Article

Innovative Strategies for education of Gen Z and Alpha with special focus on Sustainable Development Goals

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Abstract: The paper explores the possible integration of Sustainable Development Goals (SGDs) into higher education, through innovative learning strategies created as a part of *Sustainable Entrepreneurship in EDucation* project (SEED project). As world faces environmental, social and economic pressures, Higher Education Institutions (HEIs) should not only prepare students for professional success, but also develop their Sustainable Development (SD) competencies and SDGs oriented awareness. Such efforts must be proactive, what means that new generations (Gen Z and Alpha) learning preferences have to be taken into account and educational strategies used, properly aligned with them. Therefore the paper presents several educational strategies oriented on SDGs and preferences of new generations. In order to effectively equip students with necessary SD competencies, several approaches have been adopted and adapted in the frame of SEED project. The most important include Game-based Learning, Challenge-based Learning and Design Thinking. Assessment methods have also been tailored to new requirements driven by new generations learning preferences, with special focus on SDGs. The paper demonstrates the potential of SEED project outcomes in developing skills and knowledge of future leaders and decision-makers who will contribute to sustainable business practices, aligning education with global sustainability agenda.

Keywords: Education for Sustainable Development; SEED project; Game-based Learning; Challenge-based Learning; Design Thinking

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1. Introduction

The concept of sustainable development (SD) can be dated back to 1972, when it received first international recognition. During the last decade it has become a global priority. The main driving force was an urgent need to consider social, environmental and economic challenges faced by humanity. To address all pressing issues, 17 Sustainable Development Goals (SDGs) have been set and adopted by all United Nations Member States in 2015. SDGs achievement requires involvement in all important sectors of society – profit and non-profit organizations, civil society, governments and educational institutions. One of the most important roles in these efforts is played by Higher Education Institutions (HEIs). HEIs are responsible for preparing graduates (future decision makers, leaders, staff members, innovators) who will shape and develop polices, requirements and best practices to meet SDGs and determine if they are met. To do this, HEIs must integrate SDGs into their curricula and research efforts. Such integration should foster building of sustainable development awareness, competencies and values needed to successfully achieve SDGs. The area that is quite resistant to efficient integration is education. The reason is that new generations (Gen Z and Alpha) have developed specific learning preferences. Nowadays, educating in an optimal manner requires deep understanding of

those preferences and careful aligning educational strategies with them. Such educational transformation is supported by UNESCO Education for Sustainable Development framework (ESD) [1]. ESD promotes active learning, critical thinking, problem solving and encourages students and educators to apply SD concepts to real world contexts. However, implementation of the framework is a demanding task. To integrate these recommendations in practical learning context, the HEIs optimal educational strategies, that takes into account learning preferences of Gen Z and Alpha, have to be applied.

This paper presents the outcomes of *Sustainable Entrepreneurship in EDucation* project (SEED project), funded by the European Union (2022-1-PL01-KA220-HED-000088765) in the form of innovative educational strategies – Game-based Learning, Challenge based Learning, Assessment tools, Design Thinking – focused on cultivating SDGs awareness and competencies. Exploring the application of these educational strategies, the paper shows how to use them in preparing future staff members, leaders and decision makers who will address the complex challenges of sustainable development.

2. Importance of SDGs awareness within workforce of contemporary enterprises

Adopted in 2015 by all United Nations Member States, SDGs represent global call to action for undertaking the challenges regarding environment, society and economy. SDGs achievement should lead to peace and prosperity for all people in the planet. SDGs concern, among others, such issues as poverty, inequality, education, climate change, peace, justice and environmental degradation. This initiative's core vision is to achieve a sustainable future for all, in a balanced manner. This balance is important because SDGs are strongly interconnected, and actions undertaken in one area may affect outcomes in others. Therefore, every activity that is being done should balance social, environmental and economic sustainability.

High level of SDGs awareness within workforce is the source of many benefits for contemporary organizations. A core advantage is a high level of staff members' performance in various dimensions of sustainability, while carrying out business activities. Apart from higher performance, staff members take a more proactive approach to sustainable practices. A study conducted in the public sector has shown that employees with a high level of SDGs awareness exhibit better performance in economic, environmental and social areas [2]. It is important from a business perspective, as this may reduce resource consumption, minimize waste, and adopt socially responsible policies. For instance, deep understanding of SDG12 (Responsible Consumption and Production), can be a driving force for internal motivation to constantly finding way for better, more sustainable production methods, cost saving in the long-run and reducing environmental footprint (Smaniotto).

High level of SDGs awareness may also impact performance on organizational level and finally lead to better enterprise resilience. It is related to understanding the relevance of SDG8 (Decent Work and Economic Growth) and SDG13 (Climate action). With such awareness employees will help organizations to better adapt to shifting market demands, regulatory changes and more likely identify opportunities for sustainable growth and development. Moreover, because consumers increasingly prefer companies that are SD responsible, businesses that value SDGs can observe positive impact on the brand image and brand loyalty.

In the contemporary business ecosystem, having employees with high SDGs awareness is a catalyst for bargaining power and thus gaining and sustaining competitive advantage. SDGs awareness within the workforce enhances engagement, drives innovation, improves performance of enterprise on individual as well as organizational levels and is an enabler for achieving sustainability objectives in global context. Embedding awareness in organizational culture helps in operating in the business world where sustainability is a key success factor.

