



The MOOCs through the Typology of Learning Styles: What Prospects?

Soumaya EL EMRANI¹, Ali EL MERZOUQI², Mohamed KHALDI³

¹LIROSA Laboratory, Abdelmalek Essaâdi University of Tetuan, Morocco

²LIROSA Laboratory, Abdelmalek Essaâdi University of Tetuan, Morocco

³LIROSA Laboratory, Abdelmalek Essaâdi University of Tetuan, Morocco

Abstract —This article has two main objectives: the first is to shed some light on the concept and the typology of learning styles, and their fundamental role in the learning process in general, and in the case of MOOCs in particular, through a descriptive study of some models, like the Kolb's model, the HONEY and MUMFORD's model, the VAK's model, and the DUNN and DUNN's model.

The second objective of the article is to discuss the decision to use two particular models of learning styles in our work: the Kolb's experiential model to test the content across its measure instrument (LSI), and the DUNN and DUNN's model in order to test the general context of the course through the (BE) instrument.

Keywords- Adaptive Learning, Learning styles, Learning Models, Adaptive cMOOC.

I. INTRODUCTION

On the one hand, some MOOCs providers and adopters are trying today to create Connectivist MOOCs (cMOOCs). In this type, knowledge is shared between all learners, and the same information is provided in real time in an open inter-connective space. The courses are the result of collaboration between teachers, who act as leaders, while the learners contribute via forums, wikis, blogs, etc [1].

On the other hand, the majority of other MOOCs use the conventional method, where a professor or trainer gives a presentation providing a maximum of information in a limited time, without any adaptation to the needs of each type of learners, obliging the learner to follow the professor's specific methodology and curriculum, which brings us back to the same pedagogical problems.

Meanwhile, these MOOCs are trying to adopt the connectivism notion, by providing some tools to facilitate interaction among learners, and between learners and their instructors, using social networks, discussion forums, FAQs, announcements, guides explaining the course progress (text, images, videos ...), live virtual Q&A conferences (at the end of every conference, or sometimes a full Q&A session once a month or a fortnight) [2].

In fact, assigning the adequate learning styles model for each MOOC learner must be the first concern that every designer or MOOC adopter must have, because each learner is characterized by certain criteria that can notably help discover the various effective learning styles and the adequate and compatible learning methods for each type of learners, thus the improvement of the learning process efficiency and a better time and knowledge management [3].

Therefore, the specialists discussed the learning styles in different ways, which gave way to many theories on how learners prefer to learn and a variety of definitions of the learning styles concept saw light [4]. Some of them focused on the characteristics of the learning behavior itself, while others concentrated on the process or the structure inferred from the behavior [2].

According to Bennett, a learning style is the way in which the learner prefers to learn [5]. Besides, Honey and Mumford defined the learning style as the attitudes and behaviors that determine the learning preferences for each learner [6][7]. In addition, R. Dunn and K. Dunn [8] consider the learning style as the way in which each learner begins to concentrate on, treats and retracts new and difficult information [2].

This paper aims at focusing on the concept of learning styles, which vary from one person to another, their importance and how to identify them in general and in the case of MOOCs in particular. The paper will also present in some detail a number of learning styles models, namely: (1) **the Kolb's model** which discusses the theory of experiential learning, (2) **the Honey and Mumford's model** which is an experiential learning model, that adapts the learning styles of Kolb, (3) **the VAK's model** based on the human observation channels, and finally (4) **the Dunn and Dunn's model** which focuses on the identification of the individuals' preferences in educational environments [9].

II. LEARNING STYLES MODELS

Some studies suggest that there are over than 70 different models. Among those models, there are:

A. Kolb's Learning Style Model:

David Kolb is the first who adopted an experiential learning style model. He subsequently influenced the construction of other models. He published his model in 1984, from which he developed his learning styles inventory (LSI) [2].

The Kolb's experiential learning theory made a synthesis between the Dewey philosophy of education and Piaget genetic epistemology. A big part of this theory is concerned with the learner's internal cognitive processes [10].

