Towards the process of adapting the concrete and the abstract through learning activities according to Kolb's styles in online teaching.

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Abstract. In the context of experiential learning, which has developed around the concepts of experiential learning according to the theory of David Kolb, this theory postulates that learning can only take place when a learner experiences the information that he or she has been given or discovers during an experience. In other words, it is through action that learning takes place. The purpose of this paper is to contribute to the development of a learning activity architecture that matches the learning style of each learner in online education. The study explores how Kolb's four learning styles (convergent, divergent, assimilative and accommodative) can be integrated into online learning activities. The aim is to improve learner engagement, performance and success. Our work highlights the importance of considering learners' learning styles in the design and delivery of e-learning activities. First, we address the dimension of perception (concrete and abstract and vice versa) using two inductive and deductive methods and in a practical way within the framework of modular teaching. Finally, the other dimension of processing (active experimentation and reflective observation) will be presented in a future article.

Keywords: Kolb's learning styles, concrete and abstract, concrete and abstract activity architecture.

1 Introduction

Learners differ in their thinking styles and modes of creative expression. According to research these differences focus on personality-related behaviour, information processing and organization, learner preferences and social environment, ... In order to address individual differences, it is important to take these factors into account and to choose activities that can accommodate a variety of learning styles (Bonham, 1987; Curry, 1990b; Riding and Rayner, 1998). [1][2][3]. The aim of our work is to propose an architecture of learning activities according to learning styles based on the Kolb cycle.

In our approach, we are interested in Kolb's theoretical model, which postulates that learning can only take place when a learner experiences the information that he or she has been given or discovers during an experience. In other words, learning develops through action and experiential learning developed around the notions of experiential learning (Balleux, 2000) [4] . This article consists in proposing an architecture of learning activities according to the concrete-abstract process that we detail in the theoretical

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framework and present the framework of activities for each style and to have a synthesis of how to teach its two main concepts through two approaches inductive and deductive according to Kolb in online education.

2 Theoretical frameworks

Our research work is designed to deepen the knowledge of Kolb's learning styles and to identify how his integrated styles in activities can be used to improve learning performance. The theoretical study explores experiential learning, its foundations, the Kolb cycle and then the concrete and abstract extracted from the cycle which will form the basis of the practical study.

2.1 Experiential learning

Experiential learning, or learning from experience, is a teaching model inspired by the socioconstructivist current, based on Kolb's model, where experience is involved throughout the learning process. According to Legendre R. (2007) [5]. Experiential learning is a model of learning that advocates participation in activities in contexts that are as close as possible to the knowledge to be acquired, the skills to be developed and the attitudes to be formed or changed. Donald Schön (1983) [6]. To suggest that the learner develops knowledge not by applying theory to practice, but rather by a dual process of reflection in action and reflection on action.

2.2 Curry's learning style model typologies

A reading of the numerous writings on learning style quickly reveals the plurality and diversity of definitions of the concept of learning style and refer to: characteristic ways of acting, predispositions or preferences that relate to teaching and learning contexts; information processing processes and personality characteristics.
According to Curry, (1983) [7]. The different learning style models are grouped into three typologies:
- Learning style models that focus on preferences for teaching and learning conditions. Crasha and Reichmann (1975) [8].
- Learning style models which look at how the learner processes information, in terms of preferred means. Gregorc (1979) [9]; Honey and Mumford (2000) [10]; Kolb (1984) [11].
- Learning style models that deal with the personality of the learner. Kagan, Rosman, Day, Alpert and Phillips (1964)[12]; Myers and Briggs (1962)[13]; Witkin (1976)[14].
Our work is based on the fact that each learner has the time and opportunity to learn according to the four styles presented in Kolb's cycle, which avoids putting them in situations where they have to adapt. There are several similar works that evoke learning styles as criteria for adapting online courses without detailing the activities and tasks that allow this adaptation to be carried out, whether from the point of view of design or development. So, these issues have allowed us to contribute to the elaboration of an architecture of activities according to a scenario accompanying the learning cycle in its entirety.

