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HOW E-LEARNING PROGRAMS CAN BE MORE INDIVIDUALIZED WITH ARTIFICIAL INTELLIGENCE – A THEORETICAL APPROACH FROM A PEDAGOGICAL POINT OF VIEW

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Abstract

Countless e-learning programs have been developed over the last few years. Learning opportunities supported by technology have become widespread in educational contexts, and many people rely on the Internet to continue their education in personal, professional, or school contexts. Findings indicate that recently developed e-learning programs are built on modern digital tools but need more purposeful content and a different focus than traditional learning scenarios. These observations raise whether online learning features are optimal extensions to traditional in-person, in-class teaching. This article focuses on how to optimize an e-learning program with the development of a query builder based on Artificial Intelligence (AI) that leverages the know-how of pedagogical experts to incorporate pedagogical learning methods effectively. For this reason, different definitions of e-learning and traditional learning theories, e.g., behaviorism, cognitivism, constructivism, and connectivism, will be analyzed to help derive theory ideas for an EU-funded project called “Young Refugees AI Student Empowerment Program.” Finally, the article will show some first technical results of implementation integrated into the project. Because of the project's target group, the needs, motives, and requirements of migrants and refugees will also be analyzed, and into the ideas for implementation included.

Keywords: Artificial Intelligence, e-learning, learning theories, integration, migrants, refugees

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Introduction

Online learning has established itself as an essential part of education. The concept is based on the idea of a human-machine interface with its two subsystems, "human" and "machine": On the one side, it is about the user, who benefits from automated processes by machines; on the other side, the focus is on data-processing technology, the technical device. The middle link is the so-called human-machine communication, which can be understood as a construct that focuses on the communication between these two mentioned subsystems (Etzrodt, Gentzel, Utz, & Engesser, 2022)¹. An example of this communication between humans and technology is digital learning, often based on traditional learning patterns. However, e-learning, in contrast to classical learning theories and scenarios, is more complex but also offers excellent opportunities for the educational process at the same time. Technology makes learning more efficient for accessing relevant information and can be done quickly regardless of place and time. It also becomes more dynamic for the user since the communication between humans and technology gets automated (Bahri & Lestari, 2021)².

Regarding the educational context, the e-learning program “The Youth Volunteer Educators Program” (*e-VELP*) was developed within an EU-funded project in 2021 to educate young immigrants and refugees (aged 18-30). The reason to require this project is the often-problematic integration of migrants and refugees in the labor market and the deficient acceptance of the new culture due to the lack of contact with society. Thus, the main goal was to integrate migrants and refugees with other backgrounds into the job market to go beyond social barriers and build openness for different cultures without prejudice or discrimination (Flindt, Magarian, & Hohl, 2021).³ The idea was to prepare interested students with the e-learning program *e-VELP* for giving or supporting voluntary (online) workshops. After learning about pedagogical methods and valuable knowledge about workshops, the participants must establish contact with suitable registered companies regarding content to realize their intention. The so-called host organizations are able to structurally integrate the participants on occasion through a work or training relationship.

More than 3500 registered users and over 330 host organizations support participants in making their knowledge accessible to interested students (TeachSurfing, 2022)⁴. However, user feedback has shown that the online learning tool has the following specific deficits (list not complete) (Garbauskaitė, 2022)⁵:

- The e-learning program is not personalized and not tailored to the didactical needs of the participants.
- The scope of the e-learning program is too large and therefore takes too much time.
- There is no possibility to ask questions, give feedback, or exchange with other participants independent of the learning content of the e-learning program.
- Many quiz units within the e-learning program steer voluntary learning.

The EU-funded follow-up project, “Young Refugees AI Student Empowerment Program” (*RAISE*), aims to optimize the existing e-learning program by minimizing the mentioned issues (Erasmus+, 2021)⁶. The new project's central requirement is to make the program more individual without changing the actual program. Thus, AI will be developed based on a query builder, which is supposed to capture the individual needs and abilities of the participants to build a customized learning plan.

AI and Machine Learning (ML) are already widespread in educational contexts, most prominently in tools that focus on developing participants' skills and testing systems (Marr, 2021). By using AI and its subset ML, educational programs aim to fill the gaps in contexts of learning and teaching and to enable schools and teachers to use the help of modern technology: AI can increase “efficiency, personalization, and streamline admin tasks to allow teachers the time and freedom to provide understanding and adaptability” (Marr, 2021)⁷.