KOLB asserts that learning requires the acquisition of abstract concepts that can be applied in a flexible manner in various situations [10]. In this theory, the impulsion for the development of new concepts is provided by the new experiences. He prefers that students learn through a cycle in order to improve their learning. This cycle of learning consists of four modes of learning: (1) **concrete experience**, (2) **reflective observation**, (3) **abstract conceptualization** and (4) **active experimentation**. *Table 1*. Shows the learners' and the teachers' behaviors compared to the four learning modes [10]:

Table 1. The Kolb's learning modes

Learning mode	The teacher	The learner
Concrete experience	- Considered as a helper .	- Learns by the intuition of his experiences; - His judgments are based on his emotions.
Reflective Observation	- Considered as a guide .	- Learns through the perception of his own observations and reflections; - Is characterized by an introverted personality.
Abstract conceptualization	- Considered as a communicator of information .	- Learns with thinking, integrating his observations, and creating concepts; - Is more oriented towards the symbols than to people.
Active experimentation	- Considered as a model to imitate [10].	- Uses his new knowledge to solve a problem; - Is characterized by an extroverted personality [10].

From the model of experiential learning process in four phases [11], Kolb suggests the existence of four modes of adaptation [12]: **concrete, reflective, abstract, and active**.

By combining two by two of the four modes of adaptation, Kolb forms four learning styles [2] according to the phase of the cycle preferred by the learner:

➤ **The divergent style (concrete-reflective):**

The learner prefers to learn by experience, including the concrete experience and the reflective observation (See *Table 2*.):

Table 2. The Kolb's divergent style

Learning style	Phase or Learning mode	Learner's characteristics	Learning preference
The divergent style (The reflector)	The concrete experience. + The reflective observation.	- He is characterized by interpreting concrete situations [3]; - He is capable of generating ideas; - He is characterized by a fertile imagination [13] and good observation; - He is interested in people and emotions; - He appreciates innovative activities [14];	Learn by experience .

➤ **The assimilator style (reflective- abstract):**

This style concerns the preference to learn through theoretical courses. It describes the abstract conceptualization and the reflective observation phases (See *Table 3*.):

Table 3. The Kolb's assimilator style

Learning style	Phase or Learning mode	Learner's characteristics	Learning preference
The assimilator style (The theorist)	The abstract conceptualization. + The reflective observation.	- He is able to design theoretical models; - He can do inductive reasoning [3]; - He is concerned with abstract concepts rather than people and practical applications of knowledge; - He reorganizes the information in a logical manner [14].	Preferring Theoretical courses.

➤ **The convergent style (abstract-active):**

It includes the abstract conceptualization and the active experimentation phases. This style prefers working on self-directed projects and activities (See *Table 4*.):

Table 4. The Kolb's convergent style

Learning style	Phase or Learning mode	Learner's characteristics	Learning preference
The convergent style (The pragmatist)	The abstract conceptualization. + The active experimentation.	<ul style="list-style-type: none"> - He is able to create practical applications for ideas; - He can make inferences and reasoning to solve problems; - He is unemotional. 	Working on self-directed projects and activities.

