Learning Insights

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Scientific Insights into Adult- and E-Learning

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Learning in the Context of the Ethical Dilemma Project and Gamified platforms for corporate learning

For the development of the three different games and platforms for learning the key insights from our dilemma project, I have conducted a scientific deep-dive into key literature of adult- as well as online learning, which is likely to benefit the development of the gamified platforms. Implementing suggestions on how people learn, is likely to enhance the impact the games and platforms will have on the users. In this regard, the next pages aim to maximize the corporate learning based in our research and our ethical exploration and decision-making model.

1. Adult education with e-learning

Having identified the cognitive processes to be stimulated in relation to the competence in question, the third chapter is devoted to the cognitive processes involved in learning and the requirements for training, taking into account the characteristics of the learner and the learning tools used. The following three topics are relevant to the design of innovation training for SME employees: adult learning, learning as a cognitive process and e-learning. The literature on adult learning is intended to convey what training requirements arise from the fact that the learners are adults. Outline point 3.2. on learning as a cognitive process describes cognitive processes or characteristics of people in relation to learning and identifies learning theories and learning activities based on these that promote positive learning outcomes. The use of computer-based learning tools is seen as a solution to application requirements, such as flexibility, and content requirements, such as interactive learning. Therefore, bullet point 3.3. on e-learning deals with the characteristics of ICT tools, which in turn represent requirements for the design of a training course and are considered in the concept. The requirements for a learning process or activities for their fulfilment, which result from this chapter, are implemented in the subsequent innovation training recommendation.

1.1. Adult Education

Tynjälä and Häkkinen (2005) summarise the requirements of a learning process in relation to adult education as follows: optimal adult education 1) is based on the learner's experience, 2) involves the learner in a reflexive process, 3) involves the learner in social processes, 4) is problem-oriented, 5) aims to promote both personal development and educational processes of the organisation, and 6) is flexibly organised.

Essential to learning is the process of (self-) reflection, in which the learner thoroughly revises his or her existing mental models by actively engaging with the new, unfamiliar content (Hao et al., 2016). This active process of (self-)reflection requires support as opposed to instruction (Andrews & Haythornthwaite, 2007; Schäfer, 2017). This finding shows the transition away from passive learning, where the teacher is the focus, and the learner absorbs the knowledge imparted unilaterally by the teacher, and leans towards active learning (Conole, 2012; Mayer, 2005; Shuell, 1986). (Self-) reflection, problem orientation and critical analysis frequently occur as prerequisites for a successful learning process in the literature on adult learning (Arghode et al., 2017; Huang, 2002; Tynjälä & Häkkinen, 2005). Critical review of learning content for relevance by the adult learner is essential to obtain a lasting knowledge (Schäfer, 2017). Therefore, the goal and the meaning of the learning content should be apparent to the employee.

In addition to the individual process of problem-oriented (self-) reflection, the high importance of the social component in the individual unfolding process is much addressed in the literature (Andrews & Haythornthwaite, 2007; Schäfer, 2017; van Blankenstein et al., 2011; Webb & Farivar, 1999). Cognition is a central component of cooperative and collaborative learning theories. Webb & Farivar (1999) write that cognitive development can emerge in a social learning process specifically by making or receiving an explanation of content or one's own opinions in the context of an interaction with the other participants. Through exchange, individuals reconsider their own knowledge, fill in the gaps, form better connections between their own knowledge models, and thus construct better elaborated mental models (Webb &

Farivar, 1999).

The consideration of the learner's experience is strongly related to the requirements regarding the personalisability of the learning content and a flexible organisation of the training, the need for which is often discussed in the literature (Brookfield, 1995; Heinecke-Müller, 2003; Tynjälä & Häkkinen, 2005). High flexibility in terms of learning content, while possible in the context of e-learning, would come at a high cost (Sadler-Smith et al., 1998; Westhead & Storey, 1996). This would present a significant hurdle for SMEs, as SMEs tend to be unwilling to allocate a high budget to employee training (Sadler-Smith et al., 1998; Westhead & Storey, 1996). Moreover, a high degree of flexibility might make navigating through training content too complicated and counterintuitive (Schrader & Berzbach, 2005). Therefore, the training design resulting in this paper allows a certain degree of flexibility of the learning content without complicating the design, which is feasible with the help of ICT tools. The flexible organisation in terms of the design of the learning process, rather than the learning content, is directly associated with the characteristics of ICT tools and is explained in more detail in section 3.3. on e-learning.

