



Personalization of learning through pedagogical scenarios in adaptive e-Learning

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Abstract. Technology has transformed the way we learn and teach. With the advent of e-Learning, adaptive e-Learning is emerging as a powerful tool for personalizing the learning experience.

The recent emergence of pedagogical modeling languages for learning scenarios represents a first type of response to these new requirements, he propose the formalization of relationships between actors, resources, tools, and services. The aim is to model the design and development of personalized learning situations involving different users (learners, teachers, tutors, etc.). This article explores in depth the crucial role of pedagogical scenarios in the personalized e-learning process, based on the different types of learning activities that can be used to create a learning environment.

Keywords: personalization, modeling, pedagogical scenario, online scenario, pedagogical activity

1 Introduction

The advent of the digital revolution has redefined the contours of learning, offering new opportunities to adapt to the individual needs of learners. At the core of this pedagogical revolution are learning scenarios, organized structures that orchestrate the teaching-learning process. As a guiding framework, these scenarios are proving to be crucial elements in personalized e-Learning, particularly when we consider two fundamental axes: the type of activity proposed and the specific profile of the learner.

On the one hand, due to the emergence of new learning technologies, personalization refers to a pedagogical approach to teaching and learning, in the form of training devices that are personalized, adapted and aimed at different learner profiles [1].

On the other hand, Pedagogical scenarios correspond to teaching models, which are structured guides specifying the interactions between learners, resources and learning environments. They are used to define objectives, organize learning activities, select resources and assess performance [2], in adaptive e-Learning, which relies on the use of intelligent technologies to personalized the teaching process based on the needs and characteristics of each learner [3]. It relies on analysis and adaptation algorithms to propose content and activities that refer to the nature of the tasks or exercises proposed to learners, and in particular to ensure adaptation to the different learner profile, their

unique characteristics, such as skill level, learning preferences, interests and assimilation pace [4].

The use of a learning scenario makes it possible to monitor the learner's progress through the activities, in order to provide the appropriate assistance for the context and situation [5]. It explains the sequence of learning activities and how they fit together in a training sequence [6].

The aim of this article is to explore in depth how personalized pedagogical scenarios, taking into account the type of activity and the learner's profile, can optimize the online learning experience. We will highlight the benefits of this approach, and also propose personalized pedagogical scenario architectures according to each type of learning activity, in the third section we will describe the transition from architecture to modeling of an online pedagogical scenario. In the process, we will contribute to the evolution of adaptive e-Learning towards ever more personalized and effective forms of teaching.

2 Scientific context

In this section, we present the main concepts of our approach to personalized scenario architectures for different types of activities.

2.1 Main concepts

A. Personalization:

Personalization means that learners can choose what to learn, how to learn it, when to study it, and where to demonstrate their understanding of it with the flexibility and support of personalized learning. With regard to instructional methods, material, activities, objectives, and learning outcomes in particular, this flexibility and support is planned [7].

Personalization in the context of learning refers to the targeted, individualized adaptation of the learning experience to the specific characteristics, needs and preferences of each learner. This involves the design of personalized learning paths, integrating content, activities and teaching resources adapted to each learner profile [8].

This approach aims to optimize learning efficiency by taking into account factors such as each learner's skill level, learning styles, interests and individual goals. It relies on the use of intelligent technologies, data analysis algorithms and information systems to personalize content and interactions, delivering a more relevant and motivating learning experience.

B. Learning Activity

A situation designed by the teacher and offered to the student to assist in the achievement of a learning objective is referred to as a learning activity. The learning activity frequently involves one or more assignments. Each time a group of learners is chosen to complete an activity, there is a purpose in mind. Several factors, such as the strategy, the difficulty of the skill to be learned, the scheduling of the session, etc., can encourage this objective. In fact, by imposing a consistent overall structure on their activity, the school environment as a whole forces instructor to operate in a consistent way [9].

C. Pedagogical scenario

A pedagogical scenario is a planned structure that defines the interactions and sequences of activities between learners, teaching resources and learning environments. It offers a well-organized guideline for creating and carrying out a teaching-learning process. Pedagogical scenarios outline instructional goals, lesson plans, resource needs, and assessment and tracking procedures [10].

