

# Gamified Sustainable Entrepreneurship Education – A digital Educational Escape Room for economy classes in German High Schools

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## Abstract

Digitization is a megatrend that affects all domains of everyday life. Dealing with digital media and tools is therefore a key competency that should already be mastered in schools. In the field of Sustainable Entrepreneurship Education in High schools, playing digital Educational Escape Rooms might be a motivating activity to acquire sustainopreneurial competencies as well as digitization-related competencies. After an introduction to the fields of digital education and gamification in economics education along with Sustainable Entrepreneurship and Sustainable Entrepreneurship Education, this work-in-progress paper presents an example how to design, create and evaluate a digital Educational Escape Room to learn about Sustainable Entrepreneurship in German High Schools. Finally, a prospect of future research in this field is presented.

## Keywords 1

Digital Educational Escape Room, Sustainable Entrepreneurship Education, Digital Education, Breakout Games, Educational Games

## 1. Introduction

‘We live in a world of dramatic global changes’, wrote Secretary-General of the UN António Guterres (2020) in the foreword of the World Social Report even before the pandemic crisis showed its impact [1].

Hence, Sustainable Entrepreneurship Education in schools can make important contributions to solving social and economic challenges, as it enables young students to approach these problems with entrepreneurial acting and thinking [2, 3]. Sustainable Entrepreneurship Education is linked to Education for Sustainable Development that interconnects the economic, social and environmental domains and encourages learners to make autonomous decisions and act proactively [4, 5]. Therefore, it seems obvious that dealing with digital media and tools in Sustainable

Entrepreneurship Education can strengthen the learners’ ability to interactively and independently use technologies and special knowledge, as well as change the way they access information [6].

The use of digital tools and media is a key competence that should be mastered by all people, since the transformation of society through digitization manifests itself in all areas of life [7, 8]. Based on this, the European Commission on an European level as well as the Standing Conference of the Ministers of Education and Cultural Affairs of the countries in Germany calls for competence-oriented and cross-grade learning with and about digital media in German schools that should be thought of as an integrative part of all subjects [9, 10].

The gamification approach offers the possibility to design learning environments with digital media in a playful and motivating way [11, 12]. One method here is the digital Escape Room,

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referred to as an Educational Escape Room in the pedagogical context. The competency goals of the Educational Escape Room can be well related to those of Sustainable Entrepreneurship Education.

Although digital Educational Escape Rooms for Sustainable Entrepreneurship Education in schools may offer great learning potential, these digital games do not exist. This raises the research question of how such a competence-oriented digital Educational Escape Room can be designed and implemented for Sustainable Entrepreneurship Education. In line with this, a project designing a digital Educational Escape Room in Sustainable Entrepreneurship Education in schools has been brought forth, which is presented in this article.

In chapter 2, the domain of digital education and several key digital competencies are presented. Here, the relevance of gamification followed by the integration of a digital Educational Escape Room is explained. In chapter 3, the fields of Sustainable Entrepreneurship and Sustainable Entrepreneurship Education are presented. Chapter 4 brings together the two domains of digital education and Sustainable Entrepreneurship Education in the form of a digital Educational Escape Room for teaching Sustainable Entrepreneurship in German High Schools. Based on the Star model [13], the intended competency goals are presented as well as the design and possible forms of validation of the digital Educational Escape Room are described. This paper ends with an outlook to further research in this area.

## **2. Digital education and gamification (in economics education)**

This chapter introduces the subject of digital education. Thus, central competencies of a digital world are presented. Finally, an overview of the domains of gamification and digital Educational Escape Rooms is provided.

### **2.1 Digital education**

Digital education is considered the key to participating in a digital world [9]. Digitization-related competencies are currently indispensable for a successful participation in social life [14]. Several models already deal with digital competencies, e.g. the 'Computer and Information Related Competencies' model of the ICILS study

(2018) [15] as well as the competency framework 'DigComp' from the European Commission (2022) [16]. These competency models have been validated several times and continuously developed in international studies [e.g. 17, 18, 19, 20]. In Germany, digital competencies were presented by the Standing Conference of the Ministers of Education and Cultural Affairs in 2017 by means of a framework, which is based on former versions of the competency models DigComp and that from the ICILS study [10].

