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Adapting to climate change through play? Didactically effective elements of a business simulation game

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Introduction: The negative consequences of climate change are widespread and have a global impact. An industrialized region of Germany must adapt to the effects of climate change and comply with political regulations. Previous studies indicate that economic actors who are not directly affected by climate change approach climate change mitigation and adaptation primarily based on legal requirements and often feel discouraged by the absence of data-based reports. Addressing this challenge, game-based learning emerges as a promising pathway.

Methods: To examine game-based learning's applicability and potential for climate adaptation, we developed a business simulation game, simultaneously identifying didactically effective elements for managers who would participate in it. Using expert interviews and focus groups, we conducted a qualitative study with three HR developers from larger companies and nine managers and founders of startups to develop a business simulation game on climate adaptation. Based on the Grounded Theory methodology, theoretical coding was used to analyze the qualitative data.

Results: The derived core categories indicate that personnel development in companies is evolving in response to economic changes. Individual resources such as motivation (especially for managers), personnel and time play a crucial role in establishing a business game as an educational offering. The identified game elements can also be used theoretically and practically in the development of other educational games.

Discussion: We discussed common human resource development measures in companies and compared them with more innovative approaches such as a simulation game. The study underscores the importance of innovative approaches, such as game-based learning, in fostering climate adaptation efforts among economic actors. By integrating theoretical insights with practical applications, our findings provide valuable guidance for the development of educational games aimed at addressing complex challenges like climate change. Further research and implementation of such approaches are essential for promoting proactive climate adaptation strategies within industrialized regions and beyond.

KEYWORDS

climate adaptation, game-based learning, serious game, human resource development, business game, corporate social responsibility

1 Introduction

The recent climate reports from the Intergovernmental Panel on Climate Change indicate that climate change is progressing (IPCC, 2022). Economic actors contribute to greenhouse gas emissions through high energy and resource consumption, complex production processes, and global distribution of goods. Various concepts influence how companies approach climate change, including a sense of responsibility, managerial attitude, and shared values. Within organizations, managers often prove to be key functions or change agents (Lines and Vardireddy, 2017) to constructively deal with climate change and the necessary change processes (Linnenlücke et al., 2013; Fischer et al., 2018). In addition to acting as role models and providing resources, they are also responsible for promoting shared perception, cohesion and motivation, establishing visions and values and addressing social issues. Furthermore, managers are responsible for initiating change, developing work processes, motivating employees by setting goals, and acting as cooperation partners. Since sensitive and interdisciplinary climate communication can increase acceptance (Madani et al., 2017; Lewandowsky, 2021) among stakeholders (e.g., managers), didactic approaches are needed that go beyond the conventional numerous reports, which are often also perceived as ambiguous and confusing (Rivera and Clement, 2019). This can be achieved through game-based learning (GBL) and a serious game such as a business simulation, which provides a constructive approach (Bado, 2019), rendering complex and sociopolitically relevant learning content (Flood et al., 2018).

Integrating GBL offers several advantages, including promoting active learning and learner autonomy, as well as integrating non-disciplinary knowledge in GBL environments (D'Aprile et al., 2015; Denham et al., 2016; Flood et al., 2018). The number of climate education games has been increasing rapidly for years (Neset et al., 2020), and there is a wide range of climate games that can be classified as serious games, i.e., games that provide education in dealing with real-world problems (Crookall, 2010; Reckien and Eisenack, 2013). In most cases, three aspects are addressed: (a) teaching the basics of climate change and the interrelationships, (b) raising awareness of how to deal constructively with the present and future challenges of climate change, and (c) developing concrete strategies and solutions (Reckien and Eisenack, 2013).

Educational games are increasingly used and tested in formal educational institutions such as schools and universities (Greipl et al., 2020; Pan et al., 2021). Lamb et al. (2018) found that GBL is generally regarded positively by teachers who use it in their lessons. It is anticipated that behavioral changes and learning outcomes will be positively influenced, as described by Neset et al. (2020). Lee et al. (2013) examined a management game designed to educate individuals about climate change and motivate them to act. Their formative assessment indicates that the game is rated as exciting by users and encourages the communication of the topic positively. While the findings suggest that the game can encourage players to think about the challenges associated with climate adaptation decision making, they also indicate the challenge of incorporating a high degree of complexity that can make it difficult to grasp the consequences of individual actions and link them to the impact of climate change (Lee et al., 2013). Gatti et al. (2019) also investigated the learning experiences of students with a serious game on sustainable development. Both questionnaires indicated that the GBL approach positively affected cognitive and affective learning outcomes, with participant motivation proving central to learning success. The authors noted a positive correlation between motivation, interest, acquired knowledge, and attitudes. These findings align with those of Rumore et al. (2016), who consider educational games in sustainability profound educational tools that foster decision-making and discussion among target groups. Here, games provide an expansive, interactive platform for target groups to explore the complexities and consequences of climate change and identify opportunities and risks for adaptation concepts (Flood et al., 2018; Neset et al., 2020).

To effectively develop a game and address the relevant learning objectives, alongside specific content, the individual knowledge, needs, and contextual constraints of the target group should be considered (Ouariachi et al., 2017; Lukosch et al., 2018; Neset et al., 2020). The systematic review by Flood et al. (2018) suggests that the success of serios games for climate adaptation requires a high level of trust between researchers, developers and participants. The authors mention game elements such as briefing and debriefing in addition to implementation by experienced moderators are crucial for facilitating a sustainable transfer of learning.

In the strongly industrialized Bavarian region of Main-Franconia, average warming rates are already higher than the national average (Fischer et al., 2022). Since the goal of our research project is to educate company managers from this region about climate adaptation and climate mitigation, including this target group in the game development might be important. In this contribution, we present the findings of a qualitative study that includes expert interviews and focus groups with three HR developers from large companies as well as nine managers and founders of start-ups. The results of this study present specific game elements that managers consider effective for a simulation game on climate change. These elements were then specifically included in the accompanying game development. However, this article focuses on the specific game elements identified. With our study, we aim to accomplish the following objectives: (a) comparison of general and innovative measures for personnel development in companies through a simulation game, (b) identification of single elements that are considered educationally valuable by managers, (c) accompanying development of a simulation game, the didactic effectiveness of which is to be investigated in a follow-up study.

Thus, the research question arises: *Which didactic and contextual elements are effective for a simulation game on climate adaptation from the perspective of managers?* By directly involving the target group, generalizable insights can be gained for managers, positively impacting the suitability of educational offerings. Within this framework, we combine both theoretical and practical dimensions, providing a fundamental reference point for further research projects and valuable practical considerations for professionals involved in designing games and promoting climate awareness.

This article is structured as follows: Section 1 provides the introduction, Section 2 outlines selected theoretical and empirical findings related to GBL, Section 3 describes the methodological approach using expert interviews and focus groups, Section 4 presents an overview of expert interview results using a table with core and sub-categories, Section 5 provides answers to the research question through a comparison of empirical results with theoretical constructs, and finally, Section 6 discusses study limitations and implications for further research, particularly regarding a game evaluation.

2 Theoretical framework

2.1 Enhancing climate adaptation awareness through games

The origins of play lie in human development and experience (from childhood onwards) and specifically address the five components of pleasure, meaning, engagement, repetition and social interaction (Kaimara et al., 2021). In games, complex issues from the real world can be simulated and players can learn interactively by trying them out, discussing them and making decisions, usually with direct feedback (Lukosch et al., 2018). Terms like game, game-based learning, simulation and simulation game are often used interchangeably in discourse (Crookall, 2010). Although there are no uniform definitions, a distinction is often made between serious games, board games and business simulations. Serious games are usually digitally designed for a variety of purposes (Flood et al., 2018; Neset et al., 2020). They are designed to convey certain learning content in an entertaining way (Crookall, 2010). Board games are usually analog games with tangible materials that serve a recreational or educational purpose. (Business) simulation games serve to convey business and corporate principles. Players are immersed in a fictional simulation and gain new perspectives in the process. Our paper focuses on games with specific learning objectives that are based on real-life (professional) situations, also known as educational games (Pan et al., 2021). An educational game, such as a serious (simulation) game, provides an interactive learning environment in which participants can improve their engagement, motivation, and reflection skills (Huang et al., 2022). Therefore, we consider the term 'serious games" as the overarching category that encompasses games with serious learning objectives. A 'business game", on the other hand, is a subcategory for us that deals specifically with the context of companies and everyday business scenarios. We therefore use both terms synonymously in the following.