According to UNESCO ESD, education plays a key role in achieving SDGs. HEIs should actively support not only Goal 4 (Quality Education) achievement but may also

prepare new generations representatives for carrying out activities related to entire SDGs framework. Graduates should be prepared for both activity areas – individual, related to everyday life and organizational when playing a role of company staff members. A holistic approach provided by ESD should help educators and enable learners to fully understand and take actions that comply with the interconnections between environmental, economic and social sustainability. Well prepared graduates equipped with SD competencies will effectively contribute to the achievement of all 17 SDGs. These graduates will become companies' workforce soon. Their awareness of SDGs is for companies a key factor for successful integration of sustainability practices into business strategies, processes and operations.

3. How to educate new generation of workforce – paradigm shift in learning preferences

HEIs (Higher Education Institutions), according to their mission, should actively contribute to the Sustainable Development Goals. As the United Nations Declaration states "*Since Higher Education Institutions (HEIs) educate and train decision makers, they play a key role in building more sustainable societies and creating new paradigms. As educational institutions, they have the mission to promote development through both research and teaching, disseminating new knowledge and insight to their students and building their capabilities. Given the objectives of Rio+20, HEIs have a special responsibility to provide leadership on education for sustainable development*." [3]. The implementation of this declaration is taking place in several ways. In recent years, specialised faculties with the word sustainable in the name have been created (e.g. sustainable management, sustainable finance, environmental sustainability). All of them aim to educate future leaders, equipping them with the skills and knowledge needed to contribute to the sustainable development of societies. In addition to newly created SD specialized faculties, additional subjects or specialisations on these topics are also being added to existing ones. The universities also carry out research projects related to the SDGs, develop patents either as part of staff research or student circles. Open lectures, meetings with experts, seminars and scientific conferences are also organised. Many students also undertake internships in companies which values are linked to sustainable development. A distinction must be made between the two concepts – education for sustainable development (ESD) and sustainability education (SE). In the former, students are equipped with the necessary knowledge, skills, and values to ensure sustainable development, while the latter has a broader meaning and implies incorporating sustainability into all educational domains and aims to transform individual behaviours, fostering harmonious coexistence with society, the environment, and the planet [4]. HEIs should make an ongoing effort to build curricula based on key competences, but this requires intensive training programmes for academics and developing their knowledge on the subject [5]. Only with well prepared academics universities will be able to apply innovative and activating pedagogical strategies and provide better education for SD. These strategies should shape key competences for sustainable development. When analysing key competences, many of them are psychological and behavioural rather than practical [6]. Hence, researchers tend to cite approaches such as action learning, backcasting, collaborative learning, gamification, Game-based Learning, simulation [7], case studies, project- or problem-based learning [8], challenge-based learning [9], Design Thinking [10]. These methods are not entirely new, but their use is not as widespread as one would think. Certainly, due to the characteristics of the students, the traditional teaching methods i.e. lectures are not effective and many of the world's leading universities are considering abandoning it. The variety of pedagogical strategies is also enforced by the great diversity of students and the new generations, in particular Generation Z and Alpha.

To effectively develop students' SD competences, HEIs should, in the first place, build deep understanding of new Generations (Z and Alpha) learning preferences. This understanding will constitute a foundation that enables to apply optimal learning

strategies, increasing young people's motivation as well as engagement and finally improve the effectiveness of educational processes.

How to decode the context and the habits that influenced young learners' preferences and finally caused paradigm shift in learning styles? The following insights may help:

- *Digital Natives.* These generations are the first ones with digital technology fully integrated into their everyday life and supporting most of the activities being done, including the learning process. They are familiar with digital devices (tablets, smartphones, laptops), internet resources and services. Technology for them is a natural extension of their abilities and tool being used daily. All these affected their learning preferences about techniques and tools, where on-line, collaborative and interactive environments are pervasive.
- *Attention span of learners.* It is not possible to keep the focus of Gen Z and Alpha representatives for longer periods of time. Usually, when only listening, they turn off the focus and the cognitive processes after few seconds/minutes. According to researchers, the attention span for Gen Z and Alpha is around 8 seconds, that is less than half as long as for the Baby Boomers (20 seconds). As a result, the way they engage with educational content is different. What captures their interest are visually appealing, interactive, bite-sized learning materials that involve teamwork and cooperation with other learners.
- *Learning autonomy.* Gen Z and Alpha prefer self-directed and self-paced learning experience. The more autonomy is involved in a learning process the better. They like to search and collect information on their own, use online resources and internet services in independent manner. This insight may provide valuable hints for optimal learning strategy applied in some cases, because it means that properly selected "challenge" and unambiguous rules set, may be all they need to start learning and develop skills in autonomous manner. However, they still need a guidance and constant feedback from teachers/mentors. These are the catalyst for efficient and effective learning process.
- *Multi-modal learning.* New generations' representatives prefer learning content that includes different styles – reading, writing, visual, auditory and kinesthetic [11]. It is about teaching with the use of different channels and forms, the learning materials are represented. Various types of content enable all students to learn more productively, and in the way every individual prefers the most. There are several benefits provided by such an approach. Learners are more engaged, apply knowledge and skills to real-life situations, teachers may be more creative with subject matter content, and the learning process can be more fun. Multi-modal learning also supports learners' autonomy as everybody can choose his/her own learning style according to individual preferences.
- *Collaborative learning.* New generations are comfortable with collaborative learning tools and platforms. Collaborative learning may be conducted on-line or in-class. Analog tools, like pen and paper are also very valuable support. Gen Z and Alpha representatives, as they are in constant interaction on social media platforms and often undertake collaborative activities, prefer group projects and teamwork. Discussions on group forum and feedback provided by teachers and peers are also important elements of the learning process. Research results show that collaborative learning provides many benefits in such dimensions as social, psychological and academic. Those especially important from the SD perspective are building diversity understanding among students and staff, establishing a positive atmosphere for modelling and practicing cooperation as well as developing learning communities [12].

