(RESEARCH ARTICLE)

Personalization of an educational scenario of a learning activity according to the learning styles model David Kolb

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Abstract

The personalization of learning remains a very important subject in research particularly with the progression of technology, it refers to a pedagogical approach that is located in an intermediate space where teaching and learning come together with devices personalized and adapted training courses for the different learner profiles in a social learning context. We offer a general approach to the personalization of teaching scenarios during the different types of teaching activities and taking consideration the learning styles of the learners and based on the Kolb learning style model. Our research work aimed at developing a personalized and adaptive learning system to meet the needs of learners and adequate with their preferences and profiles all throughout the learning process offered by the system by making a correspondence with the suitable pedagogical scenario with each profile and each activity.

Keywords: Personalization; Educational scenario; learning style; Teaching activity; Adaptation

1. Introduction

Nowadays, there are many solutions for the realization of adaptive and personalized learning platforms. On the one hand, most of these platforms focus on adjusting the learning path. By doing pre-tests to learners and depending on the results obtained, the system offers a personalized learning path, so that the content can be adapted to their individual needs. On the other hand, we find solutions that focus on adjusting the pace and style of learning. A large number of recent Adaptive Learning platforms are based on Big Data, artificial intelligence, ontologies, etc.

Personalization goes further in an environment where both the learning objectives and the content, the teaching method and the rhythm vary according to the choices of the learner [1].

Based on the research on personalization, this article focuses on the presentation of a general architecture of a pedagogical scenario during a learning activity, in this regard our approach tries to overcome the personalization of the content based on the types of pedagogical activities and by creating for each its educational scenario taking into consideration the learning styles of the learners in order to meet their needs. Our approach corresponds to a pedagogical concept whose purpose is to adapt pedagogical decisions to the specific skills and needs of each learner in a training system. Our article is organized as follows: section 2 presents our scientific context of the research of which we will present the main basic concepts, section 3 presents in detail our proposed approach.

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2. Theoretical framework

2.1. Personalization

Personalization is a conception of systematic learning that focuses on adapting teaching to learners. Personalized learning provides flexibility and supports: what, how, when and where learners learn and demonstrate mastery of knowledge. More specifically, these flexibilities and supports are designed in terms of pedagogical approaches, content, activities, objectives and learning outcomes. Personalized learning systems often leverage technology to improve access to adaptive and personalized learning for all learners [2].

Personalization is based on the collective and cooperative dimension of learning. It is less interested in the unique peculiarities of each individual than taking advantage of the functioning of a group. Personalizing one's teaching means above all seeking to meet the identified needs of groups of learners [3, 4].

2.2. Educational Activity and Educational Scenario

The educational activity refers to the operations that the teacher implements to make the learners learn and concerns the organization of the content of the learning situations, how to structure and present the learning situation, the learning tasks, the questions and the instructions offered, the learning assessment procedures, etc. [5]

The educational scenario consists of two other scenarios: learning scenario and assistance scenario, and consists in describing the activity or activities specific to learning and assistance, the resources required for a realization of the activities and the productions that should be the result [6]. A learning scenario is a "collection of activities destined for learners and organized into a coherent whole; to these activities, we add the instruments offered to support the activities and the instruments to be produced by the learners [7].

An educational scenario presents a learning activity initiated by a teacher to guide the learning of his students. An educational scenario presents an approach aimed at achieving educational objectives and acquiring general or specific skills linked to one or more disciplines. It presents a learning activity, realized by a teacher in order to supervise the learning of the learners [5].

In a scenario, there are objectives, a schedule of the learning activity, a timetable, a description of the tasks of the learners, evaluation methods which are defined, arranged and organized during a process of the learning conception phase [8].

A pedagogical scenario is the result the process of designing a learning activity, and taking place in a given time and culminating in the implementation of the scenario [9].

"A pedagogical scenario is the course of a learning activity, the definition of the objectives, the planning of the tasks, the description of the tasks of the learners and the methods of evaluation" [10].

The Pedagogical Scenario is part of the training device which describes the course of a pedagogical activity. It corresponds to the design of a learning activity.

Indeed, the scenario will facilitate the learning of learners and the work environment as well as the exploration, the search for information, the objective of a scenario and to identify the errors of a learner and provide him with feedback appropriate.

According to Khaldi and his collaborators in 2020, they offer 4 types of activities that were used in order to design a pedagogical scenario for a learning situation [5].