The design of teaching scenarios enables the creation of coherent, structured learning environments, facilitating the achievement of educational objectives.

D. Adaptive Learning

Adaptive e-Learning is an approach to e-learning that uses intelligent technologies to personalize the learning experience according to the specific characteristics and needs of each learner. It is based on the continuous analysis of data on learner behavior and performance, enabling content, pedagogical activities and resources to be adjusted to optimize learning effectiveness [11].

This personalized approach aims to offer personalized learning paths, taking into account factors such as each individual's skill level, learning preferences, interests and rate of assimilation.

2.2 The personalization of the pedagogical scenario

The implementation of personalization of personalized learning activities, or more precisely the pedagogical scenario, is a fundamental issue in adaptive e-Learning research. The approach of personalizing pedagogical scenarios according to the type of activity and the learner's profile offers a set of considerable advantages that positively influence the effectiveness and relevance of the e-learning experience:

- ***Optimization of Engagement***

By adapting learning activities to the learner's profile, we maximize their level of engagement. Learners are more likely to be fully engaged in their learning when they are confronted with activities that match their interests and skill level.

- ***Improvement of Knowledge Retention***

Personalized learning scenarios enable information to be presented in a way that is more appropriate and accessible for each individual. This promotes better knowledge retention and a deeper understanding of the concepts being taught.

- ***Learning Progression Management***

By taking into account the learner's profile, it is possible to adjust the pace of learning. Some learners may need more time to assimilate a concept, while others may progress more rapidly. This adaptability promotes effective learning for all.

- ***Improving learner satisfaction***

When learners see that their learning experience is adapted to their specific needs, they are more likely to feel satisfied with their educational journey. This fosters a positive perception of the learning institution or platform.

- ***More effective learning time***

By proposing relevant activities, we avoid losing time on content already mastered or, conversely, on tasks that are too complex. This maximizes the use of each learner's learning time.

- ***Developing independent skills***

Adapting activities to the learner's profile encourages the development of autonomous learning skills. Learners are encouraged to take charge of their own learning process, which is a valuable asset for their future educational path.

Pedagogical scenarios enable learning content to be adapted to each learner's skill level, interests and preferences. Using machine learning algorithms, the system can recommend specific resources, further reading or additional activities, ensuring an optimal learning experience.

Based on our work, we can define that a scenario fulfils two functions [1]:

- Monitoring the learner's progress during the activity and providing pedagogical assistance.
- Specification of activities that are specifically proposed to learners on ITEs (Interactive Educational Objects).

Today, open and distance learning (ODL) involves teaching organized in modules, with the content of each module consisting of various learning scenarios [12].

The module is composed of three systems:

- **An entry system:** This system initiates the learner to access the training module, by handling the flow of learners entering the module.
- **A learning system:** the body of the learning module, designed to respond to the learner's needs in terms of the tasks to be performed.
- **A system of output:** the system supervises the completion of the module and assists the learner in acquiring knowledge and mastering skills.

Based on research by [13], [14], [15], personalization is achieved by adapting the design of an educational scenario to different types of activity.

We illustrate the importance of personalization of pedagogical activities in teaching-learning practices in different learning situations. The activities we are proposing correspond to situational activity, conceptualization and evaluation.

3 Results and Discussion

We present personalized scenario architectures of pedagogical activities in this section, which illustrate different teaching approaches in various learning situations.

3.1 Scenario architectures for different types of activity

A. Situational scenario

We explore a situational activity, which presents a learning situation and diagnoses the learner's level of learning and knowledge before the activity begins. To propose a remediation activity, the teacher needs to identify the learner's strengths and limitations.