2.3 David Kolb's experiential model

According to a global analysis of studies on learning styles and according to Kolb's theory, learning is a process of adaptation of the individual to the environment, Kolb considers that learning is complete only when these four phases are experienced. Kolb's experiential learning is organized into four phases: concrete experience (Experimentation), reflective observation (Reflection), abstract conceptualization (Reasoning) and active experimentation (Putting into practice), Each of these phases corresponds to a distinct way of using one's experience, Figure 1 illustrates Kolb's model, From Kolb (1984) [15]

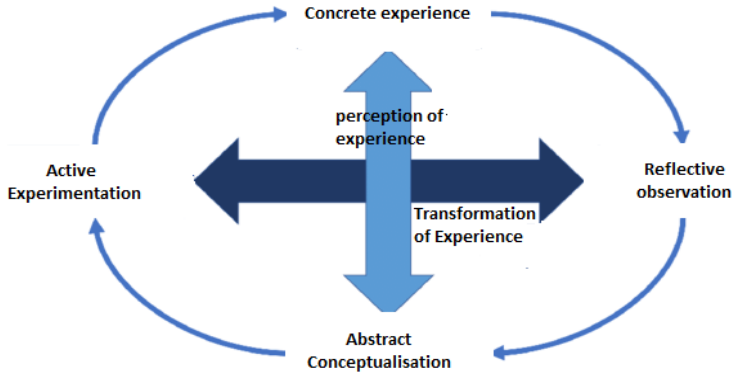

Fig. 1. The experiential Learning cycle and basic Learning styles (Kolb, 1984).

According to Figure 1, Kolb's model, the experiential cycle begins with concrete experience (concrete mode) followed by reflective observation which presents reflection on that experience (abstract mode). This reflection then leads to the abstract conceptualization of the situation (abstract mode) and the decision on how to act - active experimentation in (concrete mode). The latter are associated with the different phases two by two to give birth to the four kolb styles: Divergent, assimilative, convergent, accommodative, represented on two axes:

- Vertical, which presents the perception dimension: From concrete to abstract
- Horizontal, which presents the processing dimension: From active experimentation to reflective observation and the process is repeated for each new situation.

To measure these styles, Kolb developed the Learning Style Inventory (LSI) instrument. The LSI consists of nine groups of four words. For each set of words, the respondent assigns a different weighting from 1 to 4. Rating 4 is reserved for the word that best designates the usual way of learning and rating 1 for the one that least characterizes the usual way of learning. . Of these nine groups of words, only six will be retained in the compilation of scores. To determine the dominant mode on an axis, Kolb calculates the difference between the scores obtained on each of the modes. This process thus makes it possible to determine the dominant mode on each dimension and thereby the learner's learning style corresponds to the combination of the two dominant modes [16].

2.4 The concrete and the abstract according to kolb

Kolb's cycle in Figure 2 presents the perceptual dimension, from concrete to abstract and back again, indicating how experience is captured by the learner through observation, reflection and active experimentation. According to Kolb, (1984) [17]. Concrete experience consists of experiencing an authentic situation in which a real problem is posed that stimulates thinking, activates prior knowledge stored in long-term memory, pays attention to environmental stimuli and activates the action process.