➤ **The accommodator style (concrete-active):**

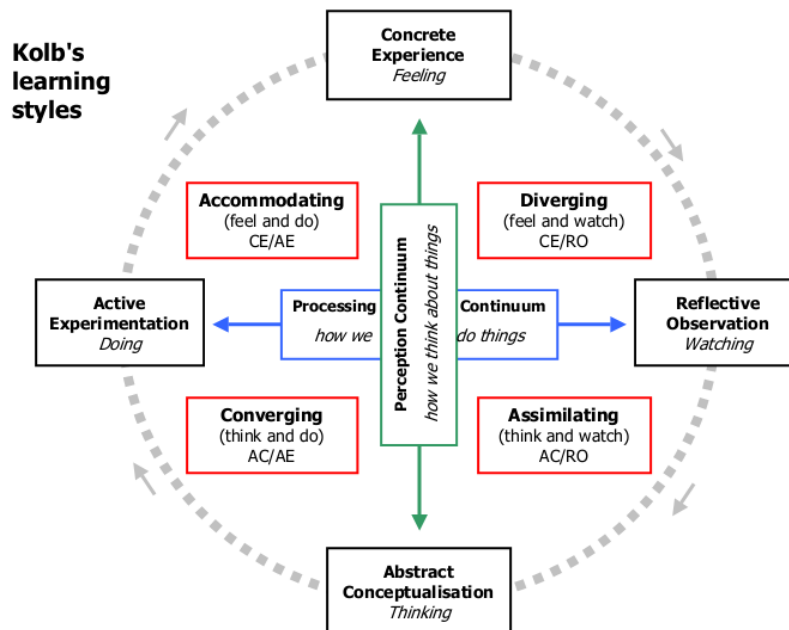
The learner prefers doing exercises in small groups. This style describes the mode of concrete experience and active experimentation (See **Table 5**):

Table 5. The Kolb's accommodator style

Learning style	Phase or Learning mode	Learner's characteristics	Learning preference
The accommodator style (The activist)	The concrete experience. + The active experimentation.	<ul style="list-style-type: none"> - His strongest point is to "do" something; - He can take the risk; - He can solve problems intuitively through emotions and not reason [3]; - He learns through manipulation and performance; - He likes to be involved in the planning and the implementation of activities [14]. 	Doing exercises in small groups [14].

According to the Kolb's experiential model, knowledge is always related to experience. On the one hand, a lived experience is transformed into personal knowledge, and on the other hand, this knowledge becomes valid in new experiences.

KOLB designed his model in four phases (**Figure 1.**), starting with "the phase of concrete experience (CE)", where the learner learns by the intuition of his experience. "The reflective observation phase (RO)", where he makes observations and then reflects upon them. This process of reflection allows learners to create rules, concepts and principles in the phase known as the "abstract conceptualization phase (AC)". The last phase that follows is that of "active experimentation (AE)" where the learner uses new knowledge, solves problems, deduces hypotheses etc.



© concept david kolb, adaptation and design alan chapman 2005-06, based on [Kolb's learning styles](#), 1984

Figure 1. Kolb's Learning Styles Diagram

Each of the four phases corresponds to a mode of adaptation: "the concrete mode", "the reflective mode", "the abstract mode" and "the active mode".

To determine the learning styles according to his model, Kolb makes a combination of two by two of the four modes of adaptation mentioned above:

- Concrete-reflective: **The divergent style**;
- Reflective- abstract: **The assimilator style**;
- Abstract-active: **The convergent style**;
- Concrete-active: **The accommodator style**.

B. HONEY and MUMFORD's learning styles:

In 1986, Honey and Mumford developed an experiential learning model that fits the learning styles of KOLB. This model consists of four phases, which comprise behaviors and proper important attitudes [15]. These four phases are:

- The experience;
- The return to the experience;
- The formulation of conclusions;
- The planning.

Honey and Mumford formed their model by directly combining each phase to a style, in terms of attitude and behavior:

- **The active style:** describes the behavior of the person who privileges the attitudes and the specific behaviors in the experience phase (See *Table 6.*):

Table 6. The HONEY and MUMFORD's active style

Learning style	Learner's characteristics	Learning style in relation to the Kolb's model
The active style	<ul style="list-style-type: none"> - He can get involved in a concrete experience; - He can dive into the activity "here and now"; - He is able to confront his ideas and challenges; - He can solve problems with a team; - He is also able to invent ideas in the absence of structural constraints or standards. 	The accommodator style

- **The reflective style:** describes the behavior in the phase of return to experience (See *Table 7.*):

Table 7. The HONEY and MUMFORD's reflective style

Learning style	Learner's characteristics	Learning style in relation to the Kolb's model
The reflective style	<ul style="list-style-type: none"> - He is characterized by prudence and careful reflection before making decisions or acting; - He is characterized by observation, listening, visualization, and comprehensive accumulation of data before forming an opinion; - He prefers making decisions without time constraints [15]. - He can brainstorm ideas easily [3]. 	The divergent style