The following domains belong to the digital competencies: *search, processing and storage* describe the act of searching, filtering, analyzing, evaluating as well as securely structuring and storing data, information and digital content. To *communicate and cooperate* means using digital media and tools for communication, collaboration, content sharing as well as document co-creation. The competency *produce and present* is about the understanding of different digital editing tools and their usability for different targeted purposes, e.g. present, publish, or share, and considering legal requirements. To *protect and act safely* describes knowing risks and dangers in digital environments, developing and applying strategies to protect, among other things, personal data, one's own health, nature and the environment. *Problem solving and acting* is about the identification of technical problems, as well as determining and finding solutions to them. Finally, *analyze and reflect* is about recognizing, analyzing and reflecting the opportunities and risks of media used in different areas of life [10].

The transformation of digitization strongly impacts the field of education. Hence, new possibilities in the context of digitization are being developed, such as digital didactic tools, dissemination channels, and new access to knowledge [9]. Other examples include multimedia and interactivity, self-directed learning as well as the adaptability to users [21, 22, 23].

### **2.2 Gamification (in economics education)**

A complementary potential of digital learning environments is the increase of learning motivation. Children and young adults have grown up with digital technologies that develop different learning styles, new attitudes toward the learning process, and higher demands on teaching

and learning. For high school teachers, this means they must constantly adapt the learning process to the needs, preferences and requirements of the students in the best possible way [24].

Regarding the learning motivation, modern pedagogical paradigms and trends in education, reinforced by the use of information and communication technologies, create conditions for the use of new approaches and techniques to support and implement active learning. Gamification in education represents one of these trends [24]. It describes 'the use of game design elements in non-game contexts' [25], such as classrooms in schools. Gamification relates to the term 'games' and not to the term 'play'. Whereas 'to play' denotes a more improvised and free form of behavior, 'to game' refers to achieve fixed goals and also to concrete structures such as rules [25]. Various research studies show that the use of digital gamification increases the motivation of learners, as the level of difficulty can be adapted to the level of the player [11, 12].

In gamification, various digital game techniques and mechanisms can be integrated into the learning process as an activity. The purpose of these is to achieve specific learning goals, promote an increase in learner motivation, and create advantageous competition with other learners. In addition to this, gamification is an effective option to positively change students' behavior and attitude towards learning: on the one hand, students have control over learning outcomes and understanding, and, on the other hand, games create the conditions for an effective learning process [24].

In economics lessons, games are suitable for the development of almost all content and learning areas of economics. For example, they can be used to acquire or improve basic economic knowledge, communication, cooperation, creativity, observation and assessment [11]. For this purpose, (digital) Escape Rooms seem to be an appropriate type of game.

### **2.3 Escape Rooms and (digital) Educational Escape Rooms**

Escape Rooms are defined as live-action games that are played primarily in teams, where players are expected to solve puzzles, discover clues as well as complete tasks in one or more rooms. Here, a specific goal (usually to escape from the room) has to be achieved within a limited amount of time. Participating in Escape Rooms

involves several valuable pedagogical elements, including teamwork, communication, delegation as well as critical, systemic and lateral thinking [26]

Escape Room are used as a fun experience or game-based activity to achieve learning enhancement. This type of game focuses on game features and thinking skills that increase motivation and improve the competency of problem solving [27].

Incorporating these qualities into educational contexts is seen as an innovative pedagogical method to engage students accustomed to traditional classroom settings. Thus, Escape Room are seen as Educational Escape Rooms [28, 29].

According to the Star model, five elements have to be considered for the creation of an Educational Escape Room [13]:

- the learning process
- the gameplay - the structure of the game
- the equipment (physical or digital)
- the narrative - the story
- the puzzles

When creating a digital Educational Escape Room, logistical and time challenges may be overcome by using a variety of available platforms [30]. Numerous online platforms already exist that allow options for designing different types of digital Educational Escape Rooms: the platforms Genial.ly, Google Forms, or an E-book Creator offer the ability to design an Educational Escape Room and show simple steps for teachers to create puzzles and codes [31]. Digital Educational Escape Rooms allow the integration of a variety of digital tools to organize treasure hunt activities based on the structure shown above. Content delivery may take place through e-books, video or audio files, digital newspaper articles, etc. Puzzles may include various tools such as digital crosswords, memories, quizzes or search puzzles. Physical or digital equipment may be any form of worksheet as well as the use of Quick Response (QR) codes [29], encrypted PDF or text processing files. Various puzzles and challenges can be used which offer excitement and rewards [32] and relate to a topic covered in economics classes [33].