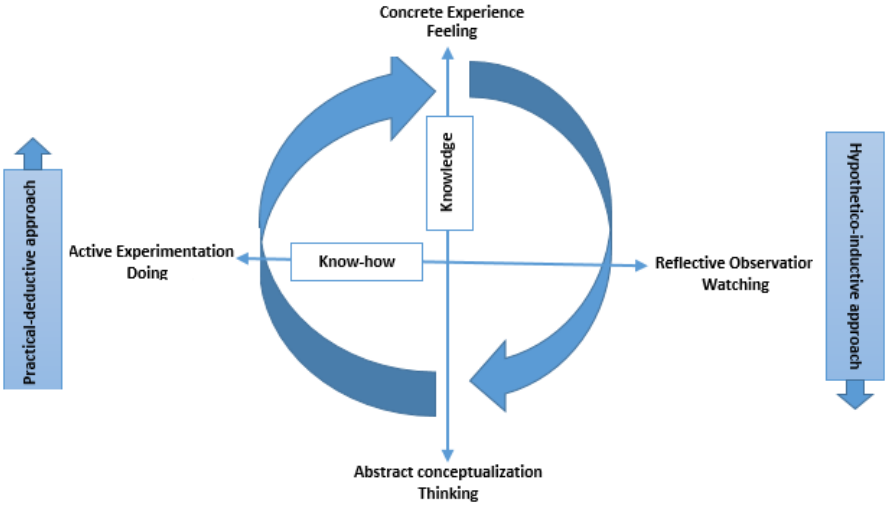

Fig. 2. The kolb cycle seen according to two axes and two approaches (Kemouss et all, 2022)[18].

Figure 2 allows us to interpret this process, integrating it into Kolb's learning cycle from the phase of concrete experience carried out and lived by the learner, which allows the learner to reflect on the experience he/she has lived to make observations and reflect on their meanings by considering different points of view; in order to build up an overview of how the experience was spent which allows the learner to build up general concepts, by induction and reasoning, conversely one can deduce results and test the theory by transferring it to different situations according to the active experimentation, which represents how the experience is captured by the learner and when he/she performs a task, lives an experience.

2.5 The inductive and deductive approach

Induction and deduction are ubiquitous elements of thinking or a way of reasoning. Arguments based on experience or observation are best expressed inductively, while arguments based on laws or rules are best expressed deductively, and knowing how to orientate them can facilitate the choice of a teaching approach and method.

The inductive approach

The inductive approach is a scientific method which allows general conclusions to be drawn from individual premises (from the particular to the general). The learner is placed in a situation of experimenting and discovering the meaning of a concept where he/she appropriates by exploration or observation, by himself/herself or in cooperation, for what he/she has to learn from cases, examples or problem situations. According to

Beaugrand, (1988)[17], the inductive approach "consists in approaching the subject of interest concretely and letting the facts suggest the important variables, the laws, and, eventually, the unifying theories".
The teacher then acts as a guide in this process, placing the learner in situations where they can hypothesis or produce a definition from what they have observed or explored, and then provides new cases, examples or situations to confirm the hypotheses or definitions developed. This helps the learner to develop their skills and move from the concrete to the abstract and back to the concrete, which can be represented by the kolb cycle.

The deductive approach

The deductive method, also called logical deduction or hypothetical-deductive approach, is a pedagogical approach that starts from general principles and deduces concrete applications. It consists of first formulating a more or less specific hypothesis and logically inferring material implications from this hypothesis, and then collecting data and testing the value of the hypotheses. (Balslev and Saada-Robert, 2002) [18].

The deductive approach, on the other hand, places the teacher more in the role of transmitter. The teacher generally teaches the notions or concepts or strategies to the learners, taking care to provide examples or counter-examples depending on what is being taught, and then places the learners in a context where they can apply the teaching received. deduction is also used to deduce consequences; these are verified by observation or by experience, according to the kolb cycle.

3 Practical part

Concrete and abstract are two opposite notions that are often used to describe different aspects. Concrete refers to what is real, perceptible by the senses. The abstract, on the other hand, refers to what is conceptual, theoretical. It can be ideas, concepts, theories. In this article, we propose an architecture of activities according to KOLB, going from the concrete to the abstract according to the inductive approach and conversely going from the abstract to the concrete according to the deductive approach.
We focus our work on the proposal of two types of associated learning activity scenarios that can be confronted in an online teaching for a module without taking into account either the nature of the discipline or the nature of the concept to be dealt with. The following figure illustrates the life cycle of a pedagogical scenario of an online learning situation.