- *Microlearning.* New generations prefer short, focused lessons or training modules. It perfectly aligns with their attention spans. Short learning modules in the form of "easy to swallow pills" can deliver most important knowledge chunks and develop critical skills related to current job market requirements. With the very rapid development of micro-credentials, which are widely recognized by employers as confirmation of specific skills, microlearning may become a basic building block of learning strategies developed by HEIs.
- *Subject-matter learning content.* There are also new generations preferences for subject-matter learning content. Firstly, it should be authentic and relevant. Gen Z and Alpha representatives value the most real-world content and experiences. They like to undertake challenges and solve problems important to their lives and personal and professional future. They are also more globally connected and culturally aware. Diverse perspectives, viewpoints and the impact of different cultures are welcome. A sense of purpose is also a very important ingredient of learning experiences. They will be more engaged with the content, which is aligned with their values and society, including SDGs. Such preferences may be the driving force for motivation and engagement when teaching about SD and developing SD skills.

This paper explores why specific learning strategies developed in SEED project are well suited for Gen Z and Alpha representatives. Table 1. presents some interconnections between their learning preferences and educational strategies selected in SEED project.

Table 1. SEED project's learning strategies and their alignment with Gen Z and Alpha preferences

Learning strategy	Alignment with Gen Z and Alpha Preferences
Design Thinking	Puts an emphasis on innovation, creativity, problem solving and critical thinking. Aligns with solution-focused mindset of Gen Z and Alpha. Provides a foundation for collaborative, iterative, active and autonomous solving complex, real-world, sustainability problems. Focus on user-centered solutions complies with new generations interest in creating practical impactful outcomes.
Game-based Learning	Provides interactive, gamified environment. Involves new technologies and immersive, hands-on experiences. Supports the need for bite-sized content and constant, immediate feedback. Maintains attention and stimulates internal motivation. Offers competitive and collaborative virtual environment that complies with preferences for teamwork and problem solving in simulated real-world context.
Challenge based Learning	Aligned with preferences for autonomous and purpose-driven learning. Shows real-world relevance and enables to engage with meaningful challenges, closely related to personal and professional future of Gen Z and Alpha representatives. Includes elements of collaborative and project-based learning, by providing environment for teamwork during solving sustainability challenges. Enables to see tangible impact of decisions made and fosters deeper understanding of SDGs importance.
Case Study	Provides with opportunities to practically apply knowledge gained, to real-world situations and explore its relevance. Involves collaborative learning, critical thinking and discussion in the context of teamwork and peer interactions. Promotes taking different perspectives, outcomes analysis, reflection on learning and develops problem solving and decision making skills.

The following sections of the paper first present each of the strategies in general terms and then show how each has been adopted in the SEED project, in the context of building awareness and developing SDG skills in Generation Z and Alpha.

4. Design Thinking as a Framework for SDGs students' awareness development

Companies use Design Thinking (DT) in generating and evaluating innovative ideas for sustain-ability-oriented innovations. In particular DT is used for defining the appropriate scope of innovation, considering different stakeholders, and identifying related user needs and sustainability outcomes [13]. DT tools that are widely used in business and

innovation can also be successfully applied in ESD. Design thinking tools are considered to deal with the increased complexity of the business, natural, and social environment, so the method is increasingly applied to SD problems, which are always complex problems without easy and quick answers. DT and sustainability science are compatible as the application of DT can result in actions that have a high impact and are integrated into their unique socio-ecological context [14]. The application of DT is versatile i.e. it can be used in the classroom as an innovative pedagogical strategy integrated into curricula to help students better understand and solve complex sustainability issues. However, the DT framework can also be used for curriculum planning, learning out-comes, competency testing, building student profiles, collaborating with the university com-munity, to name just a few of the ideas that are emerging. The literature has long provided many examples of the application of DT to SD problems that a sustainability professional will encounter, e.g. eco-design related to the use of environmentally friendly materials, design for purpose aiming at customisation, design for behaviour as design to get the user to use it sustainably and systems design for the design of whole organisations [15]. The effectiveness of the application of DT in higher education in SD is supported by case studies described in the literature. Mann et al. [16] described a project on the sustainability of a lake environment that ex-posed students to the social, business, and environmental perspectives associated with a local endangered lake and its surrounding wetlands and made SD issues close to them. This result would not have been possible without the use of DT. The use of DT in an environmental engineering course has shown a positive impact on students' perceptions of their creativity and their future sustainability practices [17]. Special courses for engineers applying Design Thinking to sustainability, innovation and interculturalism are also being developed using DT together with intercultural, transdisciplinary, and interdisciplinary perspectives in innovation development processes, and all teaching is done using online tools [18].