To improve the mentioned deficits with implementing AI technology, the pedagogical experts of Heidelberg University of Education will consider different aspects that the AI can be built quite fitting due to the didactical need by the IT tech team: The implementation has to be precise and pedagogically well-founded, starting with critically examining the attempt to define e-learning and seeing different points of view and perspectives of pedagogical learning theories. The concepts of behaviorism, cognitivism, and constructivism differ in their perspective on the learning process and put forward different arguments. Comparing the different approaches and presenting the new idea of connectivism in this paper is interesting to develop a more comprehensive understanding of the information transfer to e-learning in general. The central topic of this article - optimization of an e-learning program by creating an AI-based questionnaire - will be defined after the theoretical analysis by explaining the research question, main goal, and methodology. Afterward, reference will be made to the presented follow-up project *RAISE* by first introducing the motives of the target group and then deriving demands for the implementation. Finally, the results of developing a questionnaire with the help of a query builder will be presented.

Theoretical background

Analysis of definitions and types of e-learning

Learning with digital tools is translated with the term e-learning, which has no clear definition yet because of the dynamic technological development. According to some authors who explicitly define the term, it can be described as a digital course or electronic learning experience, including different variants for teaching and learning purposes by using, for example, the internet or pre-recorded content in digital data carriers (Kumar Basak, Wotto, & Bélanger, 2018)⁸. Other definitions focus more on the technical-organizational context or an etymological-psychological interpretation: The term either focuses more on continuing technical education with the help of online programs or e-learning can be understood as "easy learning" or "effective learning" (Dichanz & Ernst, 2001)⁹. The definition of Flindt sets the focus on the actual learning scenario in that e-learning can be seen and emphasized as an independent area besides the usual learning forms like presence courses. It concerns e-learning as a new form of knowledge transfer and learning. The fact that the learning scenario must be interactive should help distinguish e-learning from mere collections of material downloaded from the Internet. This follows a definition tailored to the actual project: "e-learning is an interactive learning scenario primarily network-supported (internet and intranet)" (Flindt, 2005, p. 28)¹⁰.

Thus, depending on the conditions and research perspective, various definitions and synonyms of e-learning differ regarding understanding education, teaching, and learning with information and communication technologies (Sangrà, Vlachopoulos, & Cabrera, 2012)¹¹. Still, all definition approaches can be incorporated into the human-machine interface concept, as there are different technical gradations related to humans.

The current use of digital media in educational contexts shows that a spectrum has been established in which digital teaching-learning programs create hybrid forms from different definitions and use different ways of implementing e-learning (Gleason & Greenhow, 2017)¹².

Five types can be classified in ascending order of electronic input. To be able to classify the project correctly afterward, a short list of possible limitations of e-learning follows.

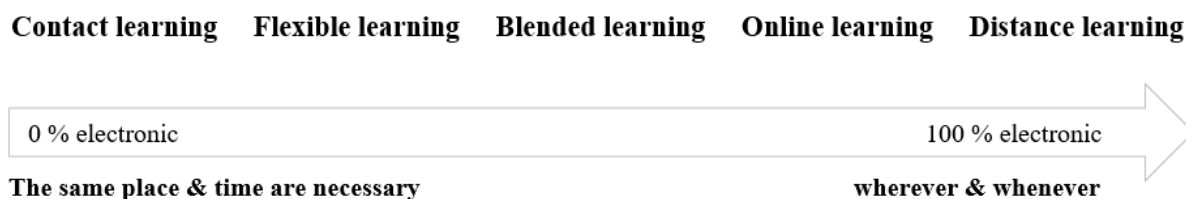


Figure 1. Limitations of e-learning

*Contact learning = Teacher and learner are at the same time and place together due to an educational setting.

*Flexible learning = Learning situation depends on different aspects of the teacher and learner. It can be synchronous, web-based, or at the same time and place.

*Blended learning = It combines face-to-face instruction with computer-media instruction.

*Online learning = It takes place via the Web using digital texts, graphics, animation, etc.

*Distance learning = It underlines the online learning process with a distance between instructor and learner

Own illustration (Bencheva, 2010)¹³

Connectivism and classic learning theories

Each definition of e-learning comes from different views of learning-teaching-mediations. There are various pedagogical structures and fundamental assumptions about such learning theories. The most representative paradigms are behaviorism, cognitivism, and constructivism, formed in the last century when technologies did not exist and focused on traditional classroom attendance. The models differ in their cognition and the details of the teaching-learning process (García Carreño, 2014)¹⁴:

Behaviorism was initially formed as a psychological theory but then adopted into the educational background. The thesis describes the process of how learning works in humans as a process with an external focus. From a behavioral perspective, students are subjects whose behavior and learning processes can be settled from different factors or stimuli. The response to the stimuli can be habituated using a positive or negative feedback mechanism. Because of these findings, many educational learning settings for adults use the main behavioral principle of “stimulus-response,” where the inputs can be programmed appropriately to reach the desired result (Chandrappa, 2018)¹⁵.