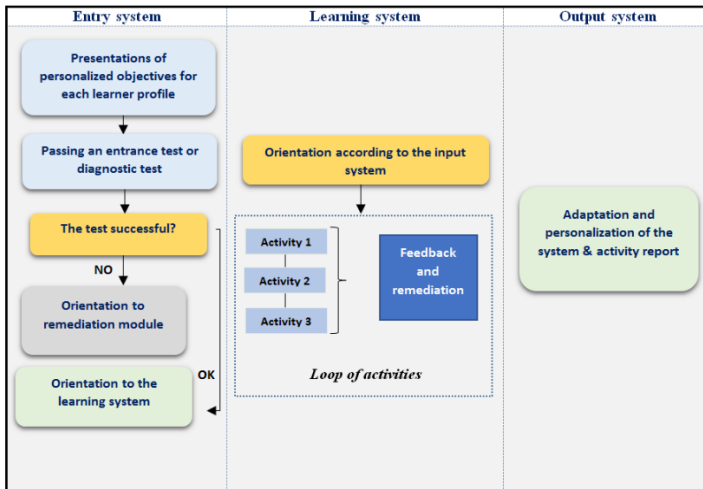


Fig. 1. Personalized situational scenario

Fig.1. illustrates the situational scenario with three systems:

- **The entry system:** By displaying personalized objectives depending on each learner's profile, the entrance system stimulates orientation toward learning. A pre-test is utilized at this point to identify the learner's gaps so that the learning path can be adapted to fit their unique needs and learning preferences.
- **The learning system:** contains all of the information, activities, and learning support features that are personalized to each learner's profile and help to structure learning.
- **The output system:** consists of implementing a post-test based on the results of which the system encourages the learner to move on to subsequent learning phases and activities at the end of the training.

B. Conceptualization scenario

We refer of a structuring scenario (inductive approach, deductive approach) in the structuring activity; this sort of scenario intends to encourage the construction of knowledge and skill development in the learner according to the approach he or she prefers.

- **Conceptualization scenario (Deductive approach)**

The deductive approach consists of starting from the general to the specific, and aims to present learners with a line of reasoning from the rule to its applications. The teacher first explains the rule in order to improve their memory and understanding.

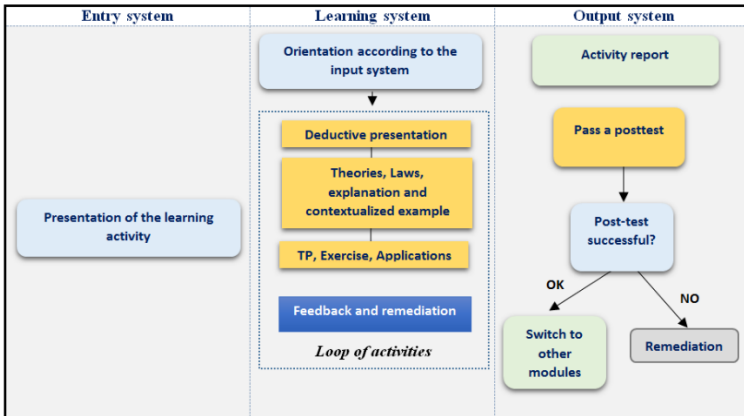


Fig. 2. Personalized conceptualization scenario (Deductive approach)

Fig. 2 presents the Conceptualization Scenario according to the Deductive Approach:

- **The input system:** describes the learning activity, its objectives, the requirements at the end of the activity, the knowledge and skills to be acquired.
- **The learning system:** provides a deductive process that involves activating learners' prior knowledge before teaching concepts, target notions, providing examples and counter-examples, placing learners into practice, and evaluating their learning.
- **The output system:** is an investigation of the conceptualization activity.

- **Conceptualization scenario (Inductive approach)**

The inductive approach is based on extracting concepts from concrete situations, which enables learners to promote learning and develop cognitive strategies.