5. Game based learning

It is not surprising that the GBL method, used in the field of higher education with success, has also started to be used in teaching for sustainable development. As research shows, students retain the knowledge gained through game-based approaches better, especially in interdisciplinary fields requiring critical thinking and communication [19]. Through educational games, students can gain experiences in a virtual world that can later shape their behavioural patterns and directly influence their reflection [20]. Educational games help develop problem-solving skills, which is crucial in preparing students for professional challenges in the field of sustain-ability, e.g. understanding sustainability, environmental protection, and resource management, etc. The ability to solve unstructured problems in games enhances students' ability to solve real-world problems once they leave university and enter the labour market [21]. Another extremely important aspect of the use of games is collaborative university learning, as most games for SD are team games. Group learning is a standard part of the learning process as games are one of the most effective methods to ensure it [22]. Many successful applications of GBL in education for SD have been described in the literature [23,24,25,26,27,28]. Obstacles standing in the way of wider application of GBL in the field of higher education are the excessive cost of preparing advanced games, the time needed [29], and the heavy involvement of academics in the process of integrating the game into the classroom [30].

6. Challenge based learning

Challenge Based Learning (CBL) is an experiential learning model of education in which students confront compliant challenges linked to the local or global environment. In the process of completing a task, students use subject-matter knowledge, technology, and teamwork. They show self-discipline and commitment by consequently taking responsibility for their own learning. CBL is one of the recommended methods for ESD, as it allows students to reflect on local, national, or global issues. CBL is quite often linked to

e-learning, which enables communication between students and between students and teachers [31]. Research shows that the use of CBL increases the sense of agency among students, where they can recognize how to benefit society [31,32]. Working on real-world challenges designed with a external stakeholders shows an increase in the level of key competencies for SD compared to a group taught traditionally [33]. CBL is one of the key methods to educate engineers who will solve recent problems considering SDGs and transfer knowledge from one context to another [34].

7. Tools for assessing students' progress

7.1. Feedback

The characteristics of instant gratification are deeply ingrained in the minds of Generation Z and Alpha students. They have grown up in an environment where immediate responses are the norm. This is evident in their expectations regarding digital interactions. On social media platforms like Facebook or Instagram, they are accustomed to seeing the reactions of their friends in real time. Similarly, when learning via a mobile app or playing a game, they anticipate immediate feedback. As might be expected, students have similar expectations of class-room interaction. One of the best tools that can be used is feedback, which helps avoid mis-takes, develops motivation, and boosts students' self-esteem. Oral or written feedback from the teacher is an important part of the assessment of learning. Feedback helps to transfer more responsibility for learning to students, promoting a more active and engaged learning environment [35]. Well-structured feedback should be specific and detailed, regular, constructive, understandable to the student, regular, and focused on the process rather than the person. Valuable feedback allows the student to understand the mistakes made to move on to the next step. Tasks that allow for valuable feedback in line with ESG objectives should be complex, where students themselves are not able to find simple answers quickly [36].

7.2. Case study

Case study is another teaching strategy that can be successfully used to improve competences in many different fields. The method can be used both to reconstruct the course of a phenomenon, to present the conditions and the factors that shape it, or to broaden the knowledge of a phenomenon that is not fully defined (which is the majority of problems in sustainable development). Many studies are showing the advantages of this teaching method in many different areas [37,38,39,40]. Case-based teaching reduces the distance between theory and practice, which is extremely important for students' future careers. Georgallis and Bruijn [41] showed how to use the case study method reinforced with debates for teaching complex sustainability issues in business schools. According to their research, the use of case-based de-bates significantly improves students' critical learning process and makes it more interactive and dynamic, finally building the ability to apply theoretical knowledge to real-world sustainability challenges. The case study method based on sustainability content can also be success-fully used in teaching English emphasizing the need to involve teachers of all subjects in effectively teaching sustainability [42].

7.3. Rubrics

Rubrics aim to make the assessment process more transparent and consistent by clearly de-fining expectations and standards. Assessment is a broader process of evaluating student learning, while rubrics are specific tools used to standardize the assessment of individual tasks. Rubrics provide detailed feedback on specific criteria, helping students to understand their strengths and areas for improvement [43]. Rubrics typically include criteria i.e. items and skills to be assessed, levels of achievement and a detailed explanation of what is expected at each level of achievement (descriptors). When formulating curricula on sustainability issues, the creation of rubrics is a significant challenge due to the interdisciplinary nature of the problems to be solved by students and the variety of

competencies needed to solve them. This problem has been noted by many researchers proposing different approaches to rubric construction. For example, Gulikers and Oonk [44] propose a Boundary-Crossing Rubric to help operationalize student learning in trans-disciplinary sustainability projects. The proposed rubrics are designed to capture what students can learn when they learn in groups through inter-disciplinary problem solving, in a cross-cultural environment and social setting. Their experience has shown that the use of rubrics has many benefits for both students and teachers over simple assessment but requires a deep understanding of the tool itself by both parties. Kushwah [45] emphasizes the importance of well-designed rubrics in enhancing student engagement, providing structured assessment and developing core competencies in ESD. Mackeown [46] proposed a 16-dimensional rubric with three levels of performance used to assess a task. McCormic et all. [47] developed a method to assess students' application of sustainability principles in engineering design. Similarly, Watson [48] proposed a rubric for the engineering sciences with different criteria for measuring sustainability in dimensions such as environ-mental impact, social implications and economic considerations. Another example of a rubric is the Sustainability in Higher Education Assessment Rubric - SHEAR which can be used to develop programmes and courses to teach sustainability concepts to students [49]. A more recent example of this type of rubric assessing entire curricula for their integration with sustainability principles and criteria to improve curricula can be found in the work of Freitas [50].