### 3. Sustainable Entrepreneurship (Education)

Entrepreneurship is understood as a creative process of disruption and destruction of traditional entrepreneurial structures and the development of innovative start-ups. Entrepreneurs as visionaries and innovators promote this process. Thus, the question arises how entrepreneurial activities can be related to the idea of sustainability [34, 35].

In its original meaning, sustainability provides for the preservation of a current state [36]. In its current understanding, Sustainable Development is interpreted as something that has to be permanently preserved and developed, while the economic, social and ecological perspectives are considered at the same time [37, 38].

In the course of sustainable development, entrepreneurship represents a mechanism for maintaining and developing services and products in the long term [39]. The connection between entrepreneurship and sustainability is known as Sustainable Entrepreneurship or Sustainopreneurship [40, 41]. Sustainable Entrepreneurship is driven by a socio-ecological mission that contributes to sustainable development and corresponds to a process of solving societal and environmental problems by exploring and exploiting market opportunities generated with innovative business ideas [42, 43, 44].

Sustainable Entrepreneurship Education promotes the teaching and learning processes which are necessary to grasp the complex connection of entrepreneurship and sustainability [45, 46]. Entrepreneurship Education in general promotes entrepreneurial acting and thinking [47] and creates a mental attitude defined by entrepreneurial characteristics such as motivation, creativity, innovation and the will to take risks [48]. Besides this, Sustainable Entrepreneurship Education also integrates approaches known from Global Learning and Environmental Education [2, 3].

A key element of Sustainable Entrepreneurship Education is to foster the sustainopreneurial intention. Here, the theory of planned behavior by Ajzen (1991) might be a robust model for explaining and predicting entrepreneurial intentions and behavior [49, 50]. According to the theory of planned behavior, intentions are influenced by one's attitudes toward behavior, subjective beliefs and norms as

well as the perceived behavior control. Therefore, the degree of self-efficacy and empathy of the learners and their perceived social support have a crucial impact on the intention to act in a sustainopreneurial way [51, 52, 53].

Promoting the sustainopreneurial intention does not mean that Sustainable Entrepreneurship Education primarily focuses on founding a sustainability-driven start-up. Sustainable Entrepreneurship Education rather creates an entrepreneurial and sustainability-oriented mindset [54]. Therefore, Sustainable Entrepreneurship Education makes use of the repertoire of skills and methods which are known in the field of Education for Sustainable Development [55, 56]. It also creates awareness that there are limits to natural resources that need to be respected in the course of entrepreneurial activities [2]. Sustainable Entrepreneurship Education is also a 'place for ethics of change' [44]. Thus, in the sense of transformative learning, Sustainable Entrepreneurship Education supports the transformation process of personal values towards a sustainability-oriented way of life and economy [57].

A Sustainable Entrepreneurship Education competence framework for Middle or High Schools is still pending. The only existing and validated competence framework for Sustainable Entrepreneurship Education is aligned to Higher Education and combines frameworks from Education for Sustainable Development and Entrepreneurship Education [58]. It distinguishes between six competencies: *systemic thinking* describes the ability to identify, analyze and combine the different domains along the Triple-Bottom-Line. *Foresighted thinking* is the ability to foresee and evaluate decisions on the environment, society and the economy. *The normative competency* is the ability to identify, apply and combine sustainability-oriented values. *Promoting diversity and interdisciplinarity* describes the ability to include stakeholders in the entrepreneurial process and to take into account different perspectives on social, economic and environmental problems. *Interpersonal acting* allows learners to motivate others and to informally lead collaborative interactions. Finally, *taking action and strategic management* supports active participation in responsible actions along with the ability to design projects and advance interventions in terms of sustainability-oriented practices [58, 59].

Sustainable Entrepreneurship Education is only weakly anchored in German high schools'

curricula [60, 61]. However, the sustainability perspective seems to support a better standing of Entrepreneurship Education in schools and is therefore a promising approach to foster entrepreneurial thinking and acting in economics lessons [60].