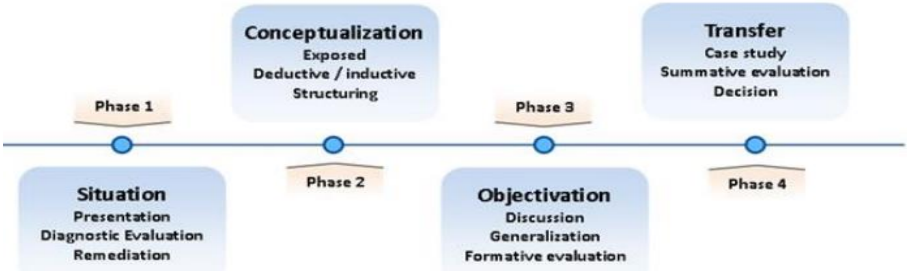

Fig. 3. Example of the life cycle of an educational scenario for a learning situation (Maha Khaldi et al,2019) [21]

Based on this architecture of the life cycle of a pedagogical scenario of a learning situation, we propose two conceptualization scenarios in order to structure the activities according to KOLB, from concrete to abstract and vice-versa, of an online teaching module, according to the inductive and deductive approach

3.1 Architecture of activities according to KOLB from concrete to abstract with an inductive approach:

Learning involves the acquisition of concrete concepts that can be flexibly applied in a variety of situations. Our work on the kolb cycle from concrete to abstract involves the use of the inductive approach. Figure 4 shows the kolb cycle from concrete to abstract.

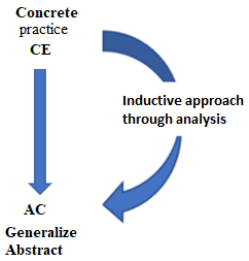

Fig. 4. From concrete to abstract following the inductive approach

This figure illustrates the inductive approach which allows to carry out an activity (Task and instruction), and through observations and analyses to reach more general perspectives. Thus, the generalization (objectivation) invites the learner to describe his/her approach and to name the processes involved (call for metacognition).
Based on this approach, and on modular learning, we propose the passage from the concrete to the abstract of the architecture of a conceptualization activity for an inductive approach of a learning situation made up of three systems:

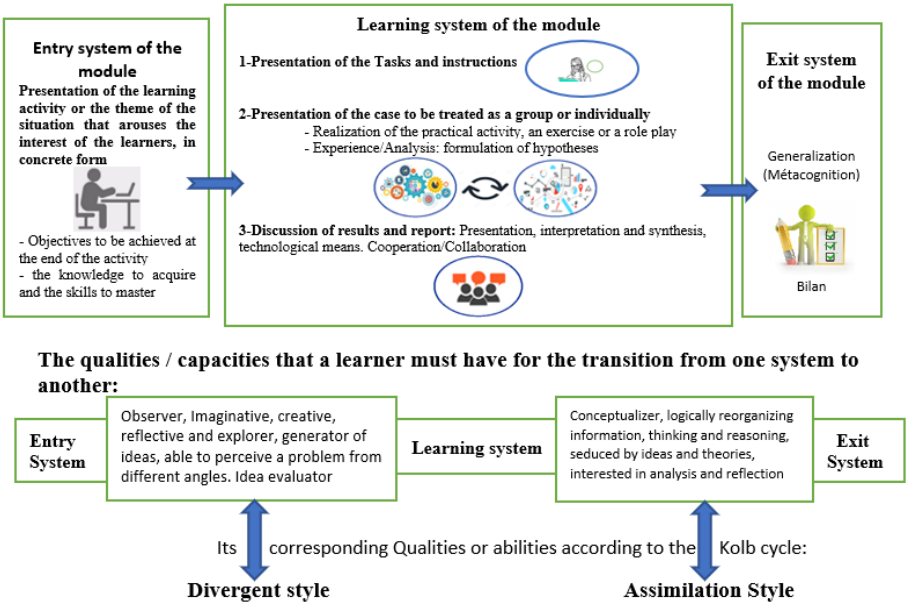

Fig. 5. Proposed scenario for conceptualizing an inductive approach to the learning situation.

- ***Input system**:* Concerns the presentation of the learning activity by defining the objectives to be achieved at the end, the target audience, the knowledge to be acquired and the skills to be mastered by the learner or the group.

- ***Learning system**:* Consists of moving from the concrete to the abstract, using the indirect learner-centered teaching strategy. It is based on inquiry, induction, problem solving, decision making and discovery, which promotes creativity and skill development. For our system, it first proposes:

- A presentation of the task to be carried out, the nature of the concept to be addressed (experiment, problem to be solved, investigation, ...).
- The realization of the practical activity, the task proposed according to the grouping of the learners (individual or in group), the distribution of the roles if the group; providing concrete experiences to analyze, the tests, the manipulations and the formulation of the hypotheses.
- At the end the discussion of the obtained results, the cooperation/collaboration using technological tools of communication, then the interpretation of the results in order to justify the experimental results and to verify them in relation to the laws and theoretical rules.