Because of the high degree of freedom and experimentation, there might be a great potential in educational games (Flood et al., 2018; Neset et al., 2020; Kaimara et al., 2021). Educating climate change through a serious game, might be a promising approach to increase sustainability behavior and thinking (Ouariachi et al., 2017; Neset et al., 2020; Douglas and Bräuer, 2021). Therefore, games and GBL approaches are increasingly being used to promote climate awareness and adaptation (Polys et al., 2017; Flood et al., 2018; Neset et al., 2020). Reckien and Eisenack (2013) classify the broad spectrum of climate-related games as serious games, meaning that these games focus on conveying information and knowledge to target groups in an entertaining way and include educational activities and instructions to promote skills and learning. The pilot study by Lee et al. (2013), examines a simulation game, which aims to educate people about climate change and motivate them to act. The formative assessment of 26 participants indicates that the game is rated as exciting by users and encourages the communication of the topic positively. While the findings suggest that the game can encourage players to think about the challenges associated with climate adaptation decision making, they also indicate the challenge of incorporating a high degree of complexity that can make it difficult to grasp the consequences of individual actions and link them to the impact of climate change.

Basically, learning success is influenced by the setting and the didactic design of learning content (Flood et al., 2018). Since games require the participants to play fictitious roles and to actively deal with fictitious events, the acceptance of a game and the experienced emotions play a relevant role for the learning success (Alklind Taylor, 2014). To experience emotions and to really get the positive effect (see Sousa and Rocha, 2019) of GBL or games, participants, e.g., managers, have to get involved in the playful context outside their serious everyday business environment. This condition may prove to be challenging, as adults possibly do not embrace these forms of education as easily as, for example, groups of students (see Chung et al., 2019). As Abbott (2019) underline, in the development of emotions and game atmosphere, the facilitator also has a significant influence on the effectiveness of a (business) game. Further, some actors may question the relevance of a simulation game in the context of climate adaptation. They may have preconceived notions that traditional learning methods are more effective or that a GBL approach lacks practical applicability. Furthermore, an offer should maintain a high level of continuity. Learning content should be transferred to the real world, modified, and improved. If a simulation game is only offered once, the in-depth reflection process may not be possible. Further, knowledge gained is not being consolidated or preserved and is not being implemented in daily work. Ideally, simulation games should be used alongside other workshops to foster reflection ("looking back"), which is crucial for long-term learning (Helyer, 2015).

As seen from the brief overview, studies are already integrating games into climate education to prepare different target groups, mainly young adults and political actors, to think and act sustainably in complex climate change contexts. In this context, it should also be noted that pupils or students are currently the target group for (climate) games. It is possible that this expression refers to the fact that educational institutions provide students time and space to try out new educational methods. In view of the different learning prerequisites and abilities, the need to individually derive elements of a climate adaptation game that promote and inhibit learning becomes clear.

2.2 Comprehensive overview of the developed game MainKassandra

The prototype version of the game MainKassandra was developed within a research project based on literature, previous expert interviews and questionnaires (Fischer et al., 2022, 2024), and has three objectives: (a) motivate players to communicate what they have learned about climate change and apply it to their business practices, (b) empower players to develop their own customized adaptation concepts within the company and become aware of what needs to be done, and (c) acquire a contextual understanding, connections and core concepts on climate change (Fischer and Schmitt, 2023). We refer to MainKassandra as a serious (simulation) game. By this we mean a structured offer in which players are confronted with managerial decisions and discussions based on real work situations. Here, we rely on Ahmed and Sutton (2017), which characterize serious games as games that have an educational purpose, are more than just a storyline and entertainment, but contain educational approaches to promote learning, the development of knowledge and skills. Accordingly, the educational purpose is subordinate to the entertainment purpose.

MainKassandra intends to strengthen players motivation for the topics of climate change and adaptation and make them tangible using a fictitious company. In addition, the participants are enabled to develop their own adaptation concepts within the company and

to understand the interrelationships, interactions and basic concepts of climate change. No prior climate knowledge or specialist knowledge is required to play the game. MainKassandra is played with 9 to 24 players, who play the game over a period of up to a whole working day with a game moderator who is familiar with the game logic, the rules of the game and the other framework conditions. The target group are German-speaking companies that download the game material (free of charge) and use it as part of a workshop. Extensive materials were developed for the game, such as an accompanying presentation, a digital catalog in which the players can select 80 different measures for climate protection and adaptation and various cards (e.g., company cards, role cards, quiz cards). Figure 1 provides an insight into the design of the cards.

Teams of three to four people each choose one of the fictitious companies located in the fictitious game region of MainKassandra, which is affected by climate change. In this game environment, the local companies have to protect themselves from extreme weather conditions. Here, players form teams and take on specific roles within their companies. There are at least three rounds in the game (Framing, Collaboration, Reshape), each with a different focus, but all with the same goal: to develop a strategy concept that protects the groups' fictitious companies from the negative consequences of climate change through a catalog of climate adaptation and mitigation measures. Related interim presentations in plenary sessions serve to deepen and synthesize the knowledge acquired. In the game, companies are successful if they achieve high scores for their individual focus indicators, which correspond to a high degree of maturity. At the end of the game, there is a debriefing session to discuss how the knowledge can be applied in the (real) daily working environment.

MainKassandra was prototyped before the expert interviews and focus groups and briefly presented to the participants during the study to give them the opportunity to provide feedback and identify