#### **4. A digital Educational Escape Room for teaching Sustainable Entrepreneurship in German High schools – a case study**

This chapter introduces the design and the possibilities of validating a digital Educational Escape Room for Sustainable Entrepreneurship Education in schools. In the first part, competency areas of digital education as well as Sustainable Entrepreneurship Education in combination are discussed, which are promoted by the use of a digital Educational Escape Room. Then, the various elements of a digital Educational Escape Room for Sustainable Entrepreneurship Education in schools are presented. The second part shows a design for validating the digital Educational Escape Room.

##### **4.1 Designing a digital Educational Escape Room for teaching Sustainable Entrepreneurship Education**

The goal of the designed digital Educational Escape Room in Sustainable Entrepreneurship Education is that students should acquire competencies and skills both in digital education [10, 14, → chapter 2] and Sustainable Entrepreneurship Education [58, 59, → chapter 3]. The competencies that can be fostered are explained in this chapter. In addition, the key components of the design of the digital Educational Escape Room based on the star model [13, → Chapter 2] are outlined.

###### *Learning process and outcomes*

The focus of Sustainable Entrepreneurship Education classes are students of the 10<sup>th</sup> grade. In the following case, students work in groups of three and do not need to have prior knowledge of Sustainable Entrepreneurship or special technical skills to use the digital Educational Escape Room. Therefore, playing the digital Educational Escape

Room is suitable as an introduction to the subject of Sustainable Entrepreneurship. The processing time is approx. 130 minutes (about three lessons).

The selection of the following competencies is based on the students' promotion to participate actively in a society influenced by digitization [9, 10, → chapter 2.1] as well as fostering their sustainopreneurial intention [51, 52 → chapter 3].

Therefore, playing this digital Educational Escape Room supports the acquisition of the following competencies:

1. *Systemic thinking*: Students are able to identify, analyze and combine the different domains of SE. Breaking through linear ways of thinking might be crucial to emphasize one's subjective beliefs and norms. Thus, systemic thinking has a pertinent impact on sustainopreneurial intentions [51, 58, 62].
2. *Searching and processing*: The ability to search and process can be seen as information literacy, which is a fundamental competence for participating in the digital world. This is promoted by using a digital Educational Escape Room [7]. Students are able to research, filter and evaluate data, information and digital content.
3. *Communication and interpersonal acting*: Students are able to interact and cooperate. Active participation in heterogeneous groups promotes the students' confidence in their abilities and competencies to act and think in a sustainopreneurial way (self-efficacy) and enhances their empathy [52, 53]. It also enables them to reflect on their interaction with social groups [63]. In addition, students are able to interact through digital media and to share information and data [7, 10].
4. *Problem solving*: The goal of a digital Escape Room is to improve the competency of problem solving with digital media and tools [27]. By playing a digital Educational Escape Room, students are enabled to learn, work, and solve problems creatively in the domain of Sustainable Entrepreneurship.
5. *Analyze and reflect*: Dealing with a digital Educational Escape Room in Sustainable Entrepreneurship Education is linked to a subsequent reflection. Analyzing and reflecting the learning process should enable students to better understand and

reflect the contents of Sustainable Entrepreneurship as well as a meaningful use of digital media and tools [7, 8, 10].

### *The structure of the game and the equipment*

The main requirement for playing the digital Educational Escape Room are tablets, computers or mobile phones with internet access. The digital Educational Escape Room has been created by the E-Book generator [www.bookcreator.com](http://www.bookcreator.com) [33]. E-books enable an appealing design. Texts, pictures, audio and video files and links to different quizzes can easily be embedded. A disadvantage of this tool is that it does not always correspond to the character of Escape Rooms, as puzzles can be skipped.

Based on a frame story, for every topic of Sustainable Entrepreneurship a specific E-Book page is designed and different puzzles are inserted (Figure 1). By solving a puzzle, a code is obtained, that enables the students to go to the following topic or chapter.



**Figure 1:** Creating an E-Book

As support, the students receive an analogue worksheet on which they can write down their notes and record the codes. In addition, the teachers are provided with a handout including a sample solution for processing the digital Educational Escape Room and recommendations that include the systematic reflection of the contents of Sustainable Entrepreneurship and the game.

### *The story – ‘Granny’s secret about the future of entrepreneurship’*

At the beginning of a digital Educational Escape Room, a frame story is told that introduces the importance of solving several puzzles.