- **The theorist style:** describes the behavior in the conclusion formulation phase (See *Table 8.*):

Table 8. The HONEY and MUMFORD's theorist style

Learning style	Learner's characteristics	Learning style in relation to the Kolb's model
The theorist style	<ul style="list-style-type: none"> - He likes to search the logic and consistency in the organization of accumulated information; - He is characterized by analysis and synthesis [15]; - He can learn through models, concepts, and theories [16]; - He is capable of making classifications, comparisons and giving orders [3]. 	The assimilator style

- **The pragmatic style:** describes the behavior in the planning phase [15] (See *Table 9.*):

Table 9. The HONEY and MUMFORD's pragmatic style

Learning style	Learner's characteristics	Learning style in relation to the Kolb's model
The pragmatic style	<ul style="list-style-type: none"> - He prefers realistic and practical solutions; - He can make useful decisions and solve concrete problems [15]; - He searches the direct connection between what he learns and the real 	The convergent style

	world [16]; - He is able to experiment, predict, and explore [3].	
--	--	--

The Tables above represent a detailed description of each of the learning styles in relation to the Kolb's model, and the learners' characteristics in every phase.

As indicated, Kolb formed his four learning styles through a combination of two phases of the learning cycle whereas Honey and Mumford formed their learning styles model by directly combining each phase to a style.




C. VAK's Learning style:

According to VAK's model (See *Table 10.*), learners can be divided into three types of learning styles, namely:

- *The visual style;*
- *The auditory style;*
- *The kinesthetic style.*

The VAK's model is the reduced version of the VARK's learning styles model, which contains an additional modality: Read / Write [12]. In addition, VAK is sometimes known as VAKT (Visual, Auditory, Kinesthetic, and tactile) [17][18].

Table 10. The four learning styles of VAK

Learning style	Learner's characteristics	Learning preference
The visual style 	<ul style="list-style-type: none"> - He learns best when the information is presented by pictures, charts, graphs, maps or diagrams; - Viewing and reading are the important activities for him [7]; 	Learning by "Seeing"
The auditory style 	<ul style="list-style-type: none"> - He likes to participate in discussions and debates; - When he is reminded of an information, he remembers how he received it; - He learns better if he receives information by listening [7], or repeating words. 	Learning by "Listening"
The kinesthetic style 	<ul style="list-style-type: none"> - He prefers to feel and act; - He likes laboratory activities or excursions about courses [7]; - He prefers to participate in projects and practical experiences. 	Learning by "Moving" Or "Affecting"

The VAK's model is one of the basic models of learning styles [12]. Some educators prefer to use it because of its simplicity, but others consider it limited since it only takes perceptual strengths as criteria. Meanwhile, there are other models such as that of Dunn and Dunn (see the next paragraph), which involves other criteria including that of the human observation channels, and as described earlier in the first paragraph, the Kolb's experiential model which includes perception.

D. Dunn and Dunn's Learning style:



The Dunn and Dunn's model was developed by Dr Rita Dunn and Dr Kenneth Dunn of St John's University in New York. It incorporates twenty to twenty-one elements, which are dependent on the appropriate age of the administered assessments. These elements are subdivided into five components [19] or dimensions:



➤ *The environnement :*

Includes four elements (See *Table 11.*):

- *The sound;*
- *The light;*
- *The temperature;*
- *The design of the seat (formal or informal).*

Table 11. The Dunn and Dunn's learning styles dependent on the environment

Dimension	Elements	Characteristics
	The sound 	<ul style="list-style-type: none"> • Some learners prefer the calm and they seek tranquility; • Others do not care about noise or movement, and they can "block the sound", once they begin to focus.
	The light 	<ul style="list-style-type: none"> • Some of them prefer a very bright light, and they can use additional lighting (lamps for example); • Others prefer low or indirect light, and they can use low or natural lighting.