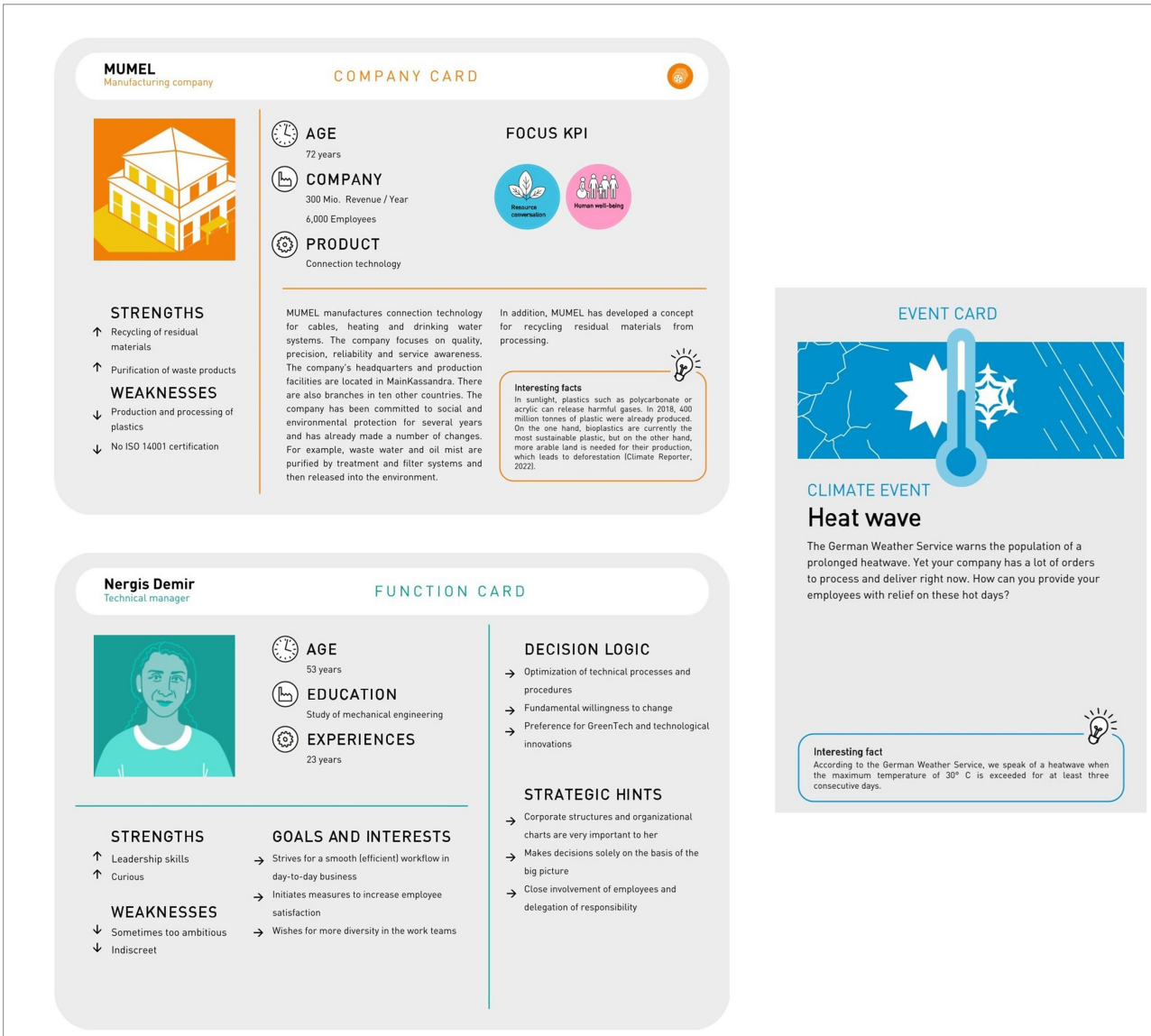

FIGURE 1
Selection of the cards of the business simulation game. The business simulation game includes an accompanying presentation and manual, an interactive catalog of measures and a booklet with game materials. The excerpt shows a company card (7 in total), a character card (12 in total) and an event card (27 in total). The game and its materials are published in German by Fischer and Schmitt (2023).

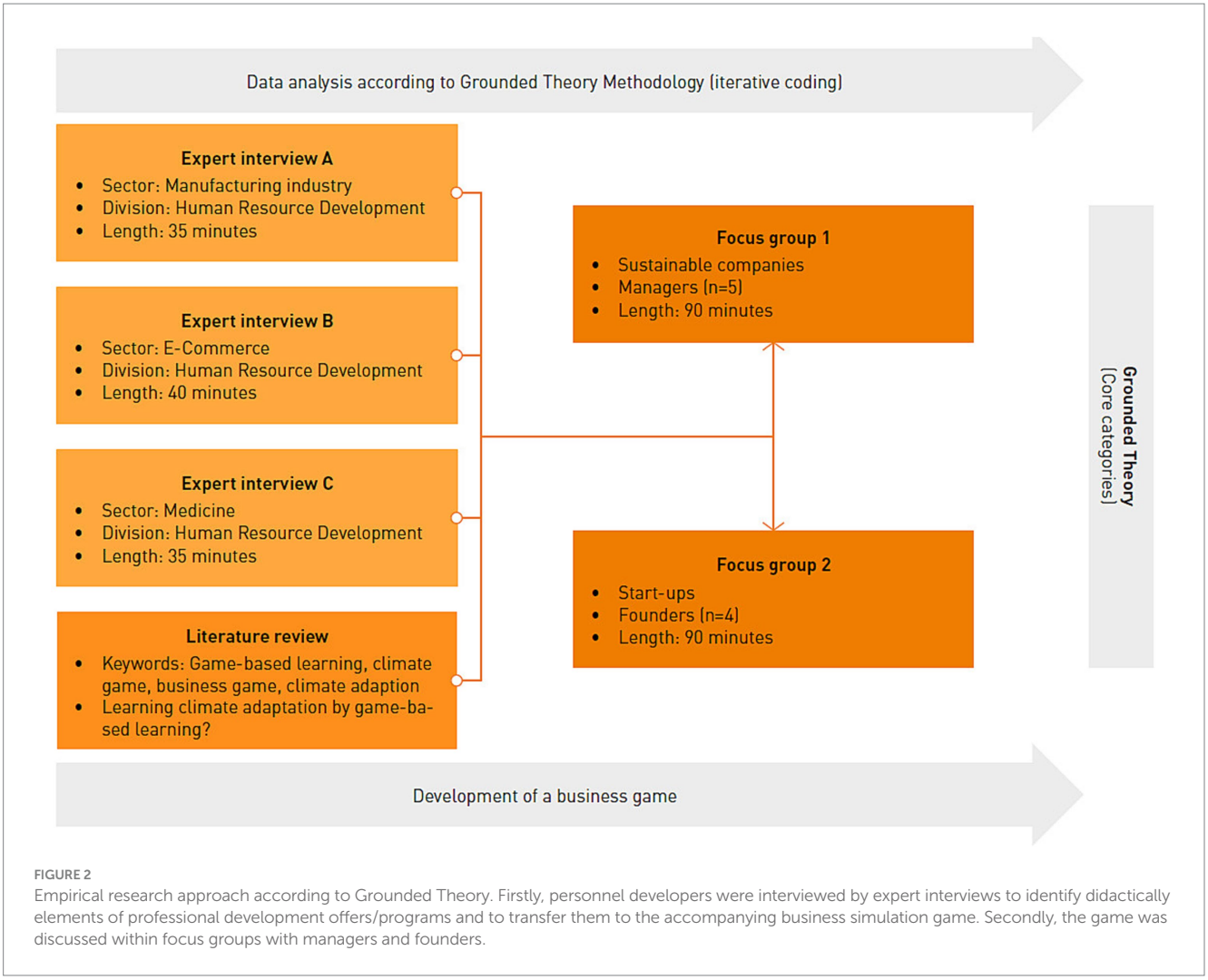

FIGURE 2
Empirical research approach according to Grounded Theory. Firstly, personnel developers were interviewed by expert interviews to identify didactically elements of professional development offers/programs and to transfer them to the accompanying business simulation game. Secondly, the game was discussed within focus groups with managers and founders.

elements that they felt were didactically effective. The focus of this study is therefore on the elements mentioned by the managers, which were subsequently integrated into the game development.

3 Methods

Following the Grounded Theory methodology, we analyzed specific game elements that are considered didactically effective or rather less effective by the interviewees. In addition, we wanted to contrast innovative approaches to personnel development, such as the simulation game on climate adaptation, with classic further development approaches in companies. We have therefore chosen a two-stage qualitative research approach, see Figure 2.

First, Human Resource Development (HRD) experts were interviewed about the establishment of professional development programs in their companies, the processes involved and internal attitudes toward innovative approaches such as management games. Specifically, the context of HRD in general and innovative approaches (such as GBL) were analyzed. The managers and founders were then asked in focus groups about their experiences with further development programs and their perception of management games. In addition, the participants were asked about didactically relevant game elements. With our two-stage empirical approach (expert interviews and focus groups), we want to compare theoretical concepts (e.g., from HRD) and practice, i.e., how the target group deals with personnel development programs. Here, we consider that in companies, personnel development departments typically oversee the initiation, development, and evaluation of training programs. Conversely, managers and employees are the intended audience for these programs.

3.1 Expert interviews

Qualitative interviews are characterized by a high degree of openness toward the state of research and are flexible instruments of data collection for the reconstruction of a specific phenomenon (Reinders et al., 2015). Therefore, three semi-structured expert interviews were conducted with HR developers from two large companies and one company from the healthcare sector in a Bavarian region in Germany to discuss both general and innovative HRD

TABLE 1 Demographic data of the HRD experts.

Features	Frequency
Sex	
Female	1
Male	2
Sector	
Manufacturing industry	2
Medical	1
Size	
Large enterprises	3

instruments, see Table 1. For the expert interviews, we selected large German companies that had to meet two sampling criteria: an established HRD program and existing sustainability strategies. With this sample, we wanted to find out to what extent HR developers who already provide innovative learning programs for their employees and have many resources (financial, personnel) react to changing learning conditions and the individual needs of their employees. These companies were also asked to use their experience to determine whether a business simulation could be a suitable learning tool. As part of our research project, we established contacts with key trade associations, enabling the selection of two well-known global manufacturing companies that are known for their sustainable practices, such as their recognition for implementing the esteemed EMAS environmental management system. Also, a very experienced employee of the personnel development department of a supramaximal care hospital was contacted. As this hospital has its own academy for personnel development, this person was also interviewed.