In summary, practical and workplace relevant, team-based and modular training in a diversified social context make up the trends in adult learning (Schrader & Berzbach, 2005). The concepts of learning as an active and collaborative reflective process in a flexible problem-solving format addressed in the literature on adult learning are mirrored in the literature on the cognitive characteristics of human learning, as presented in the following chapter.

1.2. Learning as a cognitive process

Learning is a cognitive process as it is a process of cognition, knowledge and information processing (Lemke, 2003). A learning process can consist of further cognitive processes. Examples of further cognitive processes are "planning, reasoning, deciding, fantasizing, imagining, perceiving, reflecting, thinking," etc. (Lemke, 2003, p. 71). Specifically, learning is a purposeful, purposive pursuit of understanding, with resulting changes in knowledge, skills, and practices (Andrews & Haythornthwaite, 2007).

Learning theories stem from three memory systems: visual and auditory sensory memory, short-term memory, also called working memory, and long-term memory (Clark & Harrelson, 2002; Mayer, 2005). Information from the visual and auditory sensory memory systems is selectively transferred to working memory, where it is integrated into a coherent idea. In this process, working memory is characterized by the fact that the selected information is temporarily stored in it and processed in active consciousness. The newly generated ideas must be processed in working memory in such a way that they are integrated with the existing ideas from long-term memory, also called mental schemata. This process is called encoding. In order for this to happen, the information stored in long-term memory must be able to be retrieved. This process of retrieval is also called transfer. The transfer of existing mental models is central to the ability to apply what is learned (Clark & Harrelson, 2002). The process is very complicated, the faulty operation of which can become one of the most costly gaps in the educational process (Clark & Harrelson, 2002; Mestre, 2002). The transfer of knowledge is more difficult when the instructions are too strongly tied to the context in which the knowledge was acquired and easier between tasks that require similar cognitive processes (Heinecke-Müller, 2003; Mestre, 2002).

In summary, the learning process involves cognitive processes such as directing attention, processing in short-term memory or working memory, retrieval from long-term memory, and metacognitive processes responsible for managing the limited resources of working memory, goal setting in learning, determining learning strategies, monitoring learning progress, etc. (Clark & Harrelson, 2002; Mayer, 2005). Based on this description of cognitive processes, Clark and Harrelson (2002) make requirement suggestions for an instructional design. The design should 1) focus the learner's attention on important aspects of the learning content, 2) minimize cognitive load, 3) activate relevant knowledge from long-term memory and stimulate repetition of new information, 4) initiate recall of newly acquired knowledge after the learning process, and 5) assist in the management of metacognitive processes. Instructional design is particularly helpful for learners with poorly developed metacognitive skills (Clark & Harrelson, 2002). The following section introduces concepts that address the cognitive processes described: concepts of active, collaborative, and constructivist learning, as well as cognitive load theory, all of which are interrelated.

Active learning is a process of actively engaging with the learning content using cognitive processes such as analyzing, synthesizing, evaluating, etc., which help in understanding the learning content (Bonwell & Eison, 1991; Chi & Wylie, 2014; Mayer, 2005). In this process, the learner does something and thinks about what they are doing, as opposed to passively receiving the information (Bonwell & Eison, 1991; Chi & Wylie, 2014). As a process of building mental models, active learning has strong overlap with the concept of constructivist learning, which states that knowledge is not created through a passive reception of new information, but through an active construction of knowledge (Heinecke-Müller, 2003; Mayer, 2005).

For the process of schema construction, the automation of schemas plays a major role from the perspective of cognitive load theory (Sweller John et al., 1998). For the most part, automatic information processing occurs outside of limited working memory and thus represents low cognitive load (Lemke, 2003; Sweller John et al., 1998). Automation comes with extensive practice (Lemke, 2003; Sweller John et al., 1998). Automatic information processing is relevant to the development of *alertness*, as shown in bullet point 2.1. on opportunity recognition. Furthermore, there are ways to reduce cognitive load by adjusting the instructional design (Sweller John et al., 1998).