- **Situational activity:** concerns the situation through engagement and initiation;
- **Structuring activity:** concerns the learning activity through a conceptualization, an experience, an exercise, a problem or a project;
- **Objectification activity:** concerns reflective objectification, where awareness and appreciation of what has been learned with the previous step takes place;
- **Transfer activity:** concerns reinvestment through the transfer of skills and the demonstration of skills.

2.3. Overview of the new pedagogies

The personalization of learning activities is a fundamental problem in research on personalized adaptive hypermedia systems, educational practices constitute the source of the implementation of personalized learning activities or more precisely the personalization of educational scenarios based on different types of pedagogies [11].

The new pedagogies take up a major challenge: giving meaning to knowledge without giving up making it accessible, in order to make it accessible [12, 13].

According to Perrenoud, in 1996: "To differentiate is to break with frontal pedagogy, the same lesson, the same exercises for everyone; it is above all to put in place an organization of work and devices that regularly place everyone in an optimal situation. This organization consists in using all the available resources, in playing on all the parameters, to organize the activities so that each pupil is constantly or at least very often confronted with the didactic situations most fruitful for him". To practice a differentiated pedagogy, it is essential to implement a varied and diversified methodology in order to lead each learner as far and as high as he can go or reach [14].

Differentiated pedagogy consists of taking into consideration the heterogeneity of learners at the level of the learning outcomes of learners, modes of thinking (convergent, divergent, creative, concrete, abstract, etc.), motivation, creativity, channels of communication...

Differentiated pedagogy, according to Przesmycki is "a pedagogy based on the differentiation of the learning processes" of the learners, and which, to be carried out successfully, requires, on the part of the teacher, a diversified organization of the learning processes. It is an individualized and varied pedagogy [15]. According to Cousinet, we must promote group work to organize interactions. It implements explicit and diversified learning so that the students can work by following their own path while remaining in a collective approach of required teaching. Its purpose is the fight against academic failure and its objectives are to enrich social interaction, improve the learner / teacher relationship and learn autonomy through the development of imagination and creation, with the aim of facilitate understanding [16].

In-depth studies in educational sciences led to the consideration of differentiated pedagogy as a variant of "mastery pedagogy". It was Bloom who was the first to lay down the principles of such a pedagogy in Chicago around 1971-1974, mastery pedagogy is based on the temporal framework of learning by taking objective information before and after its process, focusing on cognitive and affective data. It tries to put these program contents within the reach of individuals whose cognitive and affective characteristics are known before the educational action. The action having been carried out under suitable conditions, we seek to know objectively the results obtained with a view to a possible resumption when the educational action has not obtained the desired results [17].

2.4. The Learning Style

Learning styles focus primarily on the characteristics of the learner. When learning situations are taken into account, which is not the most frequent case, they are mainly described from the learner's point of view, in terms of the content to be acquired and the presentation supports for this content [18]. Learning styles reflect how a learner acquires, retrieves and maintains information in characteristic and collective ways [19].

A learning style is the approach taken by a learner to achieve a learning outcome.

"Learner prefer to take and process information in different ways: seeing and hearing, thinking and acting, reasoning logically and intuitively, analyzing and visualizing, regularly and in spurts" [20].

"Learner begin to focus, process, internalize and retain new and difficult information" [21].

Kolb postulates that learning is the major determinant of human development, and where each individual learns the course with their own way of promoting their learning style [22].

The learning style corresponds to a set of characteristics of the learner in relation to a certain number of dimensions each to factors that can be at the origin of individual differences in the learning context. Each of these elements acts in its own way while forming a functional whole with the others.

Kolb is the first to adopt an experiential learning style model, he then influenced the construction of other models, in 1984, Kolb in his work titled "Experiential Learning" essentially sets out the principle that a person does his learning

through discovery and experience [23]. It postulates that anyone in a learning situation goes through a cycle of four phases.