The three semi-structured interviews lasting an average of 35 min were conducted, recorded and transcribed according to standard orthography and theoretically coded on the basis of Grounded Theory (Strauss and Corbin, 1999). The semi-structured guide covers the different phases of an interpersonal exchange, including the warm-up, main conversation and closing phases. First, contextual questions were asked that related to the general HRD approaches in the organizations. Subsequently, questions were asked about the objectives, function and development of managers as well as the evaluation and implementation of innovative HRD measures. The findings from the expert interviews with HR managers were also used to develop the interview guidelines for the focus groups.

3.2 Focus groups

Furthermore, we conducted focus groups to evaluate the business simulation prototype and to gather participants' opinions and experiences of professional development activities and innovative learning approaches such as a business simulation. A focus group is a structured qualitative survey approach. This guideline-based procedure promotes the comparability of the results and provides orientation for the specifically composed groups. Within the focus groups, the moderator is responsible for conducting the conversation and clarifying formal aspects (e.g., data protection and audio recording). The sample was chosen to be as heterogeneous as possible, and both groups do not correspond to real groups (Vogl, 2022). For example, they are not established company work teams.

TABLE 2 Demographic data of the managers and founders.

Features	Frequency
Sex	
Female	5
Male	4
Sector	
Manufacturing industry	3
IT-services	3
Product services	2
E-commerce	1
Function	
General manager	6
Division manager	3
Size	
Small and medium enterprises	7
Large enterprises	2

Demographic data of the five managers and four founders of start-ups (focus groups).

In an earlier study, an expert from the internationally renowned environmental management system EMAS explained that he recognizes a difference between established companies and start-ups in terms of sustainability. His observation was that younger companies are sustainable from the outset and that founders today often see themselves as social impact entrepreneurs who want to improve economic and social conditions (Fischer and Schmitt, 2022). Accordingly, the first focus group included managers from established companies that had already dealt with climate-related issues and were in some cases EMAS-certified. We selected managers from companies with established HRD resources for two reasons: first, managers represent the target group and learning agents of these HRD offerings and thus a comparison of theoretical objectives and practical applicability would be possible; second, managers were discussed as relevant drivers of climate adaptation (Meinel and Höferl, 2017; Fischer et al., 2022, 2024). The second focus group consisted of young self-employed people who were members of a regional trade association. Here, we included founders of start-ups, i.e., companies that are less than ten years old (Wiesenberg et al., 2020). These start-ups generally do not have extensive resources for personnel development but tend to be more open to innovative learning methods. The Table 2 provides more detailed information on the participants in the focus groups.

Both focus groups lasted 90 min on average, and in both sessions all participants contributed at a similar frequency. Transcripts were prepared and recorded after the recorded discussions.

3.3 Data analysis

All interviews and focus groups were conducted, recorded and transcribed between August and December 2022. The data was analyzed based on the Grounded Theory methodology of Glaser and Strauss (2017). This methodology is characterized by an iterative process of open, axial and selective coding as well as the interweaving of information between the individual coding steps.

In open coding, the transcript is broken down into meaning units (text segments), interpreted in terms of content and paraphrased with the help of codes. These codes are numbered and documented in a table with the respective reference (the lines). In this process, the *in-vivo-codes* identify literal, expressive quotations. Subsequently, subcategories or concepts are formed, which are also coded and documented. These subcategories summarize several codes and are defined even more precisely to answer the research question.

In axial coding, individual, conspicuous categories are placed on a horizontal axis and their original conditions, contexts, influences, i.e., consequences and strategies are examined. These so-called coding paradigms are created continuously across transcripts to illustrate the interrelationships and differences between all interviews. Then, successively, during the axial coding, a network of the different categories and codes is developed, which in turn relate to each other.

The most complex step, selective coding, abstracts central statements or a central theory that is relevant for answering the research question from the multitude of codes and categories. The aim is to organize the many categories and subcategories from all the interviews around a few core categories. The selected core categories, which are interlinked with all other categories, then represent the central phenomenon of the empirical study (Strauss and Corbin, 1999). As a result, all the codes and categories formed are condensed, dimensionalized, viewed and a dense network is formed around the core categories.

The Grounded Theory methodology is very data-oriented and requires a meticulous approach that follows scientific principles and rules. However, the multi-stage process of theoretical coding involves a high degree of individuality on the part of the researcher, so it is useful to provide coding examples. At this point, we refer to the publication by Fischer et al. (2022) and the provided coding example.

4 Results

Based on expert interviews and focus groups, we analyzed didactically effective elements of a simulation game on climate adaptation that are suitable for qualifying and sensitizing managers regarding climate adaptation. Here, two basic core categories were identified:

(a) Core category 1: "this is just another event, and you just sit through it"
(b) Core category 2: Pragmatism and transferability

The first core category deals with a widespread phenomenon in educational programs, namely that many opportunities are simply missed. Despite external changes and the associated changes in learning formats, the second core category already contains fundamental requirements for effective educational offerings: Learning opportunities should be pragmatically embedded in the learning context and geared toward the needs of the learners. In addition, the individual offerings must always be permanent and integrated into everyday working life. The two phenomena each relate to the current challenges or the context for learning formats in the respondents' environment. Apart from climate-related topics, these results are applicable to various other learning content as well.

Following the grounded theory method, the core categories we have identified form the result. They serve as central themes around which all codes and categories revolve or which are interconnected. The research interest can then be answered based on the explanation of the core categories formed. In the three coding steps of axial, open and selective coding, the transcripts were "broken up" (Glaser and Strauss, 2017) and an attempt was made to find indications of the research interest. A total of 511 codes, 128 categories and two core categories were derived. With each individual coding step, the individual data is further condensed and coded, which is why Figure 3 shows the extent to which the two derived core categories relate to their respective subcategories. In Figure 3, the modified coding paradigm based on Strauss and Corbin (1997) illustrates how the derived categories are related. Here, subcategories form themselves around the two core categories, which are assigned to the dimensions Context, Casual Conditions, Intervening Conditions, Strategies and Consequences. Using the model, we illustrate the factors that influence the core categories and the resulting action strategies and consequences. As shown in the figure, the +/− sign indicates a higher or lower level of expression. Subsequently, the central theories will be explained based on these categories.

In the Table 3, the core and subcategories are explained using specific interview examples and their characteristics and differences. The results of the study are now presented on the basis of these two core categories (CC1-CC2) and 10 subcategories (SC1-SC10).

4.1. Core category 1: "this is just another event, and you just sit through it"

4.1.1 Personnel development in the context of the organization

According to the first core category (CC1), the background, the initial situation, the resources, and the actors involved should first be considered. The interviews indicate that all companies have different prerequisites in terms of resources, learning actors and learning objects, which have an impact on the corresponding personnel portfolio (CC1) and the extent to which a measure is accompanied or monitored, evaluated, and consolidated in the long term (CC2). Additionally, each company has unique experiences in personnel development and varying capacities to utilize this knowledge for enhancing or adapting their personnel development portfolio.

The (didactic) success of a measure is therefore made up of the underlying learning portfolio (SC1), the learning support (SC2), the specific HR measure and its design (SC3) over the entire process (i.e., from initiation, implementation, support to evaluation, etc.) and the objectives set by the organization/managers and learners (SC4). The individual categories stand for individual effects and dimensions but are all closely interlinked.