Enclosed is the frame story of the created digital Educational Escape Room in Sustainable Entrepreneurship Education:

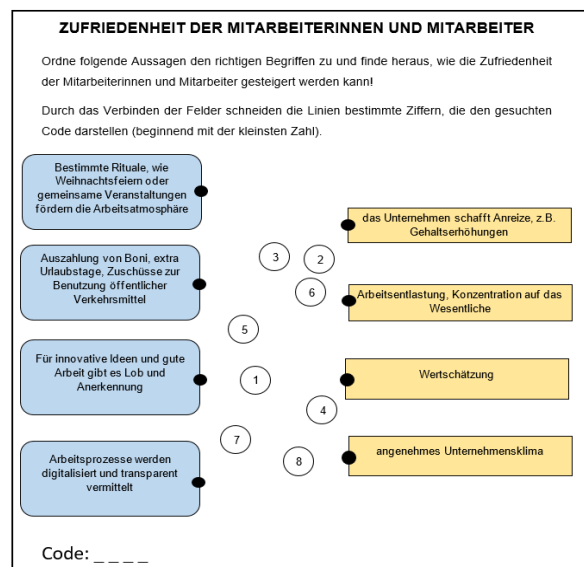
### *Granny’s secret about the future of entrepreneurship*

*Chiara and Florian want to found a start-up, but they do not know where and how to begin. Their grandmother is their role model, as she worked as a successful entrepreneur for decades. Unfortunately, she passed away a few years ago, so they can no longer consult her. However, Florian remembers that she talked a lot about taking greater account of sustainability in the field of entrepreneurship as the world was changing rapidly. Their grandmother wrote down her thoughts on this topic in a notebook that is stored in a safe. Chiara and Florian are keen to know how sustainable entrepreneurship can work, so they want to rely on their grandmother’s knowledge. However, they do not know the code of the safe...*

### *The puzzles*

The creation of puzzles that can be integrated in digital Educational Escape Room ranges from the use of text processing programs to web-based puzzle generators.

PDF and text files can be encrypted with passwords. To decrypt the files, the students need the codes from the puzzles. One possibility to find out a code is to combine questions/claims and answers via several hints [64] (Figure 2).



**Figure 2:** Matching Puzzle about employee satisfaction



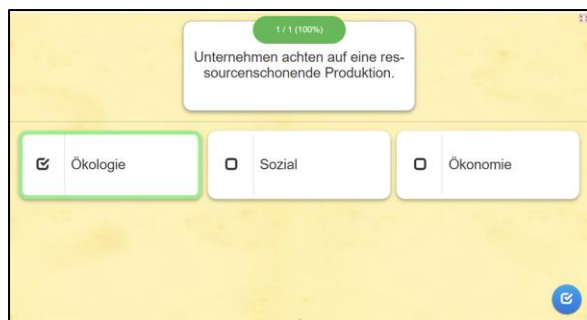
Web-based puzzles have the advantage that functioning puzzle generators already exist on the internet. Here, the quizzes had been designed using the tool [www.learningsnacks.de](http://www.learningsnacks.de). It has a question-answer format in a messenger style [31], which is motivating for the students' learning process due to its reference to everyday life.

This tool is suitable for asking specific questions about the content of an informative text, a video or a podcast and thus for playfully consolidating knowledge of the content (Figure 3). Once all the questions have been answered correctly, students will be given a code for the next puzzle.



**Figure 3:** Learning Snack about the content of a newspaper article

Another tool for creating puzzles in a single or multiple choice had been utilized which is called [learningapp.org](http://learningapp.org) (Figure 4). Here, several interactive learning modules can be used to create a digital learning environment [31].



**Figure 4:** Single Choice Puzzle concerning the three dimensions of sustainability

Memories, crossword puzzles, drag-and-drop questions, as well as cloze texts are also among the types of puzzles that motivate students in their learning process. To create all of these, tools on

the website [puzzle.org](http://puzzle.org) had been used here and integrated in the digital Educational Escape Room.

## 4.2 Validating the digital educational Escape Room in Sustainable Entrepreneurship Education

To validate the effects of playing a digital Educational Escape Room in Sustainable Entrepreneurship Education, we involve students from economics classes of the 10<sup>th</sup> grade secondary school that participate in a qualitative evaluation study in at least two research cycles.

A self-reflection learning diary [65] is used as a survey instrument for assessing the promotion of the five competencies mentioned in chapter 4.1. The students are supposed to answer and reflect on several questions that are based on thematic categories.