Environment	<p>The Temperature</p> 	<ul style="list-style-type: none"> Many learners cannot "think" when they feel hot; Others can't when they feel cold; Some focus better in either a hot or cold environment.
	<p>The design of the seat</p> 	<ul style="list-style-type: none"> Informal: <ul style="list-style-type: none"> Learners can learn on the ground, on a sofa, an armchair or a comfortable chair. Formal: <ul style="list-style-type: none"> Sitting using a chair with back straight and hard surface for books and papers; Sitting on a desk or table etc.

➤ **Emotional stimuli:**

Include four elements (See *Table 12.*):

- The motivation;
- The task persistence;
- The responsibility;
- The structure.

Table 12. The Dunn and Dunn's learning styles dependent on emotional stimuli







Dimension	Elements	Characteristics
Emotional stimuli	<p>The motivation</p> 	<ul style="list-style-type: none"> Some learners are motivated. They can make a self-conception for objectives, procedures and evaluations; Others are demotivated. They are characterized by a short design, and they need frequent monitoring.
	<p>The task persistence</p> 	<ul style="list-style-type: none"> Some learners have a strong emotional need to work on a task until it is completed [20]; They can encourage relationships with peers, and with persistent students.
	<p>The responsibility</p> 	<p>This element involves the learners desiring to do what they think they should do. In conventional education, responsibility is often related to compliance and to responding to what the teacher asks learners to do. In particular, there are two types of learners:</p> <ul style="list-style-type: none"> Some have low scores of responsibility. They are generally in compliant. Others have a high score of responsibility. They take individual challenges at the level of their functional capacity or slightly above that level.
	<p>The structure</p> 	<p>There are two types of learners:</p> <ul style="list-style-type: none"> Some who need directions or specific explanations: <ul style="list-style-type: none"> They are very motivated; They use clear statements and simple shapes to define their objectives. Others who do not need specific directions: <ul style="list-style-type: none"> They have the ability to establish clearly defined objectives, but with the selection of resources, procedures, timelines, reporting and verification.

➤ **Sociological preferences:**

Includes six elements (See *Table 13.*):

- Learning alone;
- Learning with pair;
- Learning with peers;
- Learning in groups;
- Learning with either a teacher or collegial authority;
- Learning in several ways.

Table 13. The Dunn and Dunn's learning styles dependent on sociological preferences


Dimension	Elements	Characteristics
Sociological preferences	Learning alone 	<ul style="list-style-type: none"> The learner prefers to work alone.
	Learning with pair 	<p>The analysis factors don't make distinction between learners who want to learn with one other person (with pair) or many (with peers, or in groups). For these learners, discussion and interaction facilitate learning.</p>
	Learning with peers 	
	Learning in groups 	
	Learning with an authoritative or collegial adult 	<p>This element represents two types of learners:</p> <ul style="list-style-type: none"> Some of them prefer to have someone of authority, and they feel better or more comfortable when someone of authority or with special knowledge is present; Others have the ability to work without supervision.
	Learning in several ways 	<p>Learners who prefer to learn in different ways can benefit from the opportunities to learn alone, with peers and with authority, or in combination.</p>




➤ **Physiological preferences:**

Include four elements (See **Table 14.**):

- *The perceptual strengths: Auditory, visual (text or image), tactile, and / or kinesthetic. This element incorporates the VAK's model characteristics;*
- *The contribution;*
- *The time;*
- *The mobility.*




Table 14. The Dunn and Dunn's learning styles dependent on physiological preferences

Dimension	Elements	Characteristics
Physiological preferences	<p>The perceptual strengths</p> 	<ul style="list-style-type: none"> Auditory: <ul style="list-style-type: none"> - He listens carefully; - He discusses what he learned, and shares lessons to clarify; - He speaks aloud, and he recites by singing; Visual: <ul style="list-style-type: none"> - He memorizes by using visual indices, drawing diagrams, graphics and pictures in his mind to memorize them; - He prefers to revise by watching videos; - He can learn by observing what others are doing. Tactile and / or kinesthetic: <ul style="list-style-type: none"> - He seeks to move; - He prefers to talk while walking; - He can build models; - He likes to manipulate materials [1].