4.1.2 Companies' resources for HRD

However, the focus should be more on the design of individual personnel portfolios (SC1), the format of training (e.g. within an

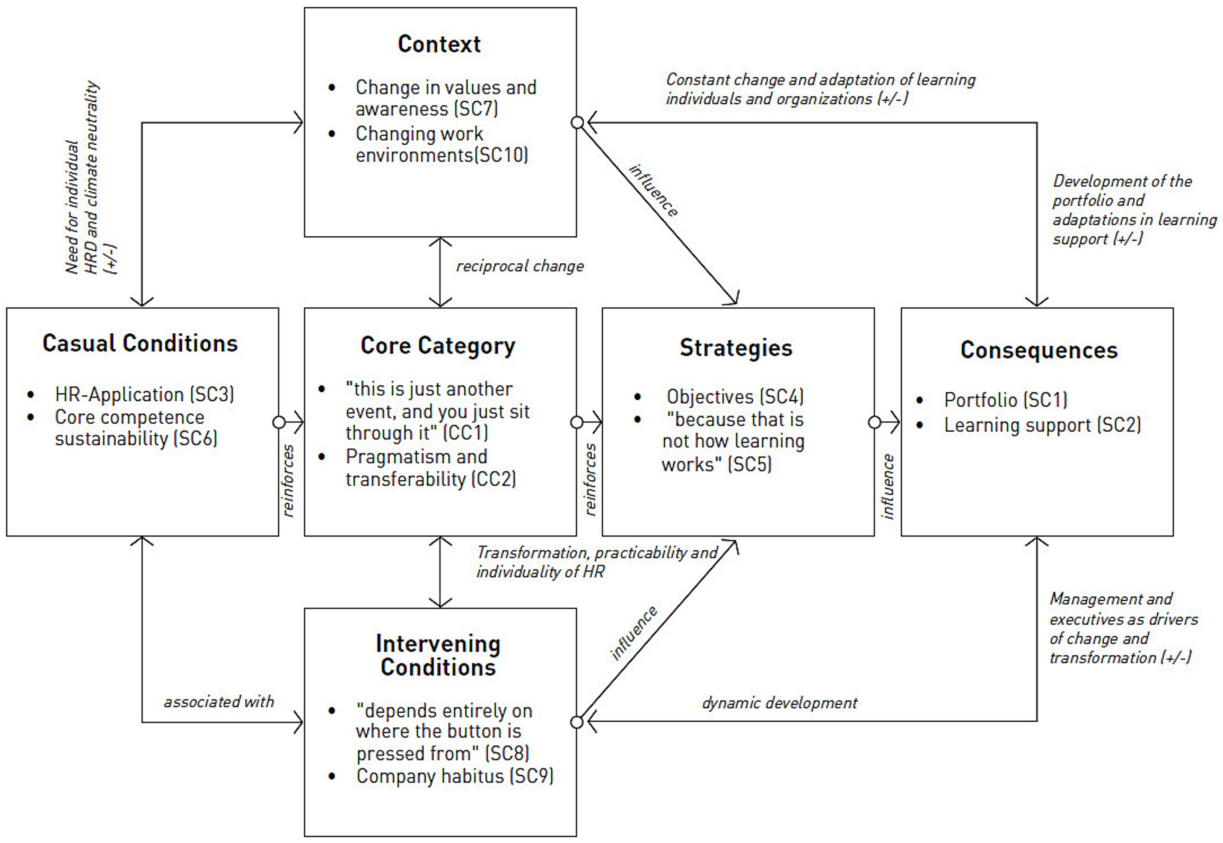

FIGURE 3
Coding paradigm with derived core and subcategories. The purpose of the surveys was to identify didactic elements for a business simulation game and to derive an empirically anchored Theory (Grounded Theory), which can be described by core categories (CC) and subcategories (SC). We modified a coding paradigm according to Dabestani et al. (2017) and Strauss and Corbin (1999).

academy, as seen in two companies), the involvement of both internal and external trainers (increasing neutrality or objectivity), resource allocation and utilization, and the degree of emphasis placed on staff development by management, as these factors are most likely to influence training outcomes. Interviewees agree that many mandatory measures or events are often presented without promoting actual learning processes (SC4). Therefore, the design of the individual HR portfolio (SC1), the format and delivery of the training (e.g. as part of an academy, experienced in two companies), the involvement of internal and external trainers (promoting neutrality or objectivity), the allocation and use of resources and the prioritization of HR development by management are important determinants of learning success.

4.1.3 Changing requirements for HRD measures

All interviews indicate that companies are undergoing change (SC7, SC10) and that the importance of HRD as a field of action for organizations has increased today. One interviewee considers it necessary to question "what personnel development can and cannot achieve" (Focus group 1, manufacturing company 1, line 76). He explains that a transformation process is taking place in his company and that the pyramid is to be turned upside down, toward less administration and more HRD. This so-called "new direction" is also confirmed by an interviewee who specifically describes how personnel development must be questioned (SC4) in order to be effective in the long term for both the organization and the individual: "What can I do and what are the economies of scale in the end" (Focus group 1, manufacturing company 2, line 407–408).

4.1.4 Sustainability of measures

The subcategory learning support (SC2) deals with the processes and dimensions involved that have an impact on the effectiveness of measures. This concerns the extent to which trainers are provided internally or by external providers or whether there are accompanying evaluations and opportunities for reflection. One interviewee reported a company-wide climate day (at global level) that was actively promoted by the management. However, there were no concrete consolidation processes to promote sustainable learning and employee participation at a deeper level:

> Recently, we held a Climate Action Day, which was declared by the management board and had to take place at the same time around the globe. More than 80,000 employees [anonymized data] were thinking about the climate the same day. That was a great approach, in my opinion. I'm sure a lot of really good ideas were generated. Nevertheless, when I walk through the office three days later and see how my colleagues are behaving, I feel that 90 % of them haven't done anything. It's just another event you have to sit through (Focus group 1, manufacturing company, lines 347–355).

TABLE 3 Overview of derived core and subcategories.

Core-categories	Subcategories	Dimensions properties	*In-vivo*-codes
Selectively formed (selective coding) categories. i.e., new categories subsuming previous categories from all interviews		Dimensions and expressions (strong/weak/large/small/small/less/much etc.) to show differences and similarities	Quotations/Sample *in-vivo-codes* that underscore theory
(CC1) "this is just another event, and you just sit through it."	(SC1) Portfolio	– Many/few offers – Acceptance/non-acceptance – Importance of HR within organization/by management level – Required and available resources – Department, Functional Areas/target group – Large/small portfolio – Organizational structure – Stakeholders involved – Digital/analog – Internal/external trainer	"What can I do and what are the scale effects behind this?" (Focus group 1)
	(SC2) Learning support	– Extern/intern – Persons/circumstances/environment – Professional/non-professional – Advanced/non-advanced – Assessment/formative assessment – Kick-off – Reflection	"The manager is actually responsible for individual development." (Expert interview 3)
	(SC3) HR-Application	– Intensity (e.g., one time/multiple times) – Voluntary/compulsory – Action by HR/leaders – Instructions or rules of the game – Briefing/debriefing – Strengths-oriented/weaknesses-oriented – On the job/near the job – Resources	"I think it is much more important to look at where someone wants to develop, where they see their own strengths." (Expert interview 3)
	(SC4) Objectives	– "Castles in the air" (Focus group 1) – Concrete need – Target group (prior knowledge: yes/no)	"But for me it is always important that personnel development is a contribution to the bigger picture and is not an end in itself." (Expert interview 1)
(CC2) Pragmatism and transferability	(SC5) "because that is not how learning works."	– Self-organization Experiences with HR – Responsive HR – Pull principle – Reflection on past HR experiences – Sustainable and participative learning	"It's always the case that when you deal with things and think about solutions yourself, then much more sticks and I think that's really great!"(Focus group 2)
	(SC6) Core competence sustainability	– Ideology – Prior knowledge – Resource-intensive company/Sector/environmental impact/consciousness	"Anyone who is involved in mechanical engineering, especially in the rolling bearing industry, knows that this is one of the dirtiest things there is after engine development." (Focus group 1)
	(SC7) Change in values and awareness	– Fit offer and target group – Cohesion – External environment and challenges (e.g., Corona pandemic, societal change in values and consciousness) – Dealing with demographic change – Participation – No separate offices – Integration	"In the company, there is a considerable difference between employees who have been with the company longer and employees who are younger. Moderating this conflict is the responsibility of leadership." (Expert interview 1)