- ***Output system:*** The evaluation of the conceptualization activity of the inductive approach proposed by the generalization by calling upon metacognition through the emission of a model or laws through a mathematical formalism.

***Observations**:* The Figure 5, presents the modular system, the transition from the input system to the learning system presents certain skills and characteristics, the management of ideas be creative, imaginative and like to think and how to approach a task. At this stage of observation, some reflection is required, the divergent style can evaluate these ideas and identify that worth pursuing observe, synthesize and draw conclusions. While the transition from the learning system to the output system, relies on the individual's ability to think and reason; the assimilator may be more interested in developing ideas and theories. They analyze and reflect on their experiences in order to gain new ideas and perspectives.

3.2 Architecture of activities according to KOLB from the abstract to the concrete following a deductive approach

The application of abstract concepts is necessary to confirm the theoretical rules. Our work on the Kolb cycle, from abstract to concrete, recruits the use of the deductive approach. Figure 6 illustrates Kolb's cycle from abstract to concrete.

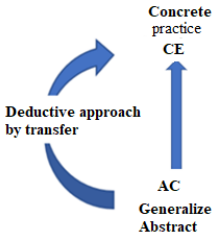

Fig. 6. From concrete to abstract following the deductive approach.

This figure illustrates the deductive process of applying general principles or concepts to new situations. By following this process, you can move from an abstract understanding to a concrete application to a given situation. Based on this approach and

modular learning, we propose to move from the abstract to the concrete in the following way.

The architecture of a conceptualization activity for a deductive approach to a learning situation composed of three systems:

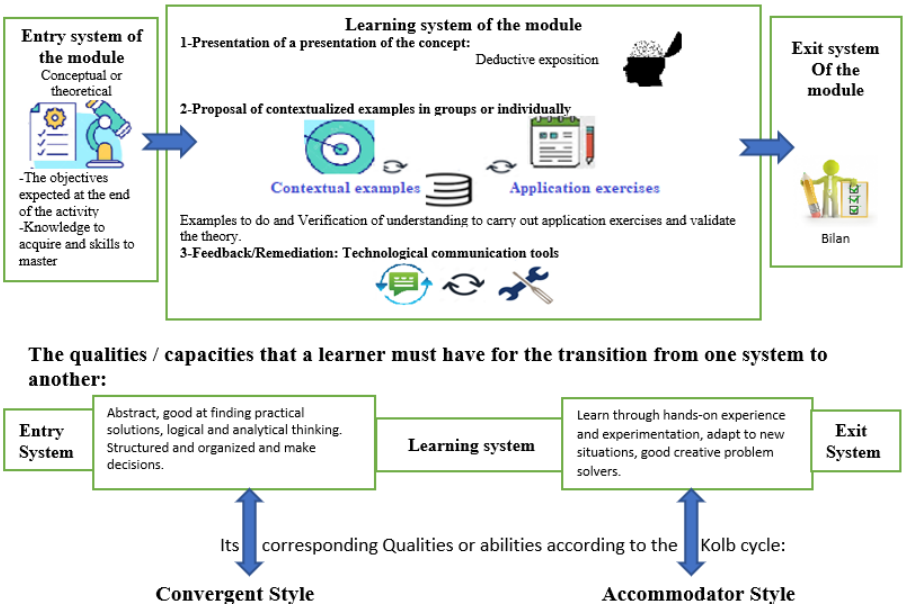

Fig. 7. Proposed scenario for conceptualizing a deductive approach to the learning situation

- ***Input system:*** Concerns the presentation of the learning activity by defining the objectives to be reached at the end, the knowledge to be acquired and the skills to be mastered by the learner or the group.