8. SEED project outcomes as the tools for SD skills development

This part of the paper describes the outcomes of Sustainable Entrepreneurship in EDucation project (SEED project, 2022-1-PL01-KA220-HED-000088765), funded by the European Union. The project aimed to implement a set of innovative learning methods and tools that considers learning preferences of new generations and, at the same time, develops sustainable development awareness, related skills as well as deepen the knowledge on SDGs.

8.1. Design Thinking

The SEED project applied the Pedagogy for Nurturing Sustainability Changemakers model [51]. The learning environment and tools will be accompanied by choices made jointly by teachers and students in relation to complex problems, structured modules, constructive adaptation, modes of assessment, problem solving, feedback and reflection. The six steps include (re)iterative DT activities involving empathy, (re)defining for understanding, idea generation, prototyping, evaluation and implementation. Each DT step is supported by suggested tasks and tools and step-by-step scenarios to help students in the learning process. Figure 1. presents the model.

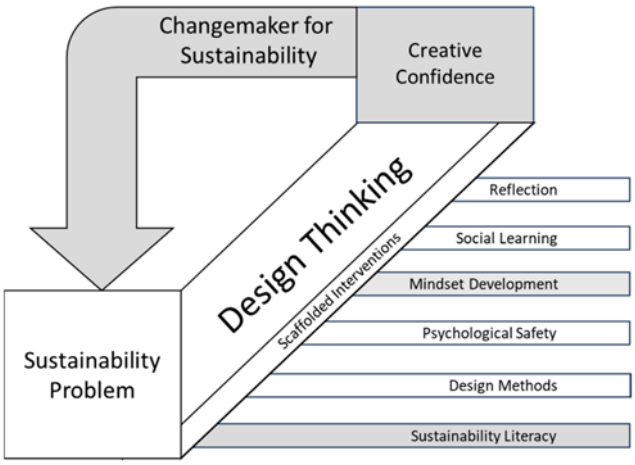

Figure 1. DT framework and its application to solving SD problems

Source: [51]

The DT process is seen as a series of interventions that support a change in thinking. Process starts with the problem of sustainability. Solving the problem requires knowledge of sustainability and design methods. Students' psychological safety is built up by signing team or class contracts. Mindset Development takes place through action, reflection, discussion, and repetition. Social learning takes place through group work, followed by in-depth reflection. Creative confidence is the outcome of the complete process [51].

8.2. Game based learning

In the SEED simulation game, the student must participate in realistic situations of business decision-making to develop key competencies in sustainable development. Players in con-trolled SEED simulation game environment have to balance company profitability with social and environmental responsibilities. This is an immersive experience game, developing the skills necessary for sustainable development. SEED simulation is aligned with the United Nations Sustainable Development Goals (SDGs) as it calls for players to implement and explore varied business sustainability practices, while managing their virtual enterprises.

Students adopt the roles of executive teams in the game, where they make realistic decisions that impact the success of an entire business - The Café. By playing through the game's challenges, the students develop their skills in running a business focusing on sustainability. Among these decisions, students will need to choose a location considering possible custom-er demographics, plan the menu, order necessary equipment, and hire employees. Beyond that, there are marketing and promotional considerations for the players. They are supposed to read market trends, keep an eye on competitors' moves, and change their business strategy accordingly in a dynamic way. The business is part of a shared market environment with other student-run businesses. During the SEED simulation, students will have the chance to:

- Develop and practice core business skills, such as strategic decision-making (goal set-ting, resource allocation, market analysis, etc.), financial management (projecting costs and revenues, tracking operational expenses, pricing strategies, etc.), human re-sources management (hiring suitable staff, providing necessary training, etc.), and marketing (building brand identity, launching campaigns to attract and retain customers, etc.).
- Enhance teamwork skills, as all decisions in the game are made collaboratively, with responsibilities distributed among team members from the start. Students must evaluate data, engage in discussions, and implement the chosen strategies together. This process strengthens communication, negotiation, critical thinking, and the ability to work under pressure. By reviewing their performance after each round, students gain insights from their mistakes and use this knowledge to plan future actions. The game instills a sense of responsibility, helping students understand how individual choices can influence the overall success of their team.
- Tackle realistic sustainability challenges. The game prompts engage to implement a sustainable strategy for The Café, requiring them to make decisions that carefully balance profitability with sustainability goals. Every choice they make as business leaders comes with consequences, pushing them to think critically about their impact as entrepreneurs.