According to Kolb's model, the learner evolves on these continuums according to his apprehensions but also according to his preferences to process or perceive information. Kolb considers that it is preferable to learn according to a cycle allowing to experiment the four modes of learning in order to fully understand a subject. However, he also observed that each person in general prefers a phase of this cycle. The cycle of learning phases. Concrete experience of an action / idea - Observation in a thoughtful and attentive way - Abstract and theoretical conceptualization - Application of the idea / action according to the initial [24].
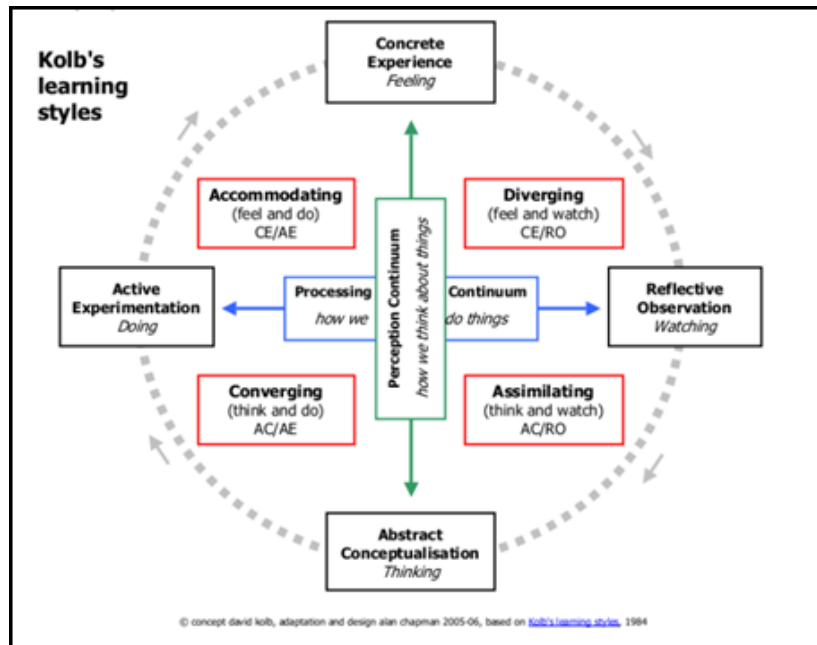

Figure 1 Learning styles according to Kolb

By combining two to two of the four adaptation modes, Kolb forms four learning styles according to the style preferred by the learner [25].

2.4.1. The divergent style

This type of learner prefers the phases of concrete experience and reflection on this experience. The divergent ones are characterized by:

- An interest in people and emotions;
- A sense of observation;
- Perception of objects or problems from different angles;
- Appreciation of innovative activities;
- A fertile imagination and varied interests.

2.4.2. The assimilator style

This type of learner prefers the phases of reflection on an experience and of abstract and theoretical conceptualization of an experience. Assimilators are characterized by:

- Creation of theoretical models;
- Less interest than others in people and practical applications of knowledge;
- Logically rearranges information, juggles ideas and theories.

2.4.3. The convergent style

This type of learner prefers the phases of abstract and theoretical conceptualization of the experience and implementation of the idea / action. The convergent are characterized by:

- Be practical and tend to be unemotional;
- Deal with things rather than people;
- Solve problems therefore the solution is unique;
- Ease of technical tasks and decision making.

2.4.4. The accommodator style

This type of learner prefers the phases of concrete experience and the implementation of the idea / action based on this experience. The accommodators are characterized by:

- Easily adapt to new experiences and tend to find solutions;
- Learn by manipulation, by performing tasks;
- Involved in planning and carrying out activities;
- Learn by trial and error;
- They tend to trust the thoughts of others rather than their own analysis;
- Easily accept to take risks.

Table 1 presents the learning strategies (learning content, homework, test and communication, method) appropriate to each learning style of the Kolb model.

The following table gives us the teaching strategies adapted to Kolb's learning styles model [26].

Table 1 Pedagogical strategies adapted to the Kolb learning styles model

Learning Style	Training Method	Educational Content	Exercise	Test	Communication
Converging	• Expressing concepts with practical examples • Expressing a solution for each example step by step	Text file	Complex individual exercises	Running a project or solving a problem individually	Asynchronous discussion
Diverging	• Expressing concepts generally • Trying to make a connection between concepts and different topics	Image file Summary text file	• Providing a new solution to the problem • Identify the relationships between concepts and construct relational mappings • Group exercises • Need to practice in each session	Running a project as a group	Synchronous group discussion

Assimilating	Expressing concepts and topics by parts	Image file	Analytical exercises No need to practice in each session	Written analytical reasoning tests	Asynchronous discussion
Accommodating	• Expressing concepts and start training with a question and link it to practical examples aimed at engaging the learner with problem- solving and expressing ideas	Audio file	Providing a new solution to the problem Group exercises	Running group projects	Synchronous group discussion
Converging & Assimilating	• Expressing concepts and start training by parts	Text file	Individual exercises	Solving questions analytically	Asynchronous discussion
Diverging & Assimilating	• Expressing concepts and start training with a thoughtful question	Presenting using PowerPoint with an audio file	Multi-section exercises and completing each section by a learner	Providing a solution to a problem and analyzing the proposed solution.	Synchronous group discussions. Communicating with the teacher.
Converging & Accommodating	• Expressing concepts with practical examples of them	• Text file with an audio file of the content (for interested learners)	Expressing real-world applications of concepts discussed in each session	Running a project	Synchronous group discussion Communicating with the teacher
Diverging & Accommodating	• Expressing concepts and start training by outlining a problem and expressing ideas for solving it	Audio file Text file	• Providing a new solution to the problem • Group exercises	Running a project as a group	Synchronous group discussion

Kolb's experiential learning theory synthesized Dewey's educational philosophy with Piaget's genetic epistemology. Much of this theory concerns the internal cognitive processes of the learner, knowledge of which is always linked to experience [27].