In the literature, active learning is typically addressed as a group work in teams of two people in the context of cooperative or collaborative learning (Chi et al., 2018; Mayer, 2005). The two concepts - collaborative and cooperative learning - are similar in many respects and play a central role in successful learning. However, the degree of independence and teacher independence as well as the sense of commitment to the common goal is higher in collaborative learning (Conole, 2012; Mayer, 2005). The idea of collaborative learning, which we focus on in the following, is an engagement with the learning content in a small group and without intervention from the teacher (Cohen, 1994). In the following, the findings of the theories will be instrumentalized in order to incorporate them into a training concept ready for use.

1.2.1. ICAP model of cognitive engagement

Successful learning requires active engagement with the learning content individually and in the context of social interaction with the aim of constructing new knowledge (Bonwell & Eison, 1991; Mayer, 2002; Weinberger et al., 2005; Wittrock, 2010). One model that accounts for this finding is the ICAP model (Chi, 2009; Chi & Wylie, 2014). The four types of *cognitive engagement* defined in the model [5]are interactive, constructive, active, and passive cognitive behaviors. In passive learning, the learner merely absorbs the information without actively engaging with it. In active learning, physical manipulations of the information take place. The characteristic feature of constructive learning is the generation of new knowledge, where as the characteristic feature of interactive learning is the collaborative generation of new knowledge. The characteristic of each behavior is captured by a characteristic descriptor (see Table 1). Depending on which cognitive behaviour the learner exhibits, the result of the learning is a more or less qualitative knowledge. Thus, the framework has a hierarchical structure in which the quality of the acquired knowledge improves with each successive stage, from passive cognitive behavior to active and constructive behavior to interactive behavior (Chi, 2009; Chi & Wylie, 2014). Some advantages of the framework are that it gives a clear definition of which behaviors or actions fall under respective *cognitive engagement* (see Appendix Table 1). Furthermore, it shows which knowledge change process and which cognitive outcome in terms of acquired knowledge the respective *cognitive engagement* is aimed at. The framework is therefore easy to operationalize (cf. Table 1).

[5] ***Cognitive engagement*** **refers to active learning in the form of cognitive engagement expressed through outwardly visible behaviors (Chi & Wylie, 2014).**

Table 1: Types of *cognitive engagement*, resulting processes of change in individual knowledge, and cognitive outcomes.

Cognitive engagement	Knowledge Change process	Cognitive outcome	Characteristic descriptor
Passive learning behaviour	Save	Remember	Record
Active learning behaviour	Integrate	Apply	Manipulate
Constructive learning behaviour	Open	Transfer	Generate
Interactive learning behaviour	Co-lock	Co-create	conduct a dialogue

Source: Own representation according to Chi and Wylie (2014)

Chi and Wylie (2014) also show that each learning activity can be adapted to respective category of *cognitive engagement.* For example, listening to a lecture by simply paying attention to the lecture would be a passive cognitive behavior. For an active behavior, one would absorb the lecture verbatim in the form of the notes and thus focus one's own attention on certain aspects. Asking questions about the lecture falls under constructive behavior. Discussing the lecture content with fellow students can be classified as interactive behavior (Chi & Wylie, 2014). This shows that an activity, such as listening to a lecture, can be adapted to any *cognitive engagement.* A detailed presentation of each learning behavior and specific activities that produce the desired behavior are presented in Table 1 of the Appendix.

In interactive learning behavior, two conditions must be met: 1) utterances by both partners are primarily constructive and 2) alternation between utterances by both partners is regular (Chi & Wylie, 2014). The sufficient exchange of words between partners results in small-scale pieces of knowledge being exposed to revision, resulting in richer and potentially innovative knowledge (Chi, 2009; Chi & Wylie, 2014; Weinberger et al., 2005). Learners must constantly refine their concepts, knowing that their schemas are being patterned in detail by their partner (Weinberger etal., 2005). Interactive behavior is not limited to a human interaction (Chi & Wylie, 2014). Thus, it may well be an interaction with software as long as the two conditions are met. However, computer-based learning, where the system often requests a response from the learner, cannot be directly described as interactive learning (Chi & Wylie, 2014). Rather, the computer-based setting allows for the realization of all types of *cognitive engagement*. The link to the cognitive concept of the learning process presented at the beginning of the chapter can be seen in the knowledge change processes and cognitive outcomes resulting from *cognitive engagement.*

Table 2: Knowledge change processes and cognitive outcomes according to cognitive engagement