(Continued)

TABLE 3 (Continued)

Core-categories	Subcategories	Dimensions properties	*In-vivo*-codes
	(SC8) "depends entirely on where the button is pressed from"	– Motivation (high/low/extrinsic/intrinsic) – Role models – Use of resources – Pressure yes/no – Prior knowledge lots/less	"If the ideas for such business games or also the implementation comes much more from the employees, there can be a different energy than if it is somehow prescribed from above." (Focus group 1)
	(SC9) Company habitus	– Experiences – Company values – Corporate culture – Attitudes – Resources – Framework of a measure – Practical relevance – Strategic monitoring – Reflection of the simulation game – Dealing with knowledge – Motivation – Communication – Competence development – Leadership/leadership styles – Leadership development	"There are no low performers, there are only employees with the wrong tasks." (Focus group 1)
	(SC10) Changing work environments	– Cohesion – External environment and challenges – Demographic change, so-called generational clash – Individual economic conditions – Economic environment (organizational preconditions)	"And the topic of sustainability not only plays a role in the products, but also in all processes" (Focus group 2)

In general, all respondents stated that many seminars are superfluous as they do not support concrete implementation steps. In the focus groups in particular, the participants agreed that a personnel development application (SC3) such as the simulation game should not be initiated as a single measure, but should also be followed by integrated impulses, e.g., reflection sessions, complete sustainability programs over several weeks. Here, a one-off implementation of the simulation game is considered ineffective, and it is suggested that it should be used as a kick-off for further strategic events, e.g., in terms of developing a corporate sustainability strategy.

4.1.5 Development of employees by default?

The subcategory objective (SC4) includes the aspect that learning and didactic effectiveness of measures cannot be achieved by "pushing a button" (Focus group 1, manufacturing company 3, line 308), Rather it might be important to consider individual learning agents and include all diverse groups of employees in discussions about climate adaptation and protection. Prescribed personnel development (which is not based on the pull principle) would tend to lead to ineffective "castles in the air" (Focus group 1, manufacturing company 3, line 771). As an example, one manager commented on voluntary participation in training programs: "We have completely switched to a pull principle. We no longer make anything compulsory because pressure does not work when it comes to learning"(Focus group 1, manufacturing company, line 306–308). This approach is confirmed by other interviewees, who also point out that personnel development is no longer successful through pressure. Rather an effective approach is based on the pull principle, allowing employees to choose measures voluntarily and independently, from the top down. However, the voluntary nature of further training measures should be critically questioned, as one interviewee stated that employees are too busy to complete measures voluntarily: "If such a topic is not held up and we say: This is now mandatory. In other words, people are expected to take part, then it will not happen anyway because there are simply too many other things to do." (Focus group 1, manufacturing company, line 313–318).

In general, motivated managers who are open to innovative offers and act as role models could have the necessary leverage (SC8) to implement and consolidate such measures. Here, one interviewee (Expert interview 1, manufacturing industry 2, lines 282–284) describes: "If the management wants something like this and says […] that all 70 managers should take part in a simulation game like this, then it will happen next year." Conversely, one interviewee notes a change within leadership since the corona pandemic and observes a restrictive leadership that adheres more to rules, and as a result, employees are increasingly becoming compliant employees (Expert interview 3, lines 376–380). Another interviewee stated that many staff development events used to be canceled because managers did not support the measures, arguing that "time is an important resource."

The topic of leadership culture is also discussed within the focus groups, as all participants see role model functions on the part of managers, in particular. In this regard, one interviewee reported that a uniform leadership culture currently needs to be created in the

company, which should align with the current demographic and economic conditions:

> We are experiencing a bit of a generational clash because 20 years ago, leadership was different than it is today. We have to ensure that we can create a sensible and healthy mix. At the same time, I also believe that, concerning leadership culture, there should be no fixed standard that everyone has to adhere to in exactly the same way because leadership also entails a certain degree of individuality (Expert interview 2, lines 180–186).

Participants from start-ups at this point observe that, based on their own experience, it's difficult to block managers "for so long" (note: the workshop of the MainKassandra game lasts approximately 4–8 h):

> I come from a banking environment, where everything is probably a bit more rigid. If I imagine that, I'll call it now: old white men have to make time for such a game, that wouldn't be met with enthusiasm everywhere (Focus group 2, start-up, lines 305–311).

Findings indicate that the success of education in companies depends on a variety of factors, regardless of whether traditional or innovative didactic approaches are used. The second core category (CC2) comprises concrete topics in terms of GBL and the underlying simulation game MainKassandra resulting from the focus groups.

4.2 Core category 2: pragmatism and transferability

In general, the results show that an HRD offer such as the simulation game should be designed to be pragmatic and easy to use. To promote learning processes effectively, the simulation game should be adapted to the context (i.e., challenges, learning agents, learning objectives, etc.). In addition, several of the above-mentioned facilitating and inhibiting elements of a simulation game were categorized in a table (Appendix A), which describes the concrete elements of a simulation game.

4.2.1 Individual educational offers

According to the sample a climate game and or educational offer should be tailored to the changing framework conditions and values, individual preconditions (SC7, SC10), competencies in the field of sustainability (SC6), resources (SC9) and needs (SC5) of an organization. In addition to the pragmatic design (Implementation, Game elements), it is mentioned as important to promote the transferability of the educational offer (Participation, Consolidation) (see Appendix A).

4.2.2 Current challenges for companies

In our study we surveyed eleven companies from five industries. It becomes apparent that all of the companies find themselves within changed work environments (SC10), which confront the companies with several economic and human challenges (besides the global climate change). Approximately half of the respondents are employed in companies that have already dealt with the demands of climate change. Nevertheless, pressure from economic efficiency is evident among all respondents. Here, efforts are made by all companies surveyed to make personnel, financial, and operational measures as efficient and profitable as possible. Hence, existing market pressure also affects plans to make corporate processes more climate-friendly:

> As a for-profit company, what's the point if I […] save a few grams or kilograms of carbon dioxide, but my product is 40 % more expensive in some places, [and] if market pressure makes it impossible for me to afford it (Focus group 1, manufacturing company, lines 547–551).

This enormous market pressure means that companies often have no choice or only implement sustainable strategies due to the immense costs, i.e., due to great pressure. In this context, there is consensus in one focus group that "change must hurt" (Focus group 1, manufacturing company, lines 469–472). Further, since some companies already operate climate-neutrally or have integrated environmental management systems, dealing with political requirements is inherent and difficult. Companies that have already reduced emissions significantly years ago and have acted as role models are disadvantaged by current legislation. It will be much more difficult for companies who have not yet taken any steps to reduce emissions by 50 percent by 2030: "For companies where sustainability is becoming a trendy term, it is easier to start with low hanging fruit" (Focus group 1, lines 514–516).

"Silo thinking" is a further challenge that is prevalent within large companies. A variety of functional areas and/or locations can result in communication difficulties which can also negatively affect the development and implementation of sustainability strategies:

> But what is always a big problem for us is this silo mentality in the individual departments. There is someone in materials development who only does materials development from morning to night. He or she probably pays relatively little attention to what happens before and after that. And the further away that is from his or her department, the less interesting what happens there becomes (Focus group 1, manufacturing company, lines 402–406).

In the focus group with the start-ups, the primary challenge is that these companies have limited resources and a small number of employees. Their primary corporate focus is initially on growth and market positioning, which leaves them with limited capacity for addressing sustainability issues. However, it's worth noting that start-ups typically consider these aspects from the very beginning when establishing their companies.

The aspect of crises such as the corona pandemic and the establishment of home offices, which have led to lasting changes in companies, was mentioned several times. It was perceived as a positive change that the pandemic has shown that new workplace models such as "job rotation" are successful (Focus group, manufacturing company, line 346), and that this has also led to an openness to new measures (e.g., a simulation game on climate adaptation). Conversely, the pandemic was also perceived as negative. For example, one interviewee (Expert interview 2, lines 376–380) said: "I have the impression that the management style has become more restrictive since the pandemic. So, what are the rules?"