Cognitivism primarily attempts to explain the reception and processing of information. It is based on the idea that the students’ cognition has to learn and resolve issues simultaneously with individual information processing. In contrast to behaviorism, the theory claims that humans are

rational individuals who require active participation to learn and think with the components of input, processing, and output (Chandrappa, 2018)¹⁵.

Constructivism is mainly concerned with the internal process of humans and their sensations as information constructors. The learning process is designed so that a stimulus from objective reality gives rise to its sensory impression, which actively forms its subjective reality. These insights are used for academic learning scenarios to stimulate critical thinking, own opinions in dialogues, and critical questions. These activities show that humans can obtain knowledge (Chandrappa, 2018)¹⁵.

The theories indicate how humans learn in traditional educational contexts. For this reason, they can only be applied to digital knowledge acquisition to a limited extent because most classic learning concepts refer to the fact that learning usually happens through people (García Carreño, 2014)¹⁶. Based on the critical basic ideas of classical approaches in e-learning programs, Siemens developed a new pedagogical concept, which refers to learning with digital media (Siemens, 2005)¹⁷.

The so-called **connectivism** envisions people perceiving themselves as self-directed and connecting with others depending on individual learning needs and information sources. With content-related, technical, and cooperative networking, learners develop the competence to orient themselves in a "decentralized network" and to grow further with the help of concepts, theories, and opinions (Downes, 2022, p. 73)¹⁸. Thus, Siemens' focus is instead on the learning process of acquiring the skills for knowledge acquisition: "The ability to connect data and information sources and make meaning from that data is what it means to learn in the information world" (Utrecht & Keller, 2019, p. 110)¹⁹.

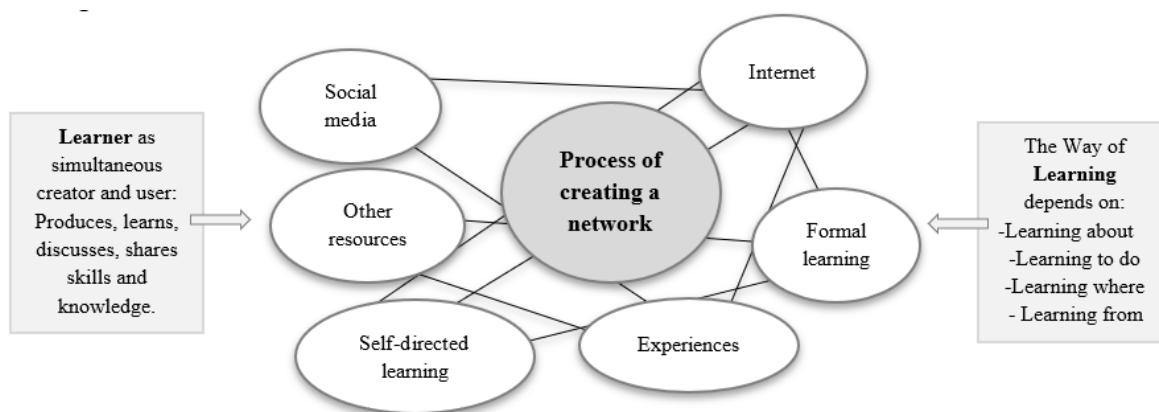


Figure 2. The process of creating a network based on the connectivism theory

Own illustration (García Carreño, 2014)¹⁶

Siemens' theoretical approach attempts to combine the fundamental elements of classical learning with modern technology. The focus is instead on the process of creating a network and not - as in classical learning theories - on the act of acquiring knowledge. Concerning *RAISE*, it can also be confirmed that the classic learning theories mentioned above transport many valuable contents; however, they cannot be transferred to the concept of e-learning without any gaps. Above all, the reference to independent and customized learning with digital technology and the ability of spontaneous learning processes regarding their knowledge is missing. Before considering the

problem in more detail, the research question, the goal of the analysis, and the methodological way will be presented.

Research question and the main goal

It seems that not all standards can be adopted from traditional learning theories for the development of e-learning programs or optimization processes, so the following research question arises:

“How to optimize an e-learning program for migrants and refugees with AI by creating a customized learning plan based on theoretical insights?”

The research question explores the extent to which a customized learning plan can be created for a particular group of learners and what pedagogical aspects must be considered. It should make the program more user-friendly and satisfy the users' needs. The learning plan is intended to save time and resources by using questions and test formats to determine which content needs to be learned for the e-learning program or which can be skipped. For this reason, the research question will be analyzed in detail.