Knowledge change processes	
Save	New information is stored in isolation
Integrate	New information activates relevant existing knowledge; during storage new information is integrated with activated existing knowledge (relevant schemata)
Open	New information is integrated with activated existing knowledge and new knowledge is derived from activated and integrated knowledge; conclusions and connections in conceptual knowledge as well as justifications in procedural knowledge are generated.
Co-lock	Each partner iteratively develops new knowledge with the activated and integrated knowledge and iteratively develops further knowledge with new contributions of the interlocutor in a cyclical, dynamic, constructive process.
Cognitive *engagement* outcome	
Remember	Inert, isolated stored knowledge that can be retrieved and reused given the same context as in the process of acquiring the new knowledge; minimal understanding.
Apply	More complete schema and more easily retrievable knowledge that can be applied in a new, but similar to the one from the learning process, context; hollow understanding
Transfer	Substantially rethought and thus enriched schema, possibly better interconnected with other schemas, facilitating knowledge transfer; deep understanding.
Co-create	Improved and expanded knowledge; potentially new knowledge and innovative ideas that neither partner could have tapped into alone; deepest understanding

Source: Own representation according to Chi and Wylie (2014)

Thus, of particular interest for innovation training is the cognitive outcome of interactive behavior, which can only be achieved after the outcomes of the other three stages of *cognitive engagement* are already in place. In this context, the framework does not encompass all cognitive processes that are specific to a learning task, such as problem solving, but complements the task-specific processes (Chi & Wylie, 2014).

A major limitation of ICAP theory is that identification of which cognitive learning behaviors the learner is engaged in occurs only through overt behaviors of the learner (Chi & Wylie, 2014). By overt behavior, externalizing the output (e.g., summarizing, a concept drawing, a discussion with learning partners) is primarily meant (Chi & Wylie, 2014). The advantage of externalizing is that externalizing one's own idea for possible solutions to problems can lead to restructuring of one's own knowledge and use of new concepts (Cohen, 1994; Weinberger et al., 2005). Furthermore, it can reduce cognitive load (Chi & Wylie, 2014; Tynjälä & Häkkinen, 2005).

1.2.2. Problem solving as a form of learning

Problem orientation of the learning process is often mentioned as a requirement in the context of adult learning (Arghode et al., 2017; Huang, 2002; Tynjälä & Häkkinen, 2005). During a problem solving process, a solution to a problem or a way to achieve the given goal is sought (Wang & Chiew, 2010). Problem solving is a complex cognitive process that interacts with all other cognitive processes and stimulates knowledge transfer (Krathwohl & Anderson, 2009; Tynjälä & Häkkinen, 2005; Wang & Chiew, 2010). Furthermore, Wang and Chiew (2010) make a connection between creativity, which was elaborated in bullet point 2.1, and problem solving by writing that theories of creativity can be reduced to theories of problem solving.

Krathwohl and Anderson. (2009) write that the cognitive processes of problem solving and critical thinking have similar characteristics to the cognitive process of understanding. Here, understanding is the focus for the first step of problem solving, problem representation. The first step of problem solving is the construction of a mental representation of the problem, followed by the formulation and execution of a plan to solve the problem (Mayer, 2002; Wang & Chiew, 2010). Whether or not the problem is a conventional one with a predetermined goal, Wang & Chiew (2010) present a problem-solving procedure: 1) defining the problem, 2) searching for goals and solution paths, 3) generating the solutions, 4) selecting appropriate solutions, 5) recursively executing step 2) if necessary, and 6) representing the solution results in a schema of long-term memory. An alternative to problem solving that promotes a deep understanding of a problem is to formulate a problem statement (Mestre, 2002). Being able to define the problem itself would help the learning process to be more connected to the learner's knowledge.

Other formats for problem solving activities, especially with regard to reducing cognitive load, are *goal-free*, *worked examples,* and *completion* problems (Clark & Harrelson, 2002; Sweller John et al., 1998). In the *goal-free* format, the problem description does not specify what is sought, but only what is given. The learner would then apply certain concepts based on the given, which would present him with a different problem in the next iteration (Clark & Harrelson, 2002; Sweller John et al., 1998). One way to solve problems where no goal and/or solution path is specified is to use exploratory or creative methods (Wang & Chiew, 2010). This could be instrumentalized in relation to innovation training.