To determine a learning style, he puts the four main learning styles (the divergent, the assimilator, the convergent and the accommodator) in a Learning Style Inventory, LSI which is a questionnaire of 80 elements that identify the learning styles of each learner [28].

3. Personalization according to the Kolb model

On the basis of the proposals of our theoretical framework, concerning the definitions of personalization, the pedagogical activity, the pedagogical scenario, the new pedagogies and the learning style.

Personalizing the learning environment makes it possible to consider educational content and materials for learners according to their abilities and preferences, which will lead to increased motivation and efficiency, as well as the identification of preferences and learners' learning styles correspond to a subject necessary to ensure personalization in e-learning environments [26].

One of the reasons for using learning style models is belonging to the significant relationship between learning style and learner performance in learning environments [29, 30]. Most of the learning styles have been developed to allow learners to be classified into a specific group, personalization is a process that emphasizes the process focused on learning and the learning style of learners who is the determining factor in improving any learning process [31].

After identifying the learning styles preferred by the learner, our work is to design teaching scenarios that correspond to their styles during a learning activity.

Through this work, and on the basis of the works cited, we propose the development of scenarios according to the type of activity and according to the 4 learning styles of Kolb.
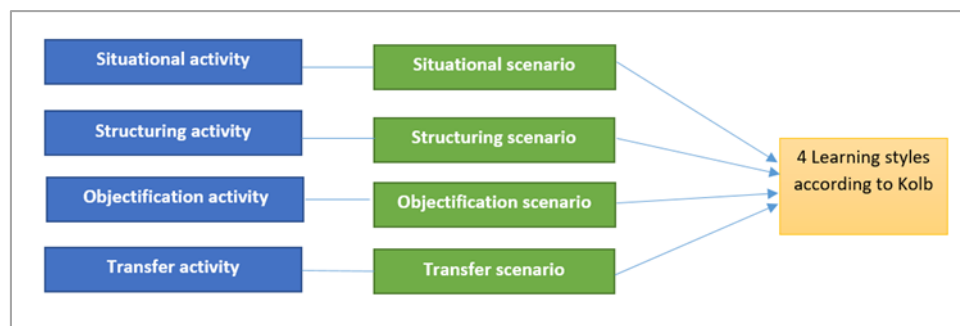

Figure 2 Types of activity and scenarios according to Kolb

This figure (Figure 2) presents scenarios adapted to the type of learning activity and taking into consideration the 4 Kolb learning styles in each step of the learning process.

3.1.1. Situational Activity

 In this activity we propose a situational scenario whose role of the teacher is the establishment of the learning situation by the definition of general, specific and intermediate objectives as well as the disciplinary and transversal skills to be acquired by the learner, in this type of activity, the situational scenario is a common scenario with the 4 learner profiles proposed by Kolb (divergent, assimilator, convergent, accommodator), the result of which is:

- Appreciation of the activity by the different learner profiles;
- Involvement in planning and carrying out activities;

3.1.2. Structuring activity

In this activity we propose a structuring scenario which links the structuring / experimentation activities (deductive approach, inductive approach), the objective in these activities is to promote the construction of knowledge and its use in the development of skills of the learner, learner chooses his own approach for the construction of his knowledge: the deductive approach (logical deduction, going from the general to the particular), and / or the inductive approach (going from the particular to the general), according to Table I presented in the first part, we can deduce that in a structuring

/ experimentation scenario, the structuring of knowledge differs according to the learner profile and his own learning approach, in other words:

- **The divergent** prefers a deductive approach conducted with the phases of concrete experience, in order to establish a link between the concept and the different subjects.
- **Assimilator** prefers an inductive approach with the reflection on an experience and abstract and theoretical conceptualization of an experience by part.
- **The convergent** prefers a deductive approach with the abstract and theoretical conceptualization of the experience and application of the idea / action.
- **The accommodation** prefers an inductive approach concrete experience and implementation of the idea / action based on this experience.