Methods

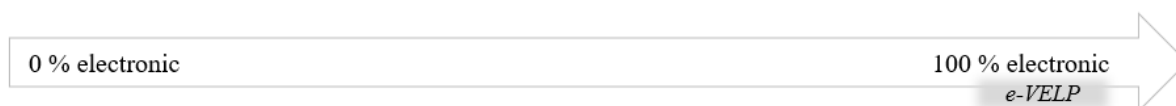
For improving the e-learning program *e-VELP* by creating a customized learning plan based on the pedagogical expertise of Heidelberg University of Education in collaboration with IT experts of the EU project, the main focus for the pedagogical experts is on the following activities: (1) Analysis of the original learning program and the target group, as well as (2) restructure the original e-learning program by developing a learning plan with AI.

This methodological plan aims to link theory and practice by elaborating on the key research findings for optimizing online learning and developing ideas for implementation: An analysis of the original e-learning program is based on comparing the theoretical research with the practical implementation of *e-VELP* to determine which aspects can be adopted and whether the theory transfer to the e-learning program was helpful. For this purpose, the different attempts to define e-learning and the descriptions of the classical learning theories of behaviorism, cognitivism, and constructivism will be cited and compared with the actual realization, or which aspects of the theory were taken over and which parts of it were target-oriented. Based on the results, conclusions can be drawn to what extent the new project can contribute to the optimization.

Analysis of the original learning program

Looking at the first version of *e-VELP* to gather insights for *RAISE*, in terms of the definitional approach to e-learning, it is noticeable that the current program is located in the segment with 100% digitality and independence of place and time for e-learning due to the pandemic. For a better understanding, the original project *e-VELP* gets now inserted into the already-known illustration.

Contact learning Flexible learning Blended learning Online learning Distance learning



The same place & time are necessary

wherever & whenever

Figure 3. Integration of original project *e-VELP* in figure “Limitations of e-learning”

Own illustration (Bencheva, 2010)¹³

Regarding the fact that e-learning can be seen as a way to create learning experiences with digital media, for example, by using the Internet or previously recorded content for the learning process, Volunteer Educators from *e-VELP* also need an Internet connection and previously produced content for their learning process. However, what is missing in this definition attempt for this context is that e-learning, according to Flindt (2005)¹⁰, can also be understood as a process of interaction and a new form of knowledge transfer. Thus, also in the context of the *RAISE* project, the imprecise definition search can be noted: On the one hand, the existing program corresponds to the more technical definition that e-learning is used as an electronic tool to gather learning experience. On the other hand, components of “easy” and “effective” learning can also be found that the process of walking through should be as simple and intuitive as possible and practical.

Regarding traditional learning theories, it is noticeable that some aspects of each learning theory can be found in online learning programs (Flindt, 2005)¹⁰. Thus, the most critical point of online learning is that many e-learning applications are based on behavioristic, cognitivistic, or constructivistic paradigms but are not grounded in theoretical frameworks for digital learning arrangements (Janelli, 2018)²⁰.

The behaviorism theory emphasizes that the person is passive in learning and controlled by external stimuli. To promote positive behavioral change within the learning process, the behaviorist paradigm advocates individual work with regular practice and repetition of misbehavior (Chandrappa, 2018)¹⁵. These theoretical insights of behaviorism can also be identified in *e-VELP*: Learning is often understood as a process of “walking through” within the chapters, and feedback tools or reward systems serve as a way to engage the participants. As defined by Skinner, the *frames* are tested with quizzes at the end of each learning process (Skinner, 1958)²¹, followed by immediate feedback on the performance, which is essential to walk through the next chapter. The learning material is usually acquired alone and without interaction and can only be presented in small-step learning units.

Additionally, there are limited possibilities for realizing the learning subject's ideas, motives, and goals. It is taken from the cognitivist theory that thinking is an individual process, and each person can form their own opinions and control their learning process individually (Mödrischer, 2006)²². Thus, in the original e-learning project *e-VELP*, there is no possibility to make connections to other contents to feel individual or to give space for their presentation of thoughts.

The reference to the constructivist theory shows that e-learning should be its construct of personal achievement in which each student manages their learning process individually, depending on their skills and competencies. The approach emphasizes that learning must be context-bounded, and the content has to be adapted to the learner (group) (Ertmer & Newby, 2013)²³

A transfer of constructivistic insights to e-learning is based on two aspects (Schulmeister, 2007)²⁴: On the one hand, the creation of motivating learning environments and, on the other side, the involvement of the learning group. About *e-VELP*, the second constructivistic claim, “involvement of the learning group,” can be perceived in parts: The program was designed for the target group of migrants and refugees and is, therefore, broad regarding knowledge transfer. Each participant is free to choose the topic of their workshop, with which they gain access to a host organization and possibly even experience structural integration. Because the e-learning program is based only on showing the participants how workshops can be held in a didactically prepared way, completely independent of the choice of topic. Nevertheless, the requirement - to integrate the learning group - is only fulfilled to a limited extent because the content and language are designed in a complex way.