- ***Learning system****:* It consists in going from the principle to the consequence. The conclusion is implicit in the premises. We start from the statement of the concept and/or the rule and go to the verification by examples. Our system proposes first of all

- A presentation of the statement according to the nature of the concept to be treated (presentation, films, documentaries,).
- The proposal of contextualized examples that the learner can choose from a resource (x examples to do and redo) to verify the understanding of the knowledge presented in the presentation and the proposal of application exercises that the learner can choose from a resource (x examples to do and redo) to test the acquisition and application of this knowledge.
- Finally, feedback is provided through remediation based on technological communication tools to fill in the gaps and correct the learning errors of the learners.

- ***Output system:*** Concerns an evaluation of the conceptualization activity of the proposed deductive approach.

Observation*:* Referring to Figure 7, moving from the input system to the learning system, requires the ability to work starting with abstract ideas and theories, on technical and scientific problems and then applying them in practical situations. being an abstract and conceptual thinker, logical and analytical, able to take abstract information and apply it to practical situations, planner, organizer and evaluator, this is the orientation of the convergent. While the move from the learning system to the output system involves learning through hands-on experience and experimentation and adapting to new situations, these are the characteristics of the accommodating style.

3.3 The structuring of a global scenario

The cycle presented in figure 8 is a learning model that describes the experiential learning process in four steps interpreted both inductively and deductively, meaning that the learner starts with a concrete experience, observes the results of the experience and reflects on these results to draw more general conclusions. They then conceptualize these abstract conclusions and apply them to new situations in an active experiment.
In the context of the cycle, the learner begins with an experiment, then observes the results of that experiment and reflects on those results to confirm or refute the initial hypotheses. Then, an abstract conceptualization, deduces general principles from this conceptualization and then applies them to an active experiment to test their validity.

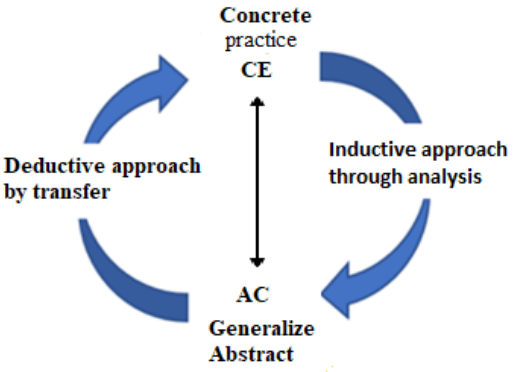

Fig. 8. Kolb cycle according to the two inductive and deductive approaches.

In sum, the above cycle can be interpreted according to both the inductive and deductive approaches, as it involves a continuous loop of experience, observation, conceptualization and experimentation that can be approached from different angles of reasoning. This allows us to conclude a general scenario according to the modular system that presents a loop with corresponding styles, which can be in the form of the figure below,