Furthermore, demographic change is cited, and a generational conflict is mentioned, which has an impact on personnel development and means that teams have to be brought together differently in order to promote communication and knowledge sharing (Expert interview 2, line 181). Demographic change and the increasing information and networking of people in the context of digitalization and technologization are leading to changes in the workforce. A change in values and awareness (SC7) is also cited, which has an impact on the internal and external development of companies (SC10, SC9).

4.2.3 Companies' level of consciousness

Regarding the individual prerequisites and contexts, the core competencies (SC6) and the extent to which sustainability has already been integrated into the organizational processes are important factors. Some of the interviews were conducted with globally operating manufacturing companies. There were companies that were certified according to the EMAS environmental management system and had already been working in a climate-neutral manner for several years. This expression illustrates the diversity in knowledge and practical guidance regarding sustainability. One company, which transitioned to climate neutrality some time ago due to management ideology, acknowledges the absence of market pressure and insufficient capacity for necessary investments at that time. Another interviewee explains: "Anyone who works in mechanical engineering, especially in the bearing industry, knows that this is one of the dirtiest things after motor development" (Focus group 1, manufacturing company 2, lines 133–135). He reports that the company outsources production processes to other countries, even though this is harmful to the climate. Nevertheless, the company cannot bear these costs due to the enormous market pressure to locate these processes regionally.

4.2.4 Knowledge and experiences

Accordingly, it can be observed that all companies have different approaches and pools of knowledge and experience. As the study indicates, the existing mission statements, attitudes of managers and employees and the corporate culture also have a relevant influence. This different corporate habitus (SC9), which is made up, for example, of the (socio) cultural and historical aspects as well as the market position of a company, has a corresponding effect on how a management game should be offered and designed to be effective in the individual company. Individual needs should be considered, particularly with regard to different management styles, available resources and prior knowledge of sustainability. Companies with an inherently positive attitude toward sustainability are less likely to accept the simulation game, or the novelty/innovation content of the project is lower, as the companies have a broader pool of knowledge and practical approaches and can therefore initiate effective changes with less success.

5 Discussion

As can be seen from the interviews and the theoretical overview, companies are challenged by climate change in a variety of ways. In addition to the direct effects of climate change, political requirements, associated restrictions and new demands from stakeholders and consumers are also playing an increasing role. The consensus on the different starting points and conditions for the implementation of sustainability strategies in companies underlines the need for specific educational approaches and communication on climate change and sustainability (see Madani et al., 2017; Lewandowsky, 2021). The results show that HRD in organizations is influenced by numerous internal and external factors and thus HRD in general is in a state of flux. Here, GBL could offer a suitable approach to address information overload and the growing inertia by empowering the target audience (individuals from companies) to actively learn and explore potential climate impacts firsthand, such as through a climate adaptation simulation game.

Addressing the guiding research question, several content-related and didactic game elements can be identified that are perceived by managers as either effective or ineffective in terms of instruction. A practical approach should be considered when planning and implementing an educational program. For example, a thorough briefing and even a pre-briefing can increase participants' understanding of the game systems and their motivation to perform their individual role or function. Team composition, i.e., forming heterogeneous teams with people from different functional areas, also promotes a broader exchange of knowledge and experience between the players. In addition, components such as an external moderator for more neutrality regarding the subject or pressure and ideology can increase the success of the game. We have identified some elements that are didactically effective or ineffective for a climate change simulation game. Some aspects are discussed in more detail in relation to the underlying literature.

5.1 Resistance to change

To be successful, HRD applications should consider the companies and employees of the learning actors as well as the environment, the objective and the (tangible and intangible) resources. Individual measures and adjustments should be made to promote creativity, the suitability of measures and motivational (emotional) concepts (see Plass et al., 2015; Diab et al., 2020). However, companies increasingly have to deal with changing economic and working environments despite different backgrounds and prior knowledge. Innovations or employee initiatives only have a chance of success if these new requirements are tackled holistically. According to the interviewees, frustration arises, for example, when employees are motivated to carry out a measure such as the management game but lack the concrete leverage to bring about change in the company with new ideas and concepts (especially in the area of sustainability). Due to its complexity and diverse interactions with political, social and economic developments (Blackburn and Pelling, 2018), global climate change presents a cognitive challenge for many people and often triggers negative associations. This expression could correlate with the necessary structural changes and altered consumption patterns, which often conflict with existing ideologies (Rivera and Clement, 2019) and people's idea of freedom (Lewandowsky, 2021). Similar to previous studies (Fischer et al., 2022, 2024), respective managers also play an important role here. Further training measures relating to climate change can be supported by managers who recognize their responsibility, provide learning structures, and offer spaces for reflection (see Helyer, 2015). As described in several individual subcategories (SC7, SC4, SC5), the individual motivations of the

actors involved in a simulation game should therefore always be considered.

The interviews show that companies are already motivated to exploit the potential of their employees, e.g., using innovative methods such as business games. In GBL and in the respective game mechanics, the focus is on addressing emotional concepts in learning (Boghian et al., 2019). Using the GBL approach to raise awareness of climate adaptation aims to increase motivation and increase people's engagement in a particular activity (Deen et al., 2015; Diab et al., 2020). The aim is to create an environment where mistakes do not have serious consequences and learning is encouraged (Krouska et al., 2021). However, this requires clear communication and follow-up, as Lewandowsky (2021) and Madani et al. (2017) emphasize.

In general, the results indicate that the arrangement and pedagogical structure of an educational program influence the acceptance and achievement of learning outcomes among participants. According to the interviews, a company's learning experiences from previous crises, such as the coronavirus pandemic, can prove valuable in change processes. The corona pandemic and the associated establishment of home offices created a completely new learning and working culture (SC5). For example, new workplace models such as job rotation are being tested and there is an increasing demand for more participation, so that offices are often no longer separated and instead focus on the integration of departments to promote knowledge transfer. In this context, the simulation game is rated as very conducive to learning and innovative due to the aspects of cohesion, motivation and teamwork mentioned. Nowadays, stakeholders and society are also increasingly demanding that products and services are sustainable and that their processes are communicated transparently to the outside world.

5.2 Learning environments

In the simulation game discussed here, a protected learning environment (see Rumore et al., 2016; Flood et al., 2018) is created in which mistakes have no consequences, which Krouska et al. (2021) consider relevant, and the course of the game can be flexibly adapted depending on the motivation, interests and prior knowledge of the players. Similar to the study by Rumore et al. (2016), interviewed companies and players have different attitudes and motivations for implementing a climate game. It should be noted that an educational game always has a flexible component and can therefore be adapted to the desired starting situation (Gödecke, 2022). Furthermore, as described in Boghian et al. (2019), the presented game MainKassandra focuses on fun while learning and tries to increase the players' motivation to deal with climate adaptation, which was identified as didactically relevant in the studies by Diab et al. (2020) and Deen et al. (2015). The respondents consider it very positive when changing methods, plot twists and different learning media (analog and digital) are used, as the study by Scholl (2018) also shows. In particular, the combination of methods and digital and analog (haptic) elements was rated as didactically effective. Didactically effective elements, such as the combination of didactic and analog media and methods such as "plot twists," on the other hand, were only evaluated theoretically. The effectiveness of the game can be assessed through an evaluation after implementation (see below 5.4).

For HRD applications to be successful, they need to consider the companies and employees of the learning actors as well as the environment, the objectives, and the resources (tangible and intangible). Individual measures and adjustments should be made to promote creativity, the suitability of measures and motivational (emotional) concepts (see Plass et al., 2015; Laurischkat and Viertelhausen, 2017; Diab et al., 2020). However, it is becoming clear that companies are increasingly having to deal with changing economic and prior knowledge despite different backgrounds and prior knowledge. Innovations or employee initiatives only have a chance of success if these new requirements are addressed holistically. According to the interviewees, frustration arises, for example, when employees are motivated to carry out a measure such as the business game but lack the concrete leverage to bring about change in the company with new ideas and concepts (particularly in the area of sustainability).