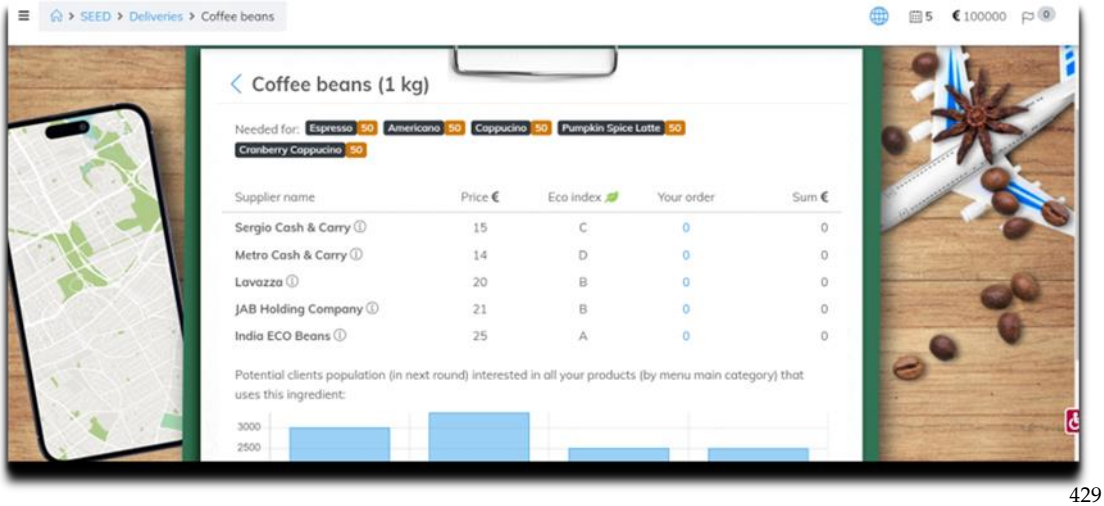

Figure 2. Decision-making interface in Deliveries area in SEED simulation game

Source: SEED Project

A ranking system has been introduced to measure the effectiveness of students' decisions. The students can compete in market positions for the following three main rankings: the Overall Ranking, based on revenues their businesses generate; the Ecological Ranking, referring to the ability of an enterprise to integrate better eco-friendly practices, such as choosing eco-friendly suppliers or using energy-efficient machinery; finally, the CSR Ranking, which shows how much each team is committed to responsible business practices, like the integration of persons with disabilities or accessibility for everyone in a café.

8.3. Challenge based learning

Twelve Sustainability Challenges were developed to ensure that students develop critical and entrepreneurial thinking with a focus on sustainability. The Sustainability Challenges were crafted to involve the students in role-playing, where they enact all the parts. By playing different roles, students can explore other perspectives as they adopt new personas.

They have been divided into four groups to ensure that the level of difficulty and familiarity is tailored to the students' needs. The following challenges were developed:

Novice Sustainability Challenges:

- *Green Office Practices* aimed to design and implement sustainable practices within the office environment for a successful startup company to reduce energy consumption, promote recycling, and minimize waste generation.
- *Eco-Friendly Event Planning* aimed to organize a sustainable entrepreneurship workshop with a focus on minimizing environmental impact, reducing waste, and promoting eco-friendly practices.
- *Green Home Gardening* aimed to *d*esign an environmentally friendly home gardening service that promotes biodiversity, conserves water and minimizes pesticide use.
- Beginner Sustainability Challenges:
- *Sustainable Pet Ownership* aimed to design a comprehensive system for sustainable pet ownership that minimizes environmental impact without compromising the health and well-being of the pets
- *Campus Food System* aimed to design a sustainable food system for your college campus that minimizes waste and reduces the carbon footprint.

- *Sustainable E-commerce Packaging aimed to d*esign an innovative e-commerce packaging solution that reduces environmental impact and aligns with consumer preferences for sustainability

Intermediate Sustainability Challenges:

- *Zero-Waste Personal Care aimed to d*esign a zero-waste subscription service for personal care products that eliminates or significantly reduces packaging waste while still delivering high-quality, effective products
- *Sustainable Grieving Practices* aimed to *d*evelop innovative urban mobility solutions that tackle traffic congestion and pollution, enhancing the overall efficiency, sustainability, and quality of urban transportation
- *Innovative Urban Mobility Solutions* aimed to *d*evelop innovative urban mobility solutions that tackle traffic congestion and pollution, enhancing the overall efficiency, sustainability, and quality of urban transportation
- Advanced Sustainability Challenges:
- *Carbon-Neutral Urban Redevelopment* aimed to design and "implement" a comprehensive plan to transform an existing urban neighborhood into a carbon-neutral community
- *Sustainable Transformation of the Fashion Industry* aimed to transform a traditional toy manufacturing facility into a zero-waste operation, where waste generation is minimized, energy efficiency is optimized, and resources are used in a sustainable manner.
- *Zero-Waste Toy Manufacturing* aimed to transform a traditional toy manufacturing facility into a zero-waste operation, where waste generation is minimized, energy efficiency is optimized, and resources are used in a sustainable manner.

The Novice and Beginner levels of the Sustainability Challenges were designed to improve existing business or pursue an innovative product or service within a company (intrapreneurship). The intermediate and advanced levels target new businesses or develop a concept for a new business (*entrepreneurship*).