	<p>The contribution</p> 	<p>This element can describe two types of learners:</p> <ul style="list-style-type: none"> - Those who can often make these gestures: Eating, drinking, chewing or biting objects; - Those who prefer otherwise: They can get snacks after the end of lesson.
	<p>The time</p> 	<p>There are here about four "time preferences" during the day:</p> <ul style="list-style-type: none"> • Morning; • Midday; • Afternoon; • Evening.
	<p>The mobility</p> 	<ul style="list-style-type: none"> • Some learners need frequent "breaks" and they have to move from the current learning environment; • Others can sit for hours while they are engaged in learning, and especially if they are interested in the task [21].

- **Psychological treatment inclinations :**
Includes three elements (See **Table 15.**):
- *Analytic or comprehensive report;*
 - *Right or left brain ;*
 - *Impulsive/ reflective report.*

Table 15. The Dunn and Dunn's learning styles dependent on the psychological treatment inclinations

Dimension	Elements	Characteristics
Psychological treatment inclinations	<p>Analytic or comprehensive report</p> 	<p>This dimension can describe whether the learner prefers to start by solving the problem immediately, or takes this time to think about it [22].</p>
	<p>Right or left brain</p> 	
	<p>Impulsive/ reflective report</p> 	

The Dunn and Dunn's model is one of the most widely used and the most popular models. It describes learners' reactions through 21 elements [23] included in 5 dimensions (*Figure 2.*), namely: **The environment** (sound, light, temperature, and seating designs), **the emotional stimuli** (motivation, task persistence, responsibility, and the structure), **the sociological preferences** (learning alone, learning with pair, learning with peers, learning in small group, learning with an authoritative or collegial adult, and learning in several ways), **the physiological preferences** (perceptual strengths, contribution, time, and mobility), and **the psychological treatment inclinations** (analytic or comprehensive report, right or left brain, and impulsive/ reflective report).

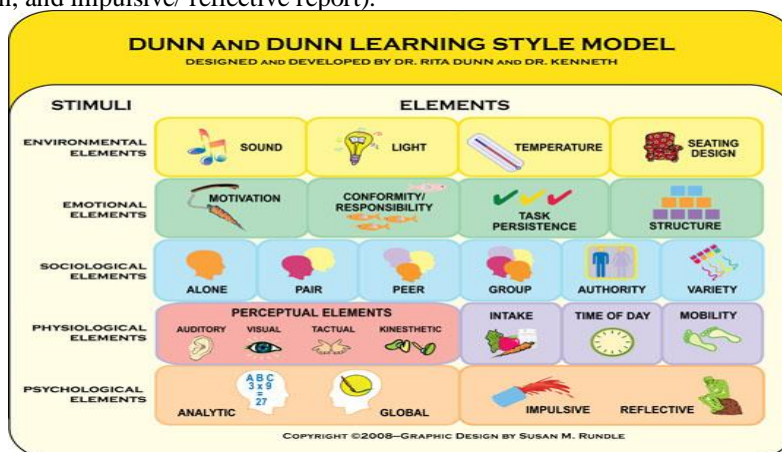


Figure 2. Dunn and Dunn's Learning Styles model

III. THE MODEL ADOPTED IN OUR STUDY CASE

In this research, we chose to work together with the Kolb's model and the DUNN and DUNN's model. In fact, since the Kolb's model focuses on theoretical and pedagogical aspects that affect the learning process, we chose the Kolb's instrument to test the course content, while the DUNN and DUNN's survey will be used to test the general context of the learning process through the five dimensions: the environment, the emotion, the physiological side (in common with that of KOLB in perceptions), the sociological and the psychological treatment side.

From one side, Kolb's model considers the knowledge creation as a result of processing new experiences and internal cognitive processes of the learner, which is done through a cycle of four phases based on experience.

To test his theory of experiential learning, KOLB developed the Learning Style Inventory (LSI) in 1984. The LSI assesses through a questionnaire, how the learner processes information, makes decisions and then takes action. The validity and reliability of the questionnaire was documented several times.