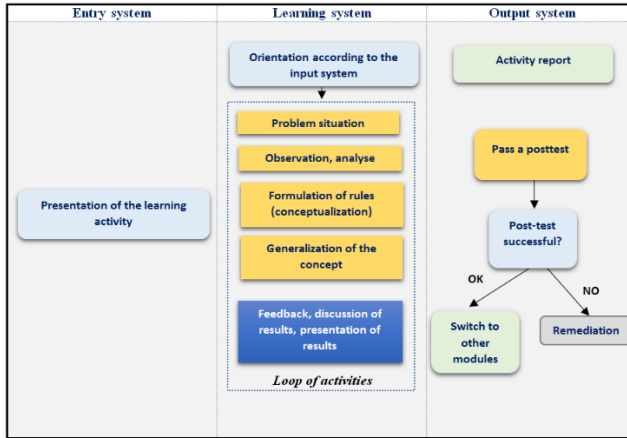


Fig. 3. Personalized conceptualization scenario (Inductive Approach)

Fig.3 presents the Conceptualization Scenario according to the Inductive Approach:

- **The input system:** presents the learning activity, its activities, the knowledge and skills to be acquired.
- **The learning system:** The learner analyses the situation by identifying its components, relating them, and finally forming an opinion about an issue they have created. A learning construction phase, a notion acquisition phase, and finally a re-contextualization phase, which emphasizes an iterative process by proposing situations to be analyzed, the transfer of notions, the use of learning, the verification of acquired knowledge, evaluations, in-class exercises, etc., characterize the de-contextualization phase. The de-contextualization phase is characterized by a learning construction phase, a notion acquisition phase, and ultimately the re-contextualization phase, which emphasizes an iterative process by providing instances to be analyzed. This system focuses on the completion of the work by each learner, followed by a discussion of the learners' results, and, ultimately, the interpretation of the results acquired in order to confirm the empirical data acquired and compare it with theoretical laws and principles.
- **The output system:** relates to a review of the conceptualization.

C. Evaluation scenario:

- **Formative evaluation**

Educational evaluation, in general, is a methodical means to examine a learner's level of understanding relative to a course objective or their overall performance. The two types of evaluation are summative and formative.

Formative evaluation is a continuous process that takes place during learning. Its main purpose is to provide feedback to learners and teachers in order to improve the learning process. Here are some characteristics of formative evaluation:

- It occurs throughout the learning process, often on a regular basis.
- It is used to diagnose students' needs, identify gaps and adjust teaching strategies.
- It is geared towards developing and improving skills and knowledge.

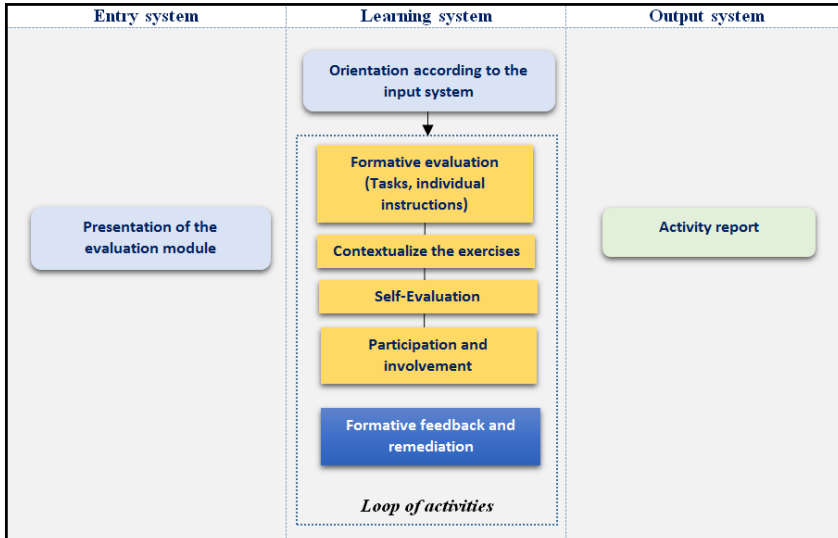


Fig. 4. Personalized evaluation scenario (Formative Evaluation)

Fig. 4 presents a personalized formative evaluation scenario:

- **The input system:** concerns the presentation of the evaluation activity
- **The learning system:** First, it suggests presenting the tasks that must be done and their unique instructions for every learner profile. The next steps are the learner's context and self-evaluation then involvement and engagement. In the final stage of this learning process, the learner's deficiencies are addressed and his or her learning is adjusted to the context and scenario.
- **The output system:** concerns a review of the evaluation activity.