Sustainability Challenges contain a clear *Title* that references the activity and proposed results, a single paragraph that introduces the challenge, accompanied by an image, which together can inspire conversation and questioning, the *Objectives* and *the Constraints* which are crafted to establish the parameters for the activity as well as six design thinking steps which follow the brief to readily go back as many steps as required to "do it again" is essential to the 3i model of design thinking and its "fail fast" ethos.

Sustainability Challenge: Novice

Green Office Practices

Offices play a significant role in environmental impact due to energy consumption, waste generation, and commuting. This challenge aims to design and implement sustainable practices within office environments, reducing energy consumption, promoting recycling, and minimizing waste. It seeks to engage employees and make sustainable practices a seamless part of office life.

Objective

Design and implement sustainable practices within the office environment for a successful startup company to reduce energy consumption, promote recycling, and minimize waste generation.

Constraints

1. The solution should be easy to adopt without significant costs.
2. It should encourage employee engagement and participation.
3. It must comply with workplace safety regulations.
4. It should address all three bottom lines: people, planet, and profit.

Design Thinking Stages

1. Empathizing: Research and understand employees' preferences and pain points related to sustainable office practices.
2. Re-defining to understand: Clearly identify the key areas where sustainability improvements can be made.
3. Ideating: Explore how you might adapt simple and cost-effective ideas for improving office sustainability.
4. Prototyping: Develop simple representations of your sustainable office practices.
5. Evaluating: Pilot the selected practices and gather feedback/feedforward from stakeholders. Adjust the practices as needed.
6. Implementing: Plan how you could monitor the impact of your sustainable office practices.

Figure 3. Sample Novice Sustainability Challenge.

Source: SEED Project

The teacher can use *the Sustainability Challenges* sequentially or build his own course by choosing the levels, experience with business, and topics according to the needs analysis of the students in a specific course.

8.4. Case studies

Ten selected *SEED Case Studies* showcase the implementation of design thinking in the world of business and beyond. The case studies support the SEED course on *Entrepreneurship for a Sustainable Future*. The case studies explore how a variety of private companies and public entities have applied human-centered design approaches to launch new products and services on the market. They concern the following companies and initiatives:

- *Apple's iPhone,*
- *Airbnb,*
- *Tesla's Electric Vehicles,*
- *IDEO's work with the Mayo Clinic,*
- *Nike's Flyknit Shoes,*
- *Uber Ride Sharing,*
- *Netflix Streaming Services,*
- *Starbucks' Mobile Ordering,*
- *Raia Heritage Initiative: Safeguarding the spirit,*
- *NextGen Vocational Ed. and Training School.*

All *Case Studies* were described in a unified way using the 6 steps of design thinking: Empathizing, Re-defining to Understand, Ideating, Prototyping, Evaluating and Implementing. These six design thinking steps mirror the activities in the *Sustainability Challenges* of the *SEED course on Entrepreneurship for a Sustainable Future*. After the description of each step, there is a *Further Reading* section containing references to useful sources with additional information as well as *Discussion questions related to…* section providing example discussion questions for teachers to use when facilitating class discussions about case.

5.3. Tesla's Electric Vehicles

Tesla's electric vehicles are a result of applying design thinking to the automotive industry. By re-imagining the traditional car design and focusing on sustainability and performance, Tesla has become a leader in the electric vehicle market, applying methods for identifying opportunities, mitigating risks, and scaling operations.

Empathizing: Tesla starts by empathizing with consumers and understanding their needs, desires, and concerns regarding transportation and sustainability. Tesla also considers broader societal trends, regulatory requirements, and environmental concerns related to transportation and energy consumption. Note that, in 1998, the United States government, under the Clinton Administration and with the automotive industry, and the Northeastern states, had reached an agreement to put cleaner cars on the road leading up to the Clean Air Act. The first of these new cars, called National Low Emission Vehicles (NLEV), were released in New England in the 1999 model year and made available nationwide in 2001. Another idea to limit emissions from the personal vehicle sector in the USA proposed that 10% of newly registered vehicles must be emission-free until 2003. Nevertheless, pressure from the car and oil companies forced the law to be repealed. Martin Eberhard and Marc Tarpenning understood the need for change in vehicle emissions and thus founded Tesla, where Elon Musk became a partner in resolving vehicle emissions.

Re-defining to understand: The problem with gas-powered vehicles is that the minimization of emissions is limited. Re-framing the problem of emissions, the company realized that only a vehicle driven by power produced by sustainable energy could be the solution. So, Tesla defined the main challenge as the need for sustainable transportation solutions that reduce dependence on fossil fuels and mitigate environmental impact, and identified performance, affordability, charging infrastructure, and environmental sustainability as key criteria for success.

Ideating: Tesla aimed to produce a car that represented a real or even better alternative to the gasoline-powered car. But they did not want to be dependent on the government and laws, so imagining ideas that were exciting and out-of-the-ordinary, they came up with a dual proposition

Figure 4. Six design thinking steps in the SEED Case Studies

Source: SEED Project

8.4. Tools for assessing students' progress

The SEED Grading Rubric was designed for simultaneous learning and assessment. It assumes that discussion of learning objectives with students engages them, both motivates and informs the students about what is expected of them. The teacher should share the assessment rubric with the students and allow time for questions and answers to enhance the students' awareness of the assessment criteria. The rubric should not only be used for assessment but also as an independent learning and reflection tool. The use of the rubric will ensure that students have enriched understandings that can spill over to other parts of academic and personal development to foster innovation and excellence. The SEED Grading Rubric includes assessment of the risk-taking and boundary crossing required to engage in exploring new areas, divided to account for successful teamwork and communication in identification, coordination, reflection, and transformation as follows:

- Risk-taking. Identification and Reflection - key entrepreneurship issues precisely articulated. Deep understanding of personal and group learning.
- Boundary crossing: Coordination and Transformation - diverse boundaries coordinated and transformed; coordinated collaboration plans; learning applied to real-world scenarios with innovative thinking and adaptability.