3.1.3. Objectification activity

The objectivation scenario proposed in this level aims to mutualize and generalize the results obtained during the structuring / experimentation. In this step all the learners promote a learning process by making a coherent assembly of all the objectives achieved in order to generalize the results.

3.1.4. Transfer activity

In this activity, we propose a scenario which concerns the transfer and reinvestment of knowledge in a context other than that of learning and at the same time the remediation to overcome certain learning difficulties faced by the learners. Learners generalize their knowledge and overcome certain learning difficulties, by promoting on the one hand the building of links and the adaptation of learning in real situations.

The following figure offers us a general architecture of a learning situation.
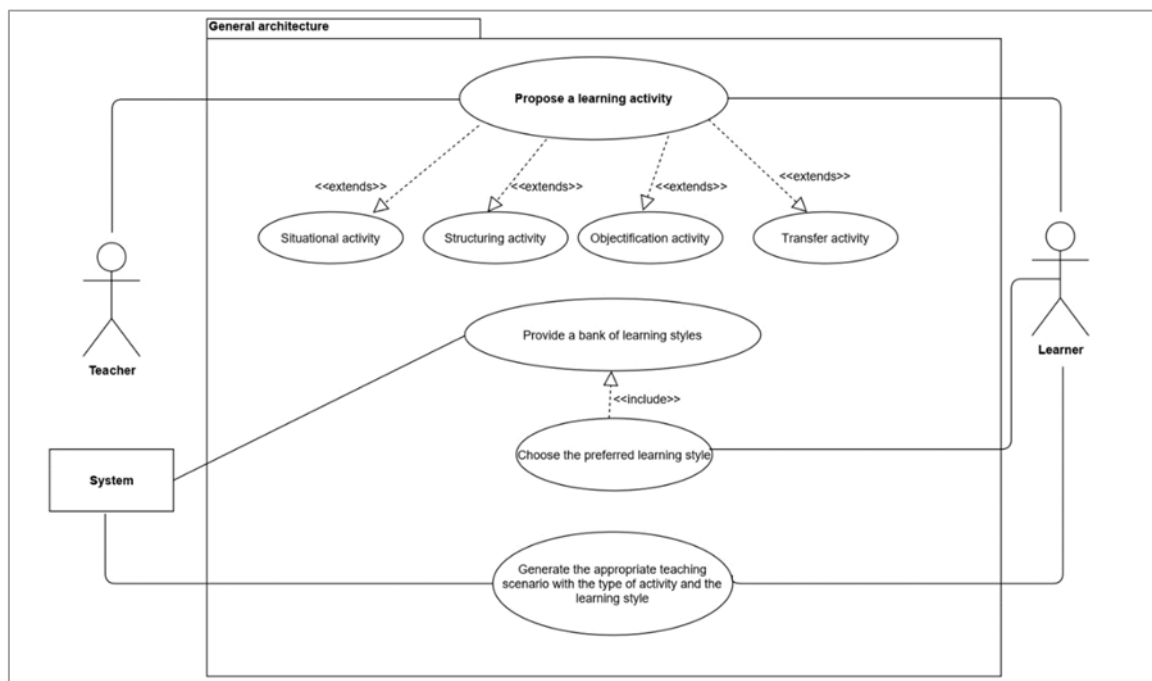

Figure 3 General architecture of a learning situation

To propose a pedagogical scenario requires an arrangement of knowledge around the content of a learning situation as well as the models and the teaching / learning strategies proposed in the different types of activities in order to assimilate the appropriate scenario with the type of activity and the profile of the learner. In figure 3 we propose a use case diagram which emphasizes our own architecture of a learning situation as well as the interaction with the different actors: Learner, Teacher and System that we intend in the future in our next work to experiment with this approach in the context of personalized adaptive learning.

4. Conclusion

In this article, we have presented our approach to set up pedagogical scenarios for each type of activity and taking into consideration the learning styles proposed by Kolb. Indeed, the scenario will facilitate the learning of learners and the work environment as well as the exploration, the search for information, the objective of a scenario and to identify the errors of a learner and provide him with feedback appropriate.

The proposed approach is based on a pedagogical framework which consists in personalizing the different learning scenarios according to each learner profile determined by the model of the learning styles adopted by Kolb. In the perspective of this work, we plan to create adaptive scenarios in order to develop a personalized and adaptive system.

Compliance with ethical standards

Disclosure of conflict of interest

Anoir Lamya, Zargane Kawtar, Erradi Mohamed, Khaldi Mohamed declare that they have no conflict of interest.

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