In addition to analyzing the original e-learning program and its deficits, the participants' reasons for completing the e-learning program are also significant. Depending on their motives, the optimization can be more appropriate for the target group by implementing a *customized* learning plan.

Implementing a customized learning plan

Motives of the target group

Three central motives to participate in *e-VELP* can be derived from the theoretical migration and motivation research findings, which will be named and explained more precisely in the following:

1. Structural Integration into the European labor market
2. Intrinsic motivation to pass on knowledge and interest in education
3. Social participation

The **first motive** is a necessary base of social life for the target group. For immigrants and refugees, finding employment means creating opportunities and gaining status in the professional context and social environment (Heckmann, 2015)²⁵. For the mentioned research project, it is interesting to observe that refugees and young adults with a migration background are highly interested in structurally integrating themselves and intrinsically motivated to achieve high educational goals. Moreover, studies on the target group's academic level show that most refugees who want to settle in Europe have a significantly higher education level than the average resident population in their countries of origin (Kosyakova & Kogan, 2022)²⁶.

The initially described motive is connected to the **second motive**: It seems that many immigrants and refugees work in other sectors than they did in their country of origin. Regarding work-related activities, a short analysis shows that most immigrants and refugees work in the following branches (Worbs & Bund, 2016)²⁷: Gastronomy, packaging, logistics, and transport,

cleaning, food production, and sales, and most highly qualified immigrants and refugees work below their educational level.

There may be several reasons for this observation: One reason could be that those interested in an academic profession need better opportunities to prove their expertise since getting certificates and documents approved is challenging, especially in the case of regulated professions. Another reason for pursuing an underqualified career could be that the demonstrated qualifications do not meet a higher standard of education. Accordingly, a less demanding job is chosen to integrate structurally. Studies show that female refugees and immigrants have more difficulties in pursuing a profession in general than men: The employment rate of women is only 11,5%, whereas, for immigrant men, the rate is 49,8% (Worbs & Bund, 2016)²⁷.

Furthermore, the average level of education and labor market experience of female refugees or immigrants is also significantly lower than that of men. This often results in women - especially those with small children - rarely taking advantage of opportunities in the destination country, such as language acquisition, schooling, or vocational training, and only integrating structurally to a limited extent due to their lack of skills (Kosyakova & Kogan, 2022)²⁶. Participation in *e-VELP* is, therefore, of great importance for the target group, as it allows them to get in touch with their learned profession of the past.

The **third motive** is often described as a "multidimensional concept" comprising the capacity for social, cultural, occupational, and political participation within society (Xie, Cao, Li, Yang, & Yu, 2022)²⁸. As already explained, for immigrants and refugees, an employment relationship has the function of integrating successfully and enabling stable and long-term social relationships (Niemi, Manhica, Gunnarsson, Stahle, & Larsson, 2019)²⁹: The more demanding the work-related activity with correspondingly high qualification requirements, the more likely it is that personal integration with integrated natives will succeed (Becker, 2011)³⁰. Looking at the target group from a psychological point of view, social integration is the process of immigrants adopting cultural values and behaviors (Cormos, 2022)³¹. In addition to the workplace, informal social organizations can provide opportunities for immigrants and refugees to become familiar with the host country's cultural diversity and adapt to the culture through interaction. Optimizing the e-learning program *e-VELP* offers many opportunities to connect with other participants to meet the wishes and reasons of the target group.

In addition to analyzing the deficits, researching the target groups' motives can also help set demands for the new project *RAISE*.

AI-Demands for RAISE

Based on the analysis of the original e-learning program and its target group, specific demands exist for restructuring an e-learning program. The focus is on providing interaction possibilities, a self-directed design of learning paths, and integrating intrinsic motivation and practical orientation because the current program is still rigid in its implementation and cannot be used as participants wish. The mentioned deficits should be fulfilled with the help of AI elements.

The buzzword Artificial Intelligence gets more and more known, and also, in the context of e-learning, there is great potential to improve online learning platforms with this modern technology (Ivanov, 2020)³². In the context of e-learning platforms, it can be understood as "a

machine/system that possesses the ability to perform different tasks requiring human intelligence” (Neelakandan, 2019)³³. Based on that definition of AI, there are a few possibilities to improve digital learning by making it more engaging and intuitive (Ivanov, 2020)³²:

- **Personalized learning paths:** AI uses the participant’s data to create customized content based on their knowledge and skills to increase the participant’s motivation.
- **Creating new course content:** Using AI, course content can be made more efficiently, and depending on the tool, translating the content into other languages is possible.
- **Virtual assistance:** Depending on the e-learning context, providing participants’ answers in real-time can be helpful. Options like feedback tools, question buttons, or possibilities of contacting other users improve the learning process and can influence motivation or improve the feeling of belonging to a group.