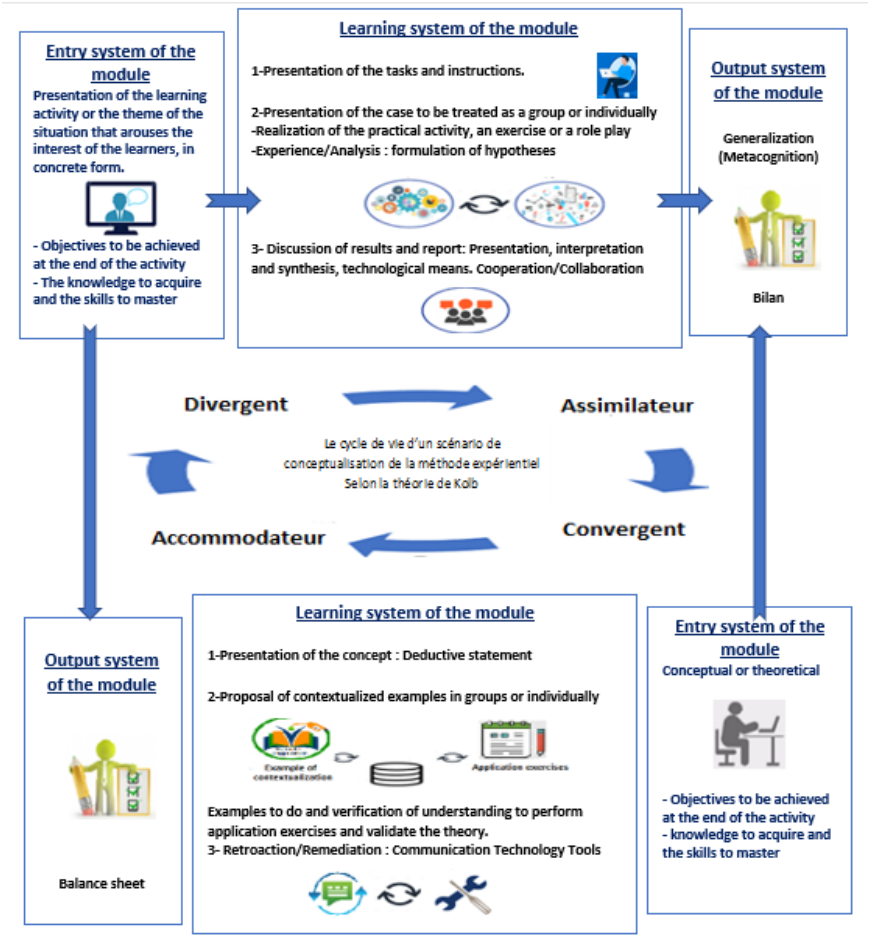

Fig. 9. Global scenario of conceptualisation from concrete to abstract and vice versa of a learning situation.

4 Results and discussion

the inductive and deductive approach are complementary, the advantage of this type of teaching is that the learner follows a logical approach to modeling and experiment, according to two activities, one abstract and the other concrete:

Abstract learning activities are tasks or exercises that involve thinking, conceptualizing, analyzing, and synthesizing abstract and complex information. They are often used in academic fields such as math, science, philosophy, and theory. They can help

learners develop thinking skills and better understand complex concepts by providing structure and resources.

Concrete learning activities are activities that involve hands-on experience or direct interaction to promote learning. These activities may include field experiments, simulations, hands-on lab work, hands-on projects, or internships. They are particularly effective in helping learners develop practical skills and a better understanding of abstract concepts. They also provide learners with exposure to real-life situations, which can improve their confidence and problem-solving skills.

These activities can be carried out in groups or individually and can be adapted to different levels of learning. Hands-on learning activities are an effective teaching method to help learners acquire practical knowledge and understand their challenge

Finally, it is important to choose the learning activities that best suit the learning styles of the learners.

Conclusion

Kolb's experiential learning theory posits that individuals have different learning styles that influence how they learn and process information.

Concrete and abstract modes are two of the four modes of information processing that help to understand how learners learn and develop. The proposed activity model, consistent with Kolb's cycle of learning styles, can help learners improve their ability to learn and problem solve more effectively in an online environment and reap its benefits. However, the concrete and abstract modes are two complementary approaches to learning and it is important that learners develop the ability to use both modes to improve their overall performance. This work presents the architecture of a global scenario for designing learning activities in the concrete and abstract modes. Concrete experience involves learning by doing, feeling and experiencing, while abstract conceptualization involves learning by thinking, analyzing and creating theories. Reflective observation and active experimentation fall between the two, with reflective observation being more contemplative and observational, and active experimentation being more hands-on. Understanding the different learning styles according to Kolb's experiential learning theory is crucial to designing effective educational activities. By incorporating activities tailored to each learning style, instructors can create a more inclusive and engaging learning environment where learners can maximize their potential and achieve their learning goals.

In conclusion, Kolb's learning cycle is a powerful model that helps individuals understand their preferred learning styles and how best to approach learning activities. By identifying their dominant learning style, individuals can better engage in different types of learning experiences and develop their skills in both concrete and abstract modes.

Concrete and abstract modes are two of the four information processing modes that help understand how learners learn and develop. The proposed activity model according to the learning styles from the kolb cycle can help learners improve their ability to learn and solve problems more effectively in an online environment and benefit from its advantages.

However, concrete and abstract modes are two complementary approaches to learning and it is important that learners develop their ability to use both modes in order to improve their overall performance.

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