Beyond the assessment of the risk-taking and boundary crossing, the SEED Grading Rubric reflects the fundamental concepts of entrepreneurship for a sustainable future, shown with maximum assessment levels:

- Feasibility - well-thought-out and feasible solutions proposed, considering potential obstacles and practical implementation.
- Market potential - strong analysis of the target market (including size and characteristics) and market potential for the proposed solution.
- Triple Bottom Line (3BL or TBL) - People, Planet, and Profit: All three bottom lines were addressed with thorough and well-researched analysis.

- Addressing and solving the challenge - comprehensive and insightful analysis of challenge-specific metrics directly related to the presented solution to the sustainability challenge.
- Novelty - Highly Original: Demonstrates a fresh perspective.

Students can be evaluated on their group's solutions to the sustainability challenge using the SEED Grading Rubric outlined in Table 2.

Table 2. SEED Grading Rubric

Criteria	0 points	1 point	2 points	3 points
Risk-taking: Identification and Reflection	Significant issues are missing; no reflection on the learning experience.	Limited identification of key issues and reflection.	Minor gaps in the key issues, Potential for more exploration of further meaningful reflection	Key entrepreneurship issues precisely articulated. Deep understanding of personal and group learning.
Boundary crossing: Coordination and Transformation	Flawed or no collaboration plans; insights are not actionable strategies.	Some coordination but plans suffer from execution challenges; strategies lack innovation or adaptability.	Potential for effective coordination across boundaries to transform ideas into actionable strategies for sustainable entrepreneurship.	Diverse boundaries, coordinated and transformed; coordinated collaboration plans; learning applied to real-world scenarios with innovative thinking and adaptability.
Feasibility	Solutions lack practicality and feasibility; implementation challenges not addressed at all.	Limited consideration of feasibility; significant implementation challenges unaddressed.	Some aspects of feasibility considered, but significant implementation challenges remain unaddressed.	Well-thought-out and feasible solutions proposed, considering potential obstacles and practical implementation.
Market potential	Limited understanding of the target market and its potential.	Some understanding of the target market, but minimal exploration of market potential.	Some understanding of the target market, but market potential not fully explored or articulated.	Strong analysis of the target market (including size and characteristics) and market potential for the proposed solution.
Triple Bottom Line	People, planet and profit not considered.	Limited attention to one or two of the three bottom lines.	All three bottom lines addressed, but with incomplete or superficial analysis.	All three bottom lines addressed with thorough and well-researched analysis.

Addressing and solving the challenge	Insufficient consideration of challenge-specific metrics; lack of relevance to the presented challenge.	Minimal attention to challenge-specific metrics; limited relevance or depth.	Some attention to challenge-specific metrics, but limited relevance or depth.	Comprehensive and insightful analysis of challenge-specific metrics directly related to the presented solution to the sustainability challenge.
Novelty	Lack of originality: ideas presented are common or unremarkable.	Limited originality: ideas lack creativity or uniqueness.	Moderate level of originality: some creative ideas presented.	Highly original: demonstrates a fresh perspective.

Source: SEED Project

Experimenting with students (during the piloting phase) showed that they felt particular interest in “risk taking” and "boundary crossing" in the SEED Grading Rubric. They felt relieved that their initiative and creativity might be recognized through the rubric and that this evidence, when shared in advance, could help to encourage taking risks and ideating in transdisciplinary contexts. They pointed out the confidence it inspired since design thinking especially requires them to engage fully in exploration, curiosity, and impertinent inquisitiveness. The rubric also includes feasibility (covering implementation challenges, potential obstacles, and practical implementation), market potential (including analysis of the target market (including size and characteristics), the Triple Bottom Line (TBL/3BL) of people, planet, and profit, addressing and solving the challenge using challenge-specific metrics, and novelty, tracing their engagement and performance as they learn to reach for innovation in the context of sustainability.

9. Conclusions

Nowadays the need for sustainability is well visible in the modern world. Tackling challenges of sustainable development requires innovative approaches in education to well prepare future generations of employees for solving problems in this interdisciplinary area. This paper explores the role of innovative education strategies in shaping HEIs approaches to teach Gen Z and Alfa representatives who will help to achieve SDGs in the near future. The integration of SDGs into higher education curricula through innovative teaching methods like GBL, CBL, DT, that align with new generations learning preferences offers significant potential for shaping future workforce. Companies that hire graduates with high level of SDGs awareness and understanding will benefit from innovative, sustainability responsible and forward-thinking employees. However, there is an urgent need for further research, development and implementation of these strategies. Educational innovations are crucial as they are driving force for successful addressing of challenges posted by sustainable development both now and in the future.

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