The idea of a customized learning plan is based on actual results from neurodidactics to produce content that is designed to be exciting and memorable for the brain (Flindt, Magarian, & Hohl, 2021)³:

- Make it simple for everyone to follow
- Structure your content by setting learning goals
- Create interesting tasks
- Use exciting exercises for your learners
- Use suitable knowledge presentation
- Use online cooperation by giving feedback

Regarding the neurodidactic requirements of online learning, a central idea for optimizing the program is that AI elements will incorporate elements that enable the learning project to be more efficient and structured. In other words, the algorithm will use specific questions to determine which content needs to be studied and which can be skipped due to prior knowledge or skills. With the idea of developing individual chatbot-like statements, the user should feel supported and motivated at any time and always be aware of why they must work on the content (Erasmus+, 2021)⁶.

Results

The following chapter presents the practical implementation based on the previous analyses. The presentation is divided into two parts: First, reference is made to the motives of the target group, then the technical implementation is described based on the described context.

Building a customized learning plan based on target groups' motives

The central requirement, connected to the motive “intrinsic motivation and interest in education,” was to create more space for students' work and ideas, allowing them to think for themselves and not copy the supervisors' behavior. It should make the learning process more intuitive and thus increase the motivation to learn online (Alzain, 2018)³⁴. With the help of an online platform that considers professional interests and previous jobs, it should be possible that the target group can also work in the sector in which they have previously worked. In particular, the fact that women have more significant difficulties in integrating and finding a job should be considered. One supporting consideration is that childcare could be offered simultaneously as participating in *e-VELP* to create more free time for committed mothers. However, this consideration could not be

realized at this state yet and still needs concrete planning. All in all, the central result of this demand for “promoting intrinsic motivation and interest in education” is the development of a questionnaire that creates a learning plan which is tailored to the participant’s needs. Linked to the fact that thinking is an individual process, and each person can form their knowledge and control their personal learning process individually (Mödritscher, 2006)²², the existing structures and cognitivist ideas were incorporated but arranged in a more modern and intuitive way. With the help of connections to other questions and learning contents, the program should be designed in a resourceful and time-efficient way.

Another central demand was that the future e-learning program needs to create more opportunities for social integration and cannot be 100% electronic.

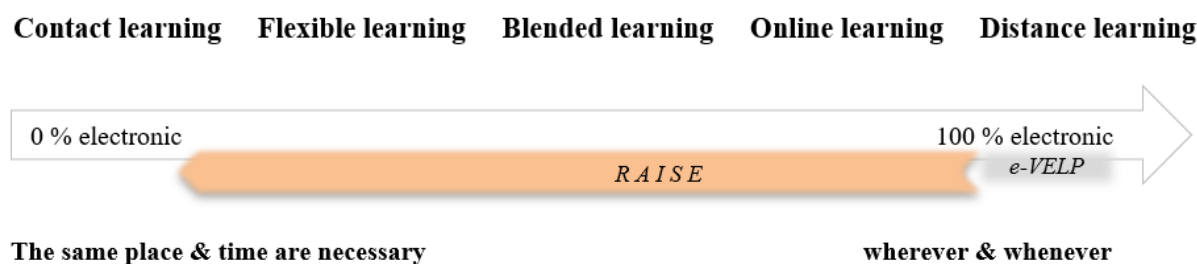


Figure 4. Integration of RAISE into the figure “Limitations of e-learning”

Own illustration (Bencheva, 2010)¹³

It is assumed that the demand for the reduction of digitality depends on how much the participants like to educate themselves on their own and whether they have a good command of English with which they can understand and process the content without external help. In addition, there is the aspect of time because many participants have limited time flexibility due to obligations (e.g., childcare). Accordingly, the arrow in the figure, which ranges from *online learning* to *contact learning*, symbolizes the imprecision of feedback.

Regardless of the percentage (0% to 100% electronic learning), it gets clear that the demand for social integration is widespread and consistent with theoretical findings regarding the motive of “social participation.” This follows the demand to create a platform where the target group can realize their interests and skills to achieve successful integration aligned with their previous experience.

From pedagogical insights to technical implementation

First, using questions and task formats, a query tree was designed to determine the participant's skills, interests, and background knowledge. The questionnaire was based on the content of the e-learning program *e-VELP*, which was divided into five central chapters with subunits.

In addition to a simple language design, pictures, various designs, and explanations were included to increase the participants' motivation. When creating the questions, there were different

options to implement: Yes-no-, multiple choice-, dropdown-, rating-, ranking-, and matrix format were used for this case.