The following sections will briefly explain how the reflection questions had been derived. The five competencies described in chapter 4.1 can be further explained and assessed by defining learning objectives. Learning goals define a state in which learners should find themselves at the end of a school lesson in terms of their knowledge and skills. Therefore, learning goals are considered the most relevant benchmark for assessing the learning process [66, 67]

To determine a taxonomy of assessing the learning process, reference is made to the Taxonomy for Learning, Teaching, and Assessing [68, 69]. This taxonomy is directly and indirectly used in different competency models, e.g. for Digital Education in Dig.Comp 2.2 [16], for Entrepreneurship Education in EntreComp [70] or for Education for Sustainable Development in the Orientation Framework for the learning field of Global Development within Education for Sustainable Development [71]. Therefore, the taxonomy is rated as being a suitable instrument for assessing the learning process after playing a digital Educational Escape Room in Sustainable Entrepreneurship Education. This taxonomy distinguishes between three different levels of cognitive activation and learner autonomy: Level one: Foundation (knowledge generation: learners are able to remember, discover and explore certain content as well as to gather and to process (digital) information) [16, 70, 71]. Level two: Intermediate (transfer of knowledge: learners are able to apply certain content, to experiment as well as to change their perspectives) [16, 70, 71]. Finally, level three: Advanced (reflecting and creating solution

approaches: learners are able to apply and evaluate certain contents as well as to create new solutions, to improve and to reflect their own and others' ideas. Therefore they participate

proactively in problem-solving processes) [16, 70, 71].

Table 1 shows a taxonomy of achieving the learning goals in playing a digital Educational

Competencies (→ Chapter 4.1)	Learning goals	Level of achievement of learning goals
Systemic thinking	Students are able to name the different domains of Sustainable Entrepreneurship with digital media	Foundation
	Students are able to identify and analyze the different domains of Sustainable Entrepreneurship with digital media	Intermediate
	Students are able to identify, analyze and combine the different domains of Sustainable Entrepreneurship with digital media	Advanced
Searching and Processing	Students are able to research data, information and digital content concerning Sustainable Entrepreneurship	Foundation
	Students are able to research and filter data, information and digital content concerning Sustainable Entrepreneurship	Intermediate
	Students are able to research, filter and evaluate data, information and digital content concerning Sustainable Entrepreneurship	Advanced
Communication and interpersonal acting	Students are able to interact with social groups through digital media and to share information and data concerning Sustainable Entrepreneurship	Foundation
	Students are able to interact and cooperate with social groups through digital media and to share information and data concerning Sustainable Entrepreneurship	Intermediate
	Students are able to interact and cooperate with social groups through digital media and to share information and data concerning Sustainable Entrepreneurship. They are able to reflect on their interactions in social groups as well as with digital media	Advanced
Problem solving	Students are able to name and describe problems in the domain of Sustainable Entrepreneurship with digital media	Foundation
	Students are able to describe and analyze problems in the domain of Sustainable Entrepreneurship with digital media	Intermediate
	Students are able to describe, analyze and solve problems creatively in the domain of Sustainable Entrepreneurship with digital media	Advanced
Analyze and reflect	Students are able to describe the contents of Sustainable Entrepreneurship as well as the meaningful use of digital media and tools	Foundation
	Students are able to describe and analyze the contents of Sustainable Entrepreneurship as well as the meaningful use of digital media and tools	Intermediate
	Students are able to describe, analyze and to reflect the contents of Sustainable Entrepreneurship as well as the meaningful use of digital media and tools	Advanced

**Table 1:** Taxonomy of achieving the learning goals in playing a digital Educational Escape Room in Sustainable Entrepreneurship Education



Escape Room in Sustainable Entrepreneurship Education. Here, learning goals that are based on the acquisition of the different competencies described in chapter 4.1 are derived and graded according to the respective level of achievement.

Based on the taxonomy shown in Table 1, the following questions are asked in the students' learning diary for self-reflection:

*Category - Systemic thinking*

Q1: Name and explain the three dimensions of sustainability.

Q2: Explain the term entrepreneurship.

Q3: Reflect on what extent sustainability and entrepreneurship go together.

Q4: Characterize a sustainable business and a sustainable entrepreneur.

*Category – Searching and processing*

Q5: Explain how you dealt with digital information and data while playing the game.

Q6: Explain how you evaluated digital information and data while playing the game.