- **Summative evaluation**

Summative evaluation takes place at the end of a given learning period. Its main purpose is to summarize what students have learned at a specific point in time, often at the end of a course or teaching unit. Here are a few characteristics of summative evaluation:

- It is used to assign a grade or an overall level of performance.
- It measures the extent to which learning objectives set in advance have been achieved.
- It is more formal and standardized than formative evaluation.

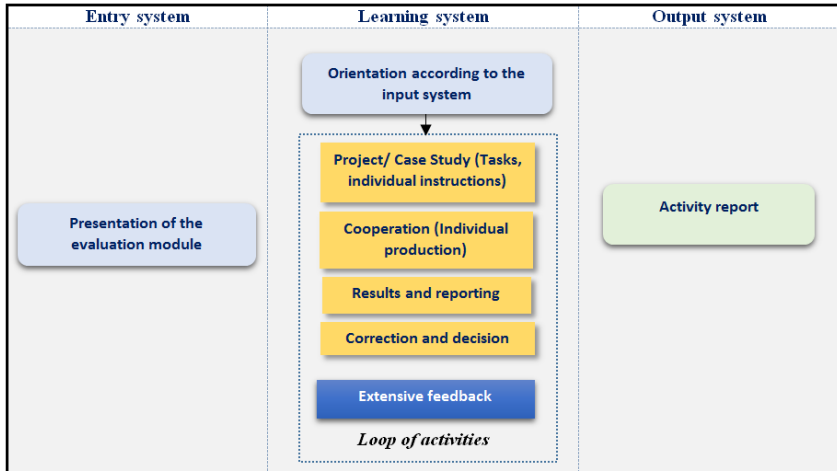


Fig. 5. Personalized evaluation scenario (summative evaluation)

Fig. 5 presents a personalized and summative evaluation scenario

- **The input system:** the presentation of the evaluation activity
- **The learning system:** At the conclusion of the course, the learner's knowledge and skills are estimated and evaluated. Before completing a synthesis and presenting the results, the learner must first present the project or case study that needs to be accomplished, defining the tasks that need to be completed and how they should be carried out—either cooperatively or individually. Finally, the teacher must suggest corrections in order to reach a judgment.
- **The output system:** Concerns an evaluation activity evaluation.
- The formative evaluation focuses on the continuous improvement of learning, while summative evaluation provides a global and often quantified assessment of knowledge acquisition at a given point in time. Both types of evaluation are complementary and have their place in the educational process.

The pedagogical scenarios allow learning content to be adjusted to each learner's skill level, interests and preferences. using algorithms for digital learning. Each learner has a unique learning style. While certain individuals like hands-on activities, others feel more at ease with readings or films. To satisfy the unique needs of each learner, pedagogical scenarios provide a range of activities.

3.2 Modelling a pedagogical scenario online

The process from scenario architecture to online pedagogical modeling is a key step in the design of effective, adaptive e-learning environments. It involves structuring the

interactions between learners, educational resources and virtual environments to promote optimal learning.