The LSI is one of the most frequently applied in the practice of management and education in the US. It is simultaneously one of the most used by researchers interested in testing individual behavior in learning situations and daily life. It contains twelve sentences that describe learning through four items. For each sentence, the items are classified according to individual preference (1, 2, 3, and 4). Number 4 describes the best manner to learn, while number 1 describes the lowest. At the end of the test, the points awarded to the sentences allow the determination of the learner profile [23].

Moreover, the DUNN and DUNN's model is one of the most comprehensive and extensive of the Learning Styles models. As of 1989, it was conducted at more than 135 institutions of higher education and at every academic and grade level [24]. It has been perfectly developed during 33 years, and more than 850 studies relative to the model have been published [25];.

Based on DUNN and DUNN's model and to identify the preferences through the elements of this model, R. DUNN developed in collaboration with other researchers, four types of questionnaires classified according to the age, namely:

- *"Elementary Learning Style Assessment" (ELSA): 7 – 9 years [19];*
- *"Learning Style: The Clue to You!" (LSCY): 10 – 13 years [19];*
- *"Learning in Vogue: Elements of Style" (LIVES): 14 – 18 years [25];*
- *"Building Excellence Survey" (BE): 17+ years [26].*

In our case, which concerns higher education students, the Building Excellence (BE) instrument, where the variables affect the productivity, the quality of the learning, and the concentration, was chosen.

The original DUNN and DUNN's model describes 21 elements through 5 dimensions. However, The BE instrument evaluates 28 elements included in 6 dimensions (Figure 2.): Environmental dimension (sound, light, temperature, and seating designs), emotional dimension (motivation, task persistence, conformity, and the structure), perceptual dimension (auditory, verbal, visual word, visual picture), Tactual/ Kinesthetic) physiological dimension (intake, time of day, and mobility), psychological dimension (analytic/ global report, and impulsive/ reflective report), and sociological dimension (learning alone, learning with pair, learning in small or large group, learning with an authoritative, and learning in several ways) [27].

The items involved in the BE survey were derived from the items of the original DUNN and DUNN's model, where 20-30 items are used for each of the six dimensions [26].

IV. CONCLUSION

Learning is a particularly complex process [2]. Learning styles allow one to classify the different ways in which people learn, and how they perceive information. The evolution of the learning style concept seems to be characterized by the parallel development of several models of learning styles, each from a different frame of reference [3].

In this paper, we tried to discuss the concept of the learning styles and their uses, by describing some of the existing models in detail to make them a reference for anyone seeking a starting point in choosing among the existing models or conceiving other new ones.

V. References

- [1] J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
- [2] S. El Emrani, A. El Merzouqi, and M. Khaldi, "The MOOCs in face of pedagogical constraints," *The International Journal of Engineering Science and Innovative Technology*, vol. 4, no. 5, pp. 7- 13, September 2015.
- [3] J. Chevrier, G. Fortin, R. Leblanc, and M. Théberge, "Problématique de la nature du style d'apprentissage," *Education et Francophonie*, vol. 28, no. 1, 2000.
- [4] J. Chevrier, G. Fortin, R. Leblanc, and M. Théberge, "Le style d'apprentissage : une perspective historique. *Education et francophonie*," vol. 28, no. 1, 2000.
- [5] Bonham, and L. Adrienne, "Theoretical and Practical Differences and Similarities among Selected Cognitive and Learning Styles of Adults: An Analysis of the Literature," Unpublished doctoral dissertation, Univ. of Georgia, Athens, 1987.
- [6] C. Bennett, "Individual differences and how teachers perceive them," *The Social Studies*, vol. 70, no. 2, pp. 56- 61, 1979.
- [7] P. Honey, and A. Mumford, "The Manual of Learning Styles," 3rd ed., Maidenhead, UK: Peters Honey, 1992.
- [8] D. Hariyanto, "The Design of Adaptive Learning System Based on the Collaboration of m-Learning and e-Learning Platform," *Journal of Advances in Computer Networks*, vol. 2, no.4, pp.311–314, 2014.