In the *worked examples* format, the problem and the solution are presented to the learner (Sweller John et al., 1998). The use of *worked examples is* intended to focus the learner's attention on the problem state and problem solving strategies. This is expected to reduce extrinsic cognitive load and thus free up more working memory resources for the formation of mental models. In order not to prevent the worked examples effect, the problem illustration and the solution should be integrated so that, for example, the problem and the solution to it can be seen on one illustration. One of the biggest disadvantages of *worked examples* is that the learner is not made to study the solution carefully. Thus, *worked examples are* not unambiguously positive and should be used in moderation (Sweller John et al., 1998).

An alternative to *worked examples* is *completion problems*, where the initial and target states of a problem are given, as well as the partial solution, which must be completed by the learner. (Sweller John et al., 1998). In contrast to *worked examples, the learner* must carefully analyze the given problem and partial solution to fill in the solution gaps (Sweller John et al., 1998).

1.2.3. Assumption of limited working memory

A common assumption about the structure of the cognitive apparatus is limited working memory (Clark & Harrelson, 2002; Mayer & Moreno, 2017; Mestre, 2002; Sweller John et al., 1998; Van Merriënboer et al., 2003). Simultaneous processing of too much or too complicated information leads to high cognitive load and thus to overload and failure of the learning process (Sweller John et al., 1998). The capacity of working memory can be enhanced by using both information processing channels, auditory and visual (Mayer, 2005; Sweller John et al., 1998). This would therefore lead to better learning outcomes and can be achieved by using multimedia. In this regard, multimedia can be used to visualize the thinking process, which should facilitate knowledge integration in learning (Linn, 2000).

Another way to account for limited working memory is to introduce different strategies that support the learner and thus take the cognitive load off the learner, so-called *scaffolding* (Chi et al., 2018; Van Merriënboer et al., 2003; Weinberger et al., 2005). A selection of *scaffolding* strategies is hints, pop-up windows, feedback, saying aloud the cognitive processes being performed, cue cards, checklists, process worksheets, guiding questions, and partial solutions (Chi et al., 2018; Linn, 2000; Van Merriënboer et al., 2003). Subsequently, support should be continuously reduced, as excessive support, just like insufficient support, can lead to hindering the learning process (Van Merriënboer et al., 2003).

Interactive tasks also need *scaffolding*, e.g. in the form of social scripts (Tynjälä & Häkkinen, 2005; Weinberger et al., 2005). Social scripts have three important functions: 1) specifying the activities in collaborative learning, 2) determining the order of activities, and 3) assigning roles for all participants. They structure and facilitate collaborative learning and thus prevent an undesirable course of interactions. An example of an undesirable course of collaborative learning could be that the learning partners hastily come to an agreement without having critically analyzed each other's contributions (Tynjälä & Häkkinen, 2005; Weinberger et al., 2005). When designing a social script, one should take care that the instructions are not too detailed, which would hinder independent thinking of the participants and thus have an inverse effect on learning (Cohen, 1994). An example of a social script can be found in Table 2 in the Appendix.

Another form of *scaffolding* is controlling the timing of information presentation (Van Merriënboer et al., 2003). Complex information, such as solution strategies and thought process steps relevant to a task, should be shown or practiced before the task begins so that the information can be stored in long-term memory. Information that is directly relevant to solving a task, such as instructions or guiding questions, should be fully integrated into the learning environment (Van Merriënboer et al., 2003).

1.3. E-Learning

E-learning should be seen as a tool that can support the cognitive processes of learning. Andrews and Haythornthwaite (2007) argue that for online learning, the *affordances of* ICT tools need to be considered. The *affordances represent* possibilities offered by the features of ICT tools, e.g. communication with others, access to information etc. The *affordances* identified by authors are social *affordances*, asynchronous communication, overt or covert identification, mobility and distribution of participants, with social *affordances* being the main focus (Andrews & Haythornthwaite, 2007). Spector (2013) describes the following positive affordances *of* ICT: collaboration, interaction, dialogue, creativity, organization, inquiry and authenticity.

Based on the findings on cognitive processes in learning, the exploitation of the following *affordances of* ICT tools is of particular importance: interaction between learners, interaction with the learning content, use of multimedia, *scaffolding*, synchronous and asynchronous design and timely information provision. The requirement regarding flexible organization from the adult learning literature includes distanced learning that is timed to fit the learner and at a pace that is convenient for the learner, which is made possible by e-learning (Admiraal & Lockhorst, 2009). Designing training in the form of short modules could accommodate this, at least in part. In this context, synchronous communication would enable interactive learning, while asynchrony by separating individual modules of a training course over time can promote the reflective process (Andrews & Haythornthwaite, 2007). What should be emphasised is not only the opportunity for social interaction in learning, but also the interaction of the learner with the learning content, e.g. in the form of physical manipulation or in the form of pop-up windows with instructions or guiding questions (Andrews & Haythornthwaite, 2007).

2. Innovation training concept

Based on the findings about cognitive processes in relation to the four entrepreneurship competencies as well as to a successful learning process, requirements for innovation training were identified. In this section, a training concept for the promotion of creativity, opportunity recognition, vision and idea evaluation competencies is presented based on the identified requirements. Furthermore, the training concept has been summarized for opportunity recognition and creativity as a 2-pager to provide a quick overview of the most important criteria in creating innovation training (see Appendix Figure 1 and 2). The training concept represents a problem-solving process and provides for a modular structure with four phases: 1) initiation of the training, 2) understanding, 3) techniques to promote the respective competence, and 4) incubation. Each of the four phases can and should include opportunities for individual or social (self-) reflection. Here, synchrony of ICT tools should be used for social interaction, while asynchrony can be beneficial for individual tasks to promote reflection processes. Not only social interaction is important, but also interaction with the learning content. An active and constructive engagement with the learning content in the sense of the ICAP framework through the use of multimedia should be possible (cf. Appendix Table 1). In doing so, the learning content should connect to the learner's experience by setting the problem either through consensus among collaborators or by a participant with the support of others. The instructional design is intended to reduce cognitive load by integrating textual and visual forms of representation using multimedia as well as *scaffolding.* The phases and their cognitive processes are presented below. The cognitive processes in the four phases overlap strongly. Thus, recognition and recall are to be activated in each phase. Therefore, characteristic cognitive processes for each phase are mentioned. For more information, please refer to Tables 3 to 6 in the Appendix.

The first stage of preparation for the training should provide the learner with necessary information, such as the objective and rationale of the training, the training process, complex concepts for solving the problem and the problem itself. The step should fulfill the requirement for critical review on the relevance of the learning content as well as minimize cognitive load. The problem could be determined collaboratively at this stage.

The second phase is to understand the problem. Problem solving process is problem representation and problem solving (Mayer, 2002). Problem representation requires extensive understanding of the problem. Understanding is gained through active and constructive engagement with the information (Chi & Wylie, 2014). The cognitive processes from Bloom's revised taxonomy identified as relevant to this stage are interpreting, classifying, illustrating, abstracting and summarizing, reasoning, comparing, and explaining. In this process, information should be able to be physically manipulated by learners and additional information generated by the learner. The process can be supported by using appropriate techniques, such as the 6-W technique.

The third phase represents the application of the competency-specific techniques. It is important to involve cognitive processes that contribute to the promotion of the entrepreneurship competencies of opportunity recognition, creativity, vision, idea evaluation and ethical and sustainable thinking. All the cognitive processes of entrepreneurship competencies can be found in Tables 3 to 6 in the Appendix with the associated activities. Below is a summary of the entrepreneurship competencies and their underlying cognitive processes.

For opportunity recognition, the perception and abstraction of the environment to the core and the subsequent cognitive thinking process are of importance, in which different concepts are then mentally integrated. The cognitive processes underlying opportunity recognition are: explaining and constructing models, recognizing and recalling relevant knowledge, abstracting, integrating and comparing. The second entrepreneurship competency, creativity, occurs both when two concepts or ideas are combined with the goal of generating a new integrated concept or ideas (conceptual combination) and when concepts are transferred from a familiar domain to an unfamiliar one (*analogical reasoning*). The cognitive processes of opportunity recognition and creativity skills are very similar, but in creativity the cognitive process of creating has a high importance. The cognitive process dimensions and underlying cognitive activities of creativity in the ideation process are: Abstracting, Classifying, Integrating, Reasoning, Comparing, and Creating. Vision is a mental model of a future state of a process, group, or organization. Visioning skills rely heavily on future orientation, which is why cognitive processes such as hypothesizing, generating new mental models, and extrapolating and foreseeing are emphasized. Incorporating vision into training particularly helps to develop future-oriented innovations (in higher quantity and quality), as employees are otherwise too strongly oriented towards the status quo and the past. Lastly, idea evaluation represents a key entrepreneurship competency. Idea evaluation consists of evaluation and reflection. Evaluation is a critical thinking process that people use to judge quality, truthfulness, and accuracy. Reflection is the cognitive process of remembering and critically analyzing. Underlying idea evaluation are the cognitive processes of evaluating, reviewing, critiquing, and judging. Ethical and sustainable thinking last should be the framework for all actions throughout the course. The detailed descriptions of the cognitive processes, assigned to the respective entrepreneurship competence, are listed in tables 3 to 6 in the appendix.

The incubation phase serves to reflect on the learned content, test it in everyday life and consolidate and revise the newly acquired knowledge by repeating the training for the respective competence, possibly with the application of further methods in the second training phase. Through reflection, restructuring and classification of the learned methods and ideas take place (Hao et al., 2016). Practice of the same competencies in a new context and with new techniques prevent the acquired knowledge from being stored in isolation and becoming non-transferable. Interactive design can encourage learners to ask each other questions or explain learning, build on each other's contribution, ask for clarification, and correct each other's contributions. It is important to ensure that all participants are given equal time to express their own opinions and that they take turns so that everyone gets a turn. The contributions should also be of a constructive nature. This can be regulated by introducing social scripts.

3. Conclusion

The previously mentioned disadvantages could be counteracted by various measures. The in-depth literature review carried out was methodical according to scientific standards and used proven models in the fields of entrepreneurship, learning, adult education and e-learning. As mentioned earlier, the results of the narrative literature review were verified with the help of experts. Their positive feedback reinforced the validity of our recommendations for the training concept.

3.1. Conclusion on results

Better learning outcomes are achieved when the learner actively engages with the learning content and builds his or her own knowledge (Chi & Wylie, 2014; Conole, 2012; Mayer, 2005). Gaining the deepest understanding of the learning content requires social interaction (Chi & Wylie, 2014). In addition to interactive learning processes, individual reflection should be encouraged, which is possible due to the asynchrony of computer-based learning (Conole, 2012; Mayer, 2005; Schrader & Berzbach, 2005; Sweller John et al., 1998; Tynjälä & Häkkinen, 2005). Another important factor is the reduction of cognitive load, which can be achieved through short modules with clear learning objectives and use of *scaffolding* (Mayer, 2005; Schrader & Berzbach, 2005; Sweller John et al., 1998; Van Merriënboer et al., 2003; Weinberger et al., 2005). In addition, the complex concepts needed to solve the task should be shown at the introduction or separated out into a separate exercise, with the immediate instructions displayed during the task itself (Van Merriënboer et al., 2003). The learning process should be supported through the use of multimedia (Mayer, 2005; Schrader & Berzbach, 2005; Sweller John et al., 1998). The content should be taught in the form of problem solving, be linked to the learner's experience, and not be overly tied to the learning context (Heinecke-Müller, 2003; Schrader & Berzbach, 2005; Tynjälä & Häkkinen, 2005). This can be achieved by a generally designed training that is suitable for different methods of practicing the respective competence and gives the possibility to let participants define the problem.

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Appendix

Table 1: ICAP model: types of cognitive engagement, their definitions and concrete activities associated with each learning behaviour.

Cognitive engagement	Definition	Concrete activity
Passive learning behaviour	Be oriented toward and receive information from the instructional material without engaging in an overt learning activity (e.g., taking notes).	Listen to a lecture; follow a lecture attentively; look at instructional materials.
Active learning behaviour	Perform overt motor action on instructional materials, physically manipulating them to force focus of attention	Inspect objects by rotating them; search for objects based on their description; point to what is read and to the problem to be solved; stop and repeat a video to revise certain parts; underline/highlight important parts of the text; copy parts of the problem solution; repeat the text word for word; summarize the text.
Constructive learning behaviour	Generate and externalize additional knowledge products beyond those provided in the instructional materials.	Infer the meaning of the text by drawing inferences not explicitly stated; self-explain a partial solution by justifying the solution steps; draw diagrams based on a completed problem solution; draw a concept map; make notes in own words; ask questions; formulate a problem statement; compare and contrast cases; integrate two texts; integrate texts and diagrams; integrate information from different sources; make plan; formulate hypotheses; establish connection; record analogies; generate predictions; reflect on own understanding; regulate learning activities independently.
Interactive learning behaviour	Conduct dialogue by meeting two conditions: 1) utterances of both partners are mainly constructive and 2) the degree of alternation between the utterances of both partners is sufficient.	Defend or argue a position in the context of a discussion; criticise each other by asking for justification; ask each other questions and answer them; explain each other's content; take each other's contribution apart in detail (clarify, build on, correct);

Source: Own representation according to Chi and Wylie (2014)

Table 2: Examples of introductions in social scripts

"Prompts" for the constructive critic.	"Prompts" for the case analyst.
• The following aspects are still not clear to me: • We have not yet reached consensus on the following: • My suggestion for adjusting the analysis:	• Regarding the request for clarification: • As for our differences of opinion: • Regarding the modification proposal:

Source: Own representation based on Weinberger et al. (2005, p. 41)

Table 3: Opportunity recognition - Theoretical concepts and identified cognitive process dimensions of Bloom's revised taxonomy.

Opportunity Recognition		
Theoretical concepts	Cognitive process dimensions according to Bloom's revised taxonomy (Krathwohl & Anderson, 2009).	
pattern recognition	Explain/Modeling	Constructing the cause-and-effect model of a system
Alertness	Evaluate	Assessing on the basis of criteria and standards
For both concepts of opportunity recognition	Recognize/Self Remember Abstract/ Generalize Compare/ Contrast Organize/ Finding/integrating connections	Retrieving relevant information from long-term memory Abstracting the general topic and the main points Identify the connections between two ideas, objects, etc. Determine how elements fit into a structure and function within the structure

Source: Own representation according to Krathwohl and Anderson (2009)

Table 4: Creativity - Theoretical concepts and identified cognitive process dimensions of Bloom's revised taxonomy.

Creativity		
Theoretical concepts	Cognitive process dimensions according to Bloom's revised taxonomy (Krathwohl & Anderson, 2009).	
Conceptual combination	Compare/ Contrast	Identify the connections between two ideas, objects, etc.
analogical reasoning	Analyze Differentiate/ Distinguish	Dividing the material into its component parts and determining how the parts relate to each other and to an overall structure or purpose. Distinction between relevant and irrelevant or important and unimportant parts of the presented material
General	Abstract/ Generalize	Abstracting the general topic and the main points

	Classify/ Categorize	Recognise that something belongs to a category
	Organize/ Finding/integrating connections	Determine how elements fit into a structure and function within the structure
	Compare/ Contrast	Identify the connections between two ideas, objects, etc.
	Create	Assembling the elements into a coherent or functional whole; reorganizing the elements into a new pattern or structure.

Source: Own representation according to Krathwohl and Anderson (2009)

Table 5: Vision - Theoretical concepts and identified cognitive process dimensions of Bloom's revised taxonomy.

Vision		
Theoretical concepts	Cognitive process dimensions according to Bloom's revised taxonomy (Krathwohl & Anderson, 2009).	
predictive mind hypothesis	Create	Assembling the elements into a coherent or functional whole; reorganizing the elements into a new pattern or structure.
	Design	Invent a (concept of a) product
	Hypothetize	Develop alternative hypotheses based on criteria, e.g. generate hypotheses to explain an observed phenomenon.
	Conclude/ Extrapolate/forecast	Derive a logical conclusion based on presented information
Vision as a mental model	Analyze	Dividing the material into its component parts and determining how the parts relate to each other and to an overall structure or purpose.
	Deconstruct	Determine a point of view, biases, values, or intentions underlying the content presented.
	+ cognitive processes of the predictive mind hypothesis	

Source: Own representation according to Krathwohl and Anderson (2009)

Table 6: Idea Evaluation - Theoretical Concepts and Identified Cognitive Process Dimensions of Bloom's Revised Taxonomy

Idea Evaluation		
Theoretical concepts	Cognitive process dimensions according to Bloom's revised taxonomy (Krathwohl & Anderson, 2009).	
Evaluation process	Evaluate	Assessing on the basis of criteria and standards
	Checking/Testing/Monitoring	Determine inconsistencies and errors within a process or product; identify the effectiveness of a procedure during its implementation.
	Criticize/Judge	Determine inconsistencies between the product and external criteria; Determine the appropriateness of a process for a given problem.
Process of reflection	Recognize/Self Remember	Retrieving relevant information from long-term memory
	Analyze	Dividing the material into its component parts and determining how the parts relate to each other and to an overall structure or purpose.

Source: Own representation according to Krathwohl and Anderson (2009)