The yes-no format was often used to get a first impression of the participant's knowledge and if the user knew the particular content. The other mentioned task formats can be optimally used to record the content-related knowledge of the participants: With the help of a question that asks about the content of one of the five chapters, it is possible to measure the competencies and background knowledge without the participants having to write themselves. The learner can efficiently decide the correct answer by choosing from various questions. On the one hand, this type of questionnaire helps reduce the required time; on the other hand, it became clear that the participants were partially aware of the content but could not express themselves adequately (Garbauskaitė, 2022)⁵. If the learner does not know the correct answer, an "I do not know" is possible.

The following decision tree shows the general structure of the questionnaire. Each chapter is structured similarly: The first unit of each chapter is constantly introduced by a yes-no question. Content-related tasks follow if they answered yes.

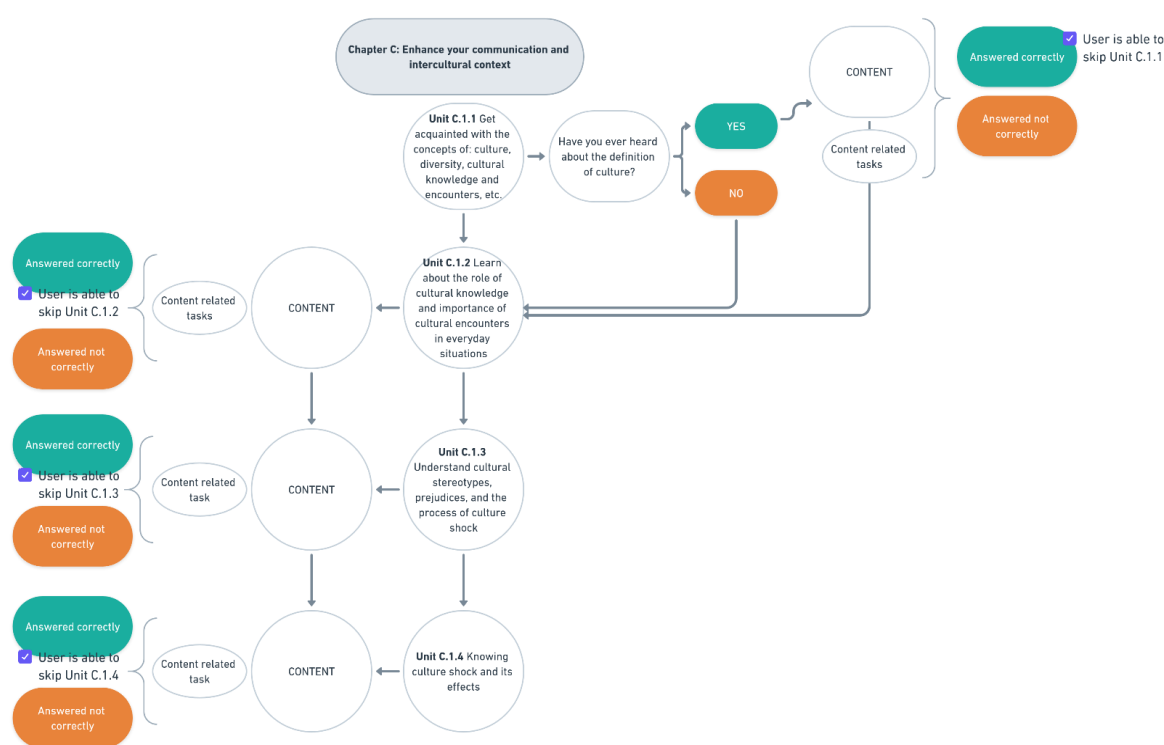


Figure 5. Exemplary decision tree of Chapter C

Own creation based on the e-learning programs content (e-VELP, 2021)³⁵

The example of the decision tree should help to understand the general structure. Thus, at least one rule is behind each question to process the user's input correctly and create the customized learning plan step by step. The following excerpt of the developed query builder should help understand Chapter C's technical background as an example. The described example and the stored

rules are not displayed to the user. The query builder just records the competencies depending on the user's input.

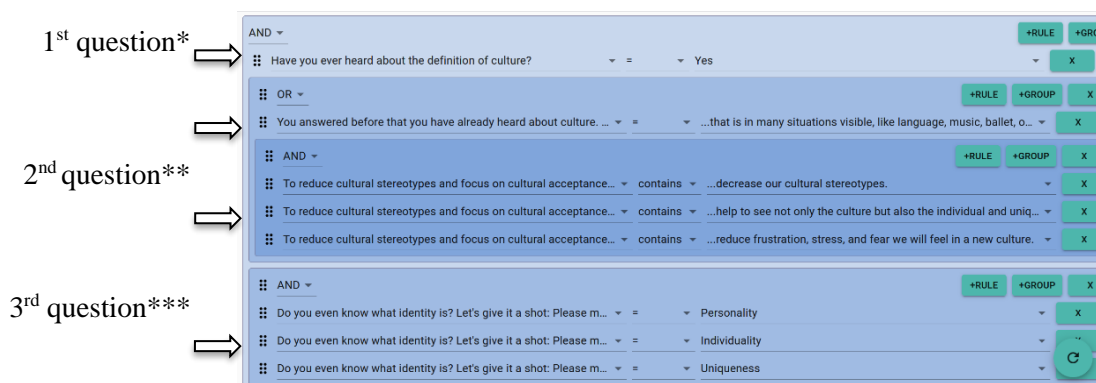


Figure 6. Exemplary rules of Chapter C

* Every user sees the first question.