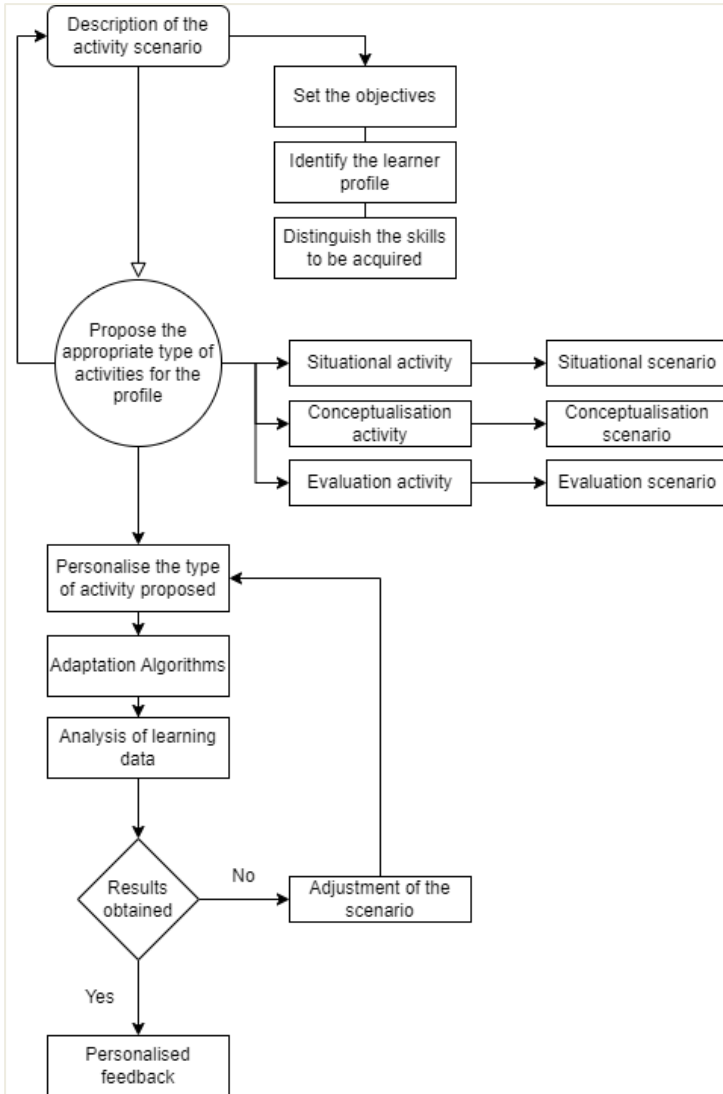


Fig. 6. A flow diagram modelling the personalized learning scenario process

The fig. 6 illustrates the modelling process for an online teaching scenario

- Describe the learning objective
- Determine the learner profile: Skill level, learning preferences, interests
- Propose the type of learning activity with its appropriate scenario
- Personalize the type of activity proposed by integrating automatic learning algorithms to adjust the activities in real time.

- Monitoring and Evaluation: Analysis of learning data with regular evaluations of learner performance and interaction.
- Continuous Readjustment: Adjustment of the scenario based on feedback and results obtained in the event of dissatisfaction.
- Feedback and Support :
- Personalized Feedback: Individualized feedback on the learner's performance and progress after the results are rated.

This personalized online learning scenario is designed to provide an optimal learning experience, taking into account the specific needs and preferences of each learner. It incorporates technological adaptation mechanisms to ensure effective personalization.

In a personalization approach, it is crucial to consider the specific context of the learner. This includes their current skill level, learning preferences, study environment and learning objectives. For example, a beginner learner might require more guided activities, while an advanced learner might benefit from more complex challenges [16].

Conceptualization involves creating pedagogical scenarios that incorporate a variety of activities relevant to achieving the learning objectives. It involves developing logical sequences of activities, taking into account the different learning styles, preferences and needs of each learner [17].

Effective evaluation must be built in to measure learning success. Personalization requires evaluation mechanisms adapted to each learner profile, ranging from formative evaluation to research projects [18].

The personalization of learning activity scenario architectures is an essential element in optimizing the learning experience. By integrating situational aspects, conceptualization and evaluation, we can create learning paths adapted to each learner. Pedagogical modelling provides a solid framework for designing and implementing these personalized scenarios in an effective and reproducible way. Pedagogical modelling goes further than simply planning activities. It is a systematic approach that integrates elements such as learning objectives, teaching resources, interactions and evaluation into a coherent structure.

4 Conclusion

Adaptive e-Learning offers enormous potential for personalizing the learning experience and thus improving results. Pedagogical scenarios play a central role in achieving this personalization, providing flexible frameworks for designing courses tailored to each individual. By integrating good design practices, educators can fully exploit the potential of adaptive e-Learning to deliver an enriching and effective learning experience.

In this article, we have presented our scenario architectures demonstrating the importance of personalization according to the different types of pedagogical activities in the teaching-learning practices in the different learning situations without taking into consideration the discipline, or the concept created. In the context of this study, we want

to investigate instructional management system learning design (IMS LD) with pedagogical modeling. In order to construct a personalized and adaptive learning system in our future work.

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