercises can be useful for promoting most sustainability competencies. In addition, interactive games and exercises can be used in any discipline to promote the principles of sustainable development, as well as take into account the interdisciplinary approach. One of the idea of this article is to promote interactive exercises and games for SDGs in higher education as effective and powerful instruments with focus on the development of sustainability competences as well as to stimulate the transition to active learning in higher education more often. But the future aspects should focus on integrating interactive games and exercises in distance learning.

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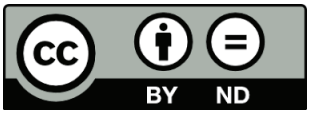
Ćwiczenia i gry interaktywne dotyczące celów zrównoważonego rozwoju: jak rozwijać kompetencje w zakresie zrównoważonego rozwoju w szkolnictwie wyższym?

Streszczenie. Artykuł jest poświęcony idei włączania celów zrównoważonego rozwoju (CZR) w ramach dowolnego przedmiotu w szkolnictwie wyższym, co może przyczynić się do rozwoju kompetencji w zakresie zrównoważonego rozwoju. W publikacji przeanalizowano ćwiczenia i gry interaktywne dotyczące wszystkich 17 celów zrównoważonego rozwoju. Artykuł obejmuje również analizę kompetencji w zakresie zrównoważonego rozwoju rozwijanych przez każdą grę lub ćwiczenie, a także przedmiotu, w których można je wykorzystać. Autorka zaleca wykorzystanie ćwiczeń i gier interaktywnych dotyczących celów zrównoważonego rozwoju w szkolnictwie wyższym jako skutecznych narzędzi do promowania kwestii zrównoważonego rozwoju i rozwijania kompetencji studentów.

Słowa kluczowe: edukacja na rzecz zrównoważonego rozwoju (EZR), cele zrównoważonego rozwoju (CZR), ćwiczenia i gry interaktywne, zrównoważone kompetencje



Suggested citation: Kozak, O. (2020). Interactive exercises and games for sustainable development goals: How to develop sustainability competencies in higher education? *Studia Periegetica*, *3*(31), 81-91. https://doi.org/10.5604/01.3001.0014.5963