- [9] R. Dunn, and K. Dunn, "Teaching Secondary Students through Their Individual Learning Styles: Practical Approaches for Grades," Boston : Allyn and Bacon , pp.7-12, 1993.
- [10] R. Dunn, S.a. Griggs, J. Olson, M. Beasley, and B.S. Gorman, "A Meta-Analytic Validation of the Dunn and Dunn Model of Learning-Style Preferences," *The Journal of Educational Research*, vol. 88, no.6, pp. 353–362, 1995.
- [11] D. Kolb, "Experiential learning: Experience as the source of learning and development," Englewood Cliffs, NJ : Prentice Hall, 1984.
- [12] D. Kolb, I. M. Rubin, and J.M. McIntyre, "On Management and the learning process," Ed. N.J: Prentice Hall, pp. 27-42, 1974.
- [13] D. Kolb, I. M. Rubin, and J.M. McIntyre, "Comportement organisationnel: une démarche expérientielle," Montréal : Guérin, 1976.
- [14] G. Williams, "David A. Kolb on experiential learning," Available from: <http://infed.org/mobi/david-a-Kolb-on-experiential-learning> [Accessed 15th February 2017].
- [15] INSA Toulouse, "Les styles d'apprentissages," Available from: <http://c2ip.insa-toulouse.fr/fr/pedagogies/concepts-de-base-en-pedagogie/les-styles-d-apprentissages.html> [Accessed 15th February 2017].
- [16] J. Chevrier, G. Fortin, R. Leblanc, and M. Théberge, "Le LSQ-Fa: une version française abrégée de l'instrument de mesure des styles d'apprentissage de Honey et Mumford," *Education et Francophonie*, vol. 28, no.1, 2000.
- [17] D. Gordon, and G. Bull, "The Nexus explored: A generalised model of learning styles," In: *The 15th International Conference of Society of Information Technology and Teacher*, 2004.
- [18] S. Gholami, and M. S. Bagheri, "Relationship between VAK Learning Styles and Problem Solving Styles regarding Gender and Students' Fields of Study," *Journal of Language Teaching and Research*, vol. 4, no.4, pp.700–706, 2013.
- [19] R. Dunn, A. Honigsfeld, L.S. Doolan, L. Bostrom, K. Russo, M.S. Schiering, and H. Tenedero, "Impact of Learning-Style Instructional Strategies on Students' Achievement and Attitudes: Perceptions of Educators in Diverse Institutions," *The Clearing House*, vol. 82, no.3, pp.135–140, 2008.
- [20] R. Dunn, and K. Burke, "Learning Style: State of the Science. LSCY: Research and Implementation Manual", 2006.
- [21] E. Kanninen, "Learning styles and e-learning. Master of Science Thesis," Tampere University Of Technology, pp. 1–76, 2008.
- [22] American TESOL Institute, "Learning Styles: Dunn and Dunn's model," Available from: <http://americantesol.com/DunnLearningStyles.pdf> [Accessed 15th February 2017].
- [23] S. Sheldon, "Learning styles," Available from: <http://eapfoundation.com/studyskills/styles/> [Accessed 15th February 2017].
- [24] C.I. Barmeyer, "Peut-on mesurer les compétences interculturelles? Une étude comparée France - Allemagne – Québec," In: *Actes XVème congrès AGRH*, Montréal, 2004.
- [25] R. Dunn, "Understanding the Dunn and Dunn Learning Styles Model and the Need for Individual Diagnosis and Prescription," *Journal of Reading, Writing, and Learning Disabilities International*, vol. 6, no.3, pp. 223–247, 1990
- [26] ILSA Australasia, "Why Choose the Dunn and Dunn Learning Styles Model?," Available from: <http://ilsa-learning-styles.com/LearningStyles> [Accessed 15th February 2017].
- [27] R. Dunn, S. Rundle, "Building Excellence Survey: Research Manual", 2000.
- [28] S. Rundle, "The Building Excellence Survey: Understanding How You Learn and Teach", 2013.