5.3 Resource constraints

The interviews also showed that implementing a game as a training offering requires adequate financial and human resources. It can be very expensive for a company to take 9–12 employees out of their daily business for a few hours and managers might fail to recognize the tangible and intangible value. Motivated, far-sighted managers are therefore needed who recognize the simulation as a learning and development opportunity for employees and the company. The interviews show that the interviewees have a very positive attitude and are willing to invest time and resources.

A rather negative assessment is given by the interviewees if there are no processes for implementing and consolidating (innovative) personnel development measures or if low-cost approaches are chosen instead of innovative approaches. Additional measures for consolidation and evaluation must therefore be taken to increase educational success. The interlinked categories indicate that HRD applications and business games should be as close as possible to real business practice and that the game design should be as simple and understandable as possible. Indeed, respondents referred in some places to past learning arrangements in their professional careers and noted that many measures were not adopted due to a lack of engagement with them. Another point that proves to be relevant for the effectiveness of a measure is the follow-up or integration of the promoted knowledge and new ideas into a strategic further development of the entire organization. The participants should therefore be provided with spaces for reflection in which they can reflect on and further develop their experiences from the simulation game (see Helyer, 2015). Here, several interviewees reported on company initiatives, such as a Climate Day or conventional training courses, which take place once and from which the lessons learned are not taken on board. To ensure the success of a measure, whether innovative or conventional, it can be crucial to initiate follow-up measures, such as recurring workshops, mutual surveys or a hybrid learning and exchange platform.

5.4 Evaluation challenge

To compare the effectiveness of GBL with formal programs (such as face-to-face teaching), most relevant studies conduct formative evaluations and use quantitative instruments such as questionnaires

(Lee et al., 2013; Rumore et al., 2016; Gatti et al., 2019; Neset et al., 2020). Our findings indicate that according to the respondents, a climate adaptation simulation game could be an innovative and effective way to enhance cognitive, social, and emotional skills linked to adapting to climate change. Nevertheless, the effectiveness of climate-related learning and knowledge transfer should be further evaluated in studies with game participants. However, quantitative surveys require larger samples to carry out reliable inferential statistical tests (to test hypotheses). So far, it has been difficult to get managers from companies to participate in the simulation game, as it is very time-consuming to run. Thus, a qualitative approach is required to validly evaluate the prototype game. Furthermore, as the simulation does not provide for reinforcement measures, it is difficult to assess the "long-term" effects of the GBL approach; these should be initiated by the companies themselves.

5.5 Limitations and further research

The current simulation game on climate adaptation was further developed based on elements that were considered didactically effective by managers. Since our suggestions draw from the qualitative study and academic literature, we have not tested the game's effectiveness for individual learning and climate adaptation strategies in a real business context. In terms of effectiveness, there are still limiting conditions that need to be considered in further research. Firstly, the interviewees had no concrete experience with game elements of MainKassandra. They made a theoretical discussion based on the presentation of the game during the focus groups. These assessments should be supplemented by further findings from practical experience. Consequently, it is possible to examine the presented sample following the game using two methodological approaches (in-depth interviews, formative evaluation). This involved asking repetitive and reflective questions and re-evaluating the game. Secondly, the interviews were conducted with start-ups and companies that are already innovative and sustainable, some of which are EMAS-certified (environmental management system). Therefore, additional interviews might be necessary with representatives from companies that have made limited progress in addressing climate change and sustainability. Based on these interviews and an evaluation of the game, we aim to make reliable statements about its relevance and effectiveness. A follow-up study is conducted with 16 experts to determine the didactic effectiveness of the game MainKassandra.

6 Conclusion

As discussed in our paper, effective climate adaptation requires the active engagement and cooperation of economic actors who play a crucial role in shaping policy and promoting sustainable practices. However, motivating and sensitizing these actors to climate adaptation can be a complex task due to the inherent complexity of the climate system and the long-term nature of its impacts. In recent years, GBL approaches have proven to be promising tools to motivate people and promote behavior change in different areas. An educational approach such as the simulation game presented could be suitable for sensitizing and empowering stakeholders in companies to take action on climate change mitigation and adaptation, as it makes learning objects that are normally perceived as abstract seem personally relevant. The results indicate that several factors determine the effectiveness of elements in games. A clear understanding of the objectives and implementation of a game is important when designing HRD offers to adapt to climate change in addition to taking into account the individual framework conditions of the target group, e.g., in terms of time and resources. Detailed briefings and preliminary discussions should be conducted so the participants can familiarize themselves with the game logic and assume their fictitious roles. It was emphasized that the formation of heterogeneous teams made up of people from different functional areas enables a more comprehensive exchange of knowledge and experience among the players. In addition, the involvement of an external moderator can be helpful in order to create new perspectives in a debriefing and to constructively moderate possible points of contention due to existing ideologies or prior knowledge. The results underline the importance of strategic planning and well thought-out implementation of educational offers such as a simulation game for the effective achievement of objectives. Our study on didactically effective elements of a simulation game on climate adaptation contributes to academic research by discussing current challenges in vocational training in companies confronted with global climate change. The accompanying developed game can serve as a multiplier for knowledge transfer, benefiting both researchers and practitioners in the field of climate adaptation.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

No ethical approval was required for our studies with humans. The participants gave their consent for the interviews to be recorded, they were assured that the data would be strictly anonymized, and they were aware that no conclusions would be drawn about them or anyone associated with them. As the transcripts were anonymized and the theoretical concepts were created without personal data, the involvement of an ethics committee was not required according to the guidelines of our institution. The studies complied with local laws and institutional requirements, and participants provided written informed consent.

Author contributions

SF: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. MG: Supervision, Writing – review & editing. JS: Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix A

TABLE A1 Didactically elements for a business simulation game identified by managers clustered in the four categories Implementation, Game elements, Participation and Consolidation. The elements are derived from open coding (see Section Methods) and still have their respective coding, e.g., "M93"). The concepts have been grouped under the core categories, so the table is provided for those who are interested. The elements were assessed as conducive (+) or inhibiting to learning (–).

Cluster	Concepts
Implementation	– Informal communication (M93) (+) – Team building (U96) (+) – Implementing in a broad workforce (F49) (+) – Matching target group (F59) (+) – External pressure (F69) (+) – External facilitator (F83) (+) – Concrete need (111) (+) – E-learning (U110) (+) – Ideology (F28) (+) – Practical relevance (F29) (+) – Heterogeneous teams (F44) (+) – "a lot of translation and application" (F82) (+) – Mapping/simulating actual reality (F86) (+) – Time keeper (F88) (+) – Lack of processes (M49) (–) – "because it's just the cheaper option" (U118) (–)
Game elements	– Mapping/simulating actual reality (F86) (+) – Timekeeper (F88) (+) – Voice-of-the-customer (F91 (+) – Haptic play materials (F92) (+) – Switching methods (F94) (+) – Plot-twists (F95) (+) – Shift in perspective (F98) (+) – Caretaker (M31) (+) – Inclusion (M36) (+) – Space for leaders (M52) (+) – "Leadership also means a certain amount of individuality" (M61) (+) – "the direction is toward more employee participation" (U44) (+) – Consideration of wishes (E40) (+)
Participation	– "if the management wants something like that" (F38) (+) – Involve management level (102) (+) – Conserving energy (F100) (+) – Lack of commitment/acceptance (+) – "we tend to come from an authoritarian management style" (U42) (+) – "Actually, I only need a business simulation game like this when I want to change the mindset" (F52) (+) – "So a big lever here are the managers" (U36) (+) – Job enrichment/enlargement (U74) (+) – Evaluation (U101) (+) – Exploiting potential (E67) (+) – Corporate culture (F46) (+) – Outdated attitude of managers (U59) (–) – Potential already exhausted (F65) (–)
Consolidation	– Use business simulation game as multiplier (F50) (+) – "then deals in the field with what you have learned in theory" (F57) (+) – Coupling ability (F85) (+) – Consolidate ideas (F108) (+) – Castles in the air (F109) (–)