** The second follows if the user answered the first question correctly.

*** The third question follows if the user answered the first question correctly. At least one (2nd and 3rd) must answer correctly to get the recommendation to skip the Unit.

**** The 4th question follows after the third and is also required to answer correctly to skip the unit in the end)

Own creation based on the e-learning programs content (e-VELP, 2021)³⁵

If the answer shows that the participant had heard about the definition of culture before (1st question: Have you ever heard about the definition of culture? = yes), other questions (2nd & 3rd question) were added, which dive deeper into the content and are supposed to find out how extensive the participant's knowledge is. However, if the participant told the system that the user had never heard of the cultural content before (1st question = no), the rule was set so that he did not have to answer any further questions about the content but was taught directly.

If at least three of the four questions are answered correctly, the user is advised to skip this unit. This procedure is used frequently depending on the unit, i.e., at least x of x+1 questions must be answered. This procedure ensures that the background knowledge is available and that the user has not merely guessed correctly to solve the question or task.

To summarize the results, the developed customized learning plan is based on automation. The tool is fixed on defined rules with the logic already described as an example. With the help of these rules, conclusions can be drawn about the skills and background knowledge of the participants, which in turn can be used to make recommendations for the learning experience. The automated system collects data from the participants using this procedure. It can present individually tailored results, but the developed tool cannot draw comparisons yet to other situations due to a lack of data. The current e-learning program is based on specific patterns that have been developed previously and have yet to reach the human level of intelligence.

Implications

Plans for the development of AI-based technology

To find out which ideas of the prototype can be adopted and whether the transfer to the e-learning program could be helpful, an evaluation will be conducted in which there will be the opportunity for participants to give feedback about the efficiency of restructuring the program.

To capture the difference, the participants will go through the content of the e-learning program twice: The first time without the optimization, i.e., without an assessment to record the background knowledge. The second time with the help of a customized learning plan, only the matching units depending on the background knowledge, need to be recorded. This procedure is intended to provide the most honest feedback of the participants. In addition, an informal questionnaire will be developed to provide additional space for individual comments, questions, or criticism to obtain insights into the target group's motivation.

Further AI-based technology

With the help of the Volunteer Educators' participation and its improvement based on the mentioned evaluation procedure, historical data from the current decision-making model must be collected to develop a "data-driven" decision-making model in the next step.

The further project aims to use the collected data to include AI in giving recommendations with the customized learning plan. This software will not only be a type of software that follows programmed rules but will also design decisions based on human thinking. The subset of AI, called Machine Learning (ML), will learn without fixed implemented rules because of its intelligence and ability to react to the participants' input (Bender, 2023)³⁶.

Regarding the customized learning plan of *RAISE*, each input of the participants will get stored and entered into the data-driven decision-making model. The more information the participants store, the more concrete the results of the AI software will be. Through this AI tool, the targeted migrants and refugees will get a more effective customized learning plan for their workshop topic by relating and analyzing the inputs and focusing on diagnosing large data quantities.

Conclusion

This paper shows that many different aspects must be considered when optimizing an e-learning program. In summary, online learning is a complex topic, but integrating AI can also bring many advantages for users and teachers. These include saving time and personalizing learning with the help of data-processing tools. To optimize an e-learning program with the help of AI, an analysis of the original program's processes, methodology, and didactics can help. In this context, it is essential to note that not all insights into these common learning theories from behaviorism, cognitivism, and constructivism can be adopted. The theories were developed for the traditional learning scenario without any digital input. The new approach from George Siemens aims to connect learning insights with online learning. The so-called connectivism considers that the learning process structure can shift through digital media and must be determined individually

depending on the context. Furthermore, it is advisable to consider the target group to consider any demands that may arise.

The presented EU-funded project *RAISE*, shall clarify that the developed query builder can provide a previously developed questionnaire with rules that are able to give information on the background knowledge and skills of the participants. After the execution, a customized learning plan is created, which can be used to make the original program more efficient. The current automation technology is based on rules set by IT experts and developed with the help of pedagogical insights. With the help of feedback collections, the program aims to become a data-driven decision-making model to analyze complex inputs from participants and learn from previous participants' experiences. For the future, it aims to recruit participants to store as much content as possible to analyze data quantities.

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