Q7: Have there been any difficulties in dealing and evaluating digital information and data? If so, explain them.

*Category – Communication and interpersonal acting*

Q8: Reflect on your communication and cooperation with your group members while playing the game!

Q8.1: How did you communicate and cooperate with the other group members?

Q8.2: What went well?

Q8.3: Where do you identify a need for improving communication and cooperation?

Q8.4: Describe your own interactions during the game and reflect on them.

*Category – Problem solving*

Q11: Name and describe issues in the field of Sustainable Entrepreneurship that were addressed in the digital Escape Room.

Q12: Compare at least two of these issues.

Q13: Explain in what way you would solve such issues.

*Category – Analyze and reflect*

Q13: Explain in what way playing the digital Escape Room helped you to understand Sustainable Entrepreneurship!

Q13: Name parts of the field of Sustainable Entrepreneurship you perhaps did not understand and explain why.

Q14: Explain further needs of improvement concerning the creation of a digital Escape Room in the field of Sustainable Entrepreneurship.

In the first research cycle, the questions from the self-reflection learning diary are validated with the Think Aloud method. One group of three to four students from 10<sup>th</sup> grade secondary school plays the digital Educational Escape Room. Afterwards, the students answer and reflect on the questions from the learning diary. They answer the questions by reporting their thoughts and feelings. Researchers take notes during this evaluation through participant evaluation or in a video analysis [72]. Thus, it is evaluated whether the questions are understood well or if there is a need to adjust them. This research cycle repeats until there is no further complaint by students on the content of the questions.

In the second and final research cycle, the digital Educational Escape Room is played by at least 30 students. Afterwards, students answer and reflect on the questions from the learning diary. As answering the questions takes some time, the students get three days to hand in their self-reflection learning diary. The different answers from the students' self-reflection learning diary are then analyzed with the qualitative content analysis [73]. For this purpose, the MAXQDA program is used as an analysis software. All the text passages will be analyzed (coded) according to the taxonomy in Table 1. To minimize misrepresentations, at least two different people analyze the same text passages. The coding process is based on super categories (the five competencies from Chapter 4.1) and their associated subcategories (learning goals and their gradation from Table 1). This process enables the determination of the level of achievement of the learning goals [73, 74]. In a next step, the coded text passages are compared to each other, and it is analyzed to what extent students have achieved the learning goals in playing a digital Educational Escape Room in Sustainable Entrepreneurship Education.

## 5. Limitations and outlook

The ideas for a digital Educational Escape Room in Sustainable Entrepreneurship Education in German High Schools are based on the theoretical background of digital education and gamification as well as Sustainable Entrepreneurship and Sustainable

Entrepreneurship Education. There has not been any research for these domains in combination, yet. The research project presented in chapter 4 shows first findings for designing and creating a digital Educational Escape Room in Sustainable Entrepreneurship Education and the promotion of related competencies. Nevertheless, several considerations and limitations follow this conceptualization:

First, the effectiveness of the different puzzles needs to be validated with reference to the competency acquisition in digital education and Sustainable Entrepreneurship Education. A possible way to validate the digital Educational Escape Room is listed in chapter 4.2. Based on the results obtained from the validation process, the effectiveness of gamification in the field of economic education can be derived. In this context, it is also of interest whether further competencies in digital education (e.g. *produce and present*) or Sustainable Entrepreneurship Education (e.g. *foresighted thinking*) can be fostered by designing and creating a digital Educational Escape Room or the creation of scenario puzzles.

Second, due to the digital format of the economics lessons, different teaching methods should be considered. For example, the flipped classroom model could be of interest here.

Third, it may be possible to integrate additional competitive elements that underline the gamification approach (→ Chapter 2.2). This can be realized by awarding points or a pre-determined speed limit to solving puzzles.

The fourth point to note is that the e-book creator has limitations in creating a digital Educational Escape Room. Thus, the use of alternative tools, such as Google Forms or Genial.ly, should be tested.

Fifth, in order to broaden the toolbox of educational escape rooms, hybrid and/ or blended media could be considered (for an overview cf. Wiepcke 2006 [75]).

Furthermore, there is the question of a possible increase to the immersion level. The combination of virtual reality with Educational Escape Rooms could be a promising field for further research.

Finally, existing providers may be consulted for further idea generation of possible puzzles and to find out whether there are questions for creating digital Educational Escape Room as well as for visualization.

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