



A MODEL FOR PEDAGOGICAL SUPPORTING BASED ON COMPETENCIES EVALUATION AND ONTOLOGIES

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Abstract— one of the most important matters in e-learning systems is the adjustment of training with the level of knowledge, personality, behavior and abilities that names learner's profile. This profile is built by numerous factors and methods. We will focus in this paper in how the level of knowledge of learner is determined and how the methods used could be efficient to help learners to overcome their difficulties by specifying the exact origin of the cognitive errors they made. Thereafter, we will propose a novel approach of diagnostic and remediation taking into account the Proximal Development Zone (PDZ) of the learner to better help and support him in his training. To do that we propose an ontology of evaluation based on competencies approach and using the 2/3 rule adopted by de-Ketele and Xavier Roegiers to specify the origin of the errors made as a cognitive errors. In this case, our proposal supporting model focuses on learners' cognitive level by proposing diagnosis activities which confirm that such resource of such competence is not acquired and therefore select the most adequate remediation. In this specification – the source of difficulties meets by learners- that lies the originality of our approach.

Keywords— pedagogical supporting; evaluation of competencies; ontologies; adaptive educational hypermedia systems;

I. INTRODUCTION

In Adaptive E- learning Systems (AES), the results of a diagnostic or formative evaluation are translated by an affectation of a learner profile, according to the average obtained; so two learners who had same average have also same profile, which is not necessarily valid.

That seems obvious in the field of medicine, for example, to find out the cause of the disease for patients who had a fever, doctor will ask for specific analyzes and will give for each of his patients a suitable treatment, and it is not necessarily the same. In Education too, we have to adopt efficient methods of analyze and specification to understand where and why the learner is on a situation of learning difficulty. Evaluation has to improve the learning process, by giving an efficient diagnostic allowing to detect the pedagogical obstacles which caused such result; and therefore to give an adequate remediation. This contribution presents a continuity of our previous work [1] [2], and aims to define the cognitive level of learner in a reliable and valid way, and based on a study case drawn from our experiment of teaching which places us in the center of the complexity to act professionally in the evaluation context within the teaching-training process. It aims to diagnose effectively the difficulties encountered by the learner in his training and use that information to build a dynamic profile for each learner and then present the appropriate support. We can summarize the objectives of our model in: Offer an efficient diagnostic, precise where exactly learner has difficulty and then select the most appropriate support.

II. RELATED WORKS

The objective of this section is to present the research's works related to pedagogical engineering according to the evaluation within competency approach in term of specifying the learner model in Adaptive educational systems. Different works in this field relates to the assignment of activities according to the learners' profiles [3] [4]. And researchers have focused on the remediation to adapt in case of difficulties. This is for example the case of Auzende et al [3]. These authors present the implementation of a set of rules orchestrating the passage of a diagnosis process of sub-competencies to a process of submitting remedial exercises (when a sub-competence is the cause of the non-mastery of a competence). Strategies related to diagnosis phase are to propose exercises such filling blank or multiple choice questions in which each incorrect item identifies the cause of the error. Also the certainty rate of the learner towards his answer allows the submission of some supplementary questions in order to confirm the acquisition of the tested competency. In the remediation phase, exercises are planned with corrective and explanatory feedbacks. In this system, the domain model (knowledge) is represented by a taxonomy of the studied discipline, enriched with a series of hierarchical sub-competencies and associated with exercises by the teachers in order to take into account their experience.

Many other systems incorporate diagnostics and remediation. For teachers, they are differentiated by the rules of passage from a pedagogical moment to another and by the course and content of the activities within each of these moments. Also with such systems, the role is for the teacher to choose the application to use according to what best fits his pedagogical strategy. Other studies have focused on competency evaluation in distance learning environments, activities of the self-assessment of learners' competencies have been designed and integrated into pedagogical scenarios to ensure the acquisition and perfect their competencies [5] and [6]. Based on existing ways to develop a competency referential [7] and [8], we present, in this paper, an overview of competency evaluation ontology which aims to represent the evaluation of a competence under an interoperable form to guarantee its reuse and sharing between different learning platforms.

III. EVALUATION FOR THE BENEFIT OF LEARNING PROCESS

A. What is evaluation?

By wondering about its purposes, Jean CARDINET [9][10] [11] defines four, fundamentals:«

- Improve the learning's decisions for each learner.
- Inform learner and his parents about his progression
- Grant certificates to learners and to society
- Improve the quality of learning in general. »

He specifies also that it's not possible to evaluate in the same way in all cases;

Evaluation consists essentially of providing information in order to make decisions: propose learning activities, for supporting and remediation; grant a diploma and certificates of mastering competencies; Transform the modalities and strategies of teaching; etc. On the other hand, if we retain the definition proposed by G.de LANDSHEERE [12]: «Estimation by grade a modality or a criterion considered in behaviour or in a production. » We are led to valid the acceptance of the most trivial signification of the term which structures the most shared representation of its nature, and also the most reductive: evaluate, is mainly giving an average. This definition agrees with the third aim of evaluation defined by J. CARDINET [11]; it is not relevant for the others. In the same article [12], G.de LANDSHEERE, quote N.E.GRÖNLUND, specifies that the evaluation «...includes both the qualitative and the quantitative description of behaviours and Contain, furthermore, a value judgments concerning their desirability. » Generally, in the presential learning logic as in the distancial one, learners which have same marks/average, even if they have different learning deficiencies, get same remediation since the mark brings same information.

It is here that lies the whole difficulty, and also the ambiguity of the evaluation, the diagnostic and therefore the remediation.

B. Evaluate what?

To answer to this question, we refer to the distinction operated by N.CHOMSKY between competency and performance. The learner's competency, related to the evaluation of his behaviors and his productions, represents the whole of what he is able, potentially, to accomplish. His performance represents the partial updating of its competence, in a defined context and production. Evaluating will consist in judging the competence of a learner through his performance, extrapolating his competence from observable behaviors and / or realized production. Y.ABERNOT, referring also to N.CHOMSKY, notes that: «...evaluation is an attempt to apprehend competence over a whole from a performance on a part » [13].

C. Typology of evaluation

There are three types of evaluation: diagnostic, formative and summative evaluation. We suppose in our proposal that the diagnostic and formative evaluation have same objectives in order to improve the level of learner.

1) Diagnostic and Formative evaluation

"It's an evaluation which intervene at the end of each learning task to inform learner and teacher about the level of knowledge and to discover where and in what learner has difficulties, in order to propose or to help him to discover new strategies that allow him to progress" G. Landsheere.[14]. It's an evaluation mode which the main objective is the regulation of learning process. Providing to the learner information about his progress relative to a defined objective, it allows to intervene during the learning process, to change learning content, allowing to the learner to differ his learning methods and strategies and then to decide of necessary help actions. So, it's a way of evaluation which consists to provide information, appreciation of work, learner's activities and productions: things that we cannot reduce on an encrypted result as a note or an average). Formative evaluation is not, in all cases, a terminal evaluation that comes after a task, it consists also a diagnostic evaluation which comes in the beginning of learning sequence. It also can be a Diagnostic evaluation because it allows to highlight the learning difficulties and gives indicators about the encountered obstacles. In this way it serves to implement activities to remove these learning obstacles. As it's mentioned by J. Cardinet. [12]

2) Summative evaluation

The main objective of summative evaluation is an objective of certification, it allows to provide a review to situate learner relative to a standard or an established criterion and to make decision: graduation, We will focus in our proposal on the diagnostic formative evaluation because we suppose that it's the one which allows us to achieve our goals, the summative one is not include in our system.

D. Evaluation's modalities

There are two modalities of evaluation:

- Normative evaluation: which compare the learners with each other.
 - Criterion evaluation: that allows to certificate what learners are able to do or not, independently of each other, by relating this certification to a set of predefined criteria.[15]
- 1) Normative evaluation allows "To place the individual with regard to (compared with) a standard, constituted by the performances of a reference group." G. Landsheere.
 - 2) Criterion evaluation verify learners' performances based on a set of competencies (know, know-how, know how to be) constituted on criterions relative to a defined model.

R. Glaser, quoted by V. Landsheere, specifies "As the criterion tests are specially designed to supply an information (directly interpretable) about performance's levels, these levels should be defined before building a test. The aim of testing is to evaluate the place of each individual regards to his levels. " [15] [16]

We adopt in the rest of our paper the formative criterion evaluation for our proposal model of diagnostic and supporting.

IV. EVALUATION RELATED TO COMPETENCIES APPROACH

A. What is a competence?

According to D'Hainaut, a competence is « a set of knowledge, know-how to do and know-how to be that allows to properly carry out a role, a function or an activity. »[16]. Based on this definition, we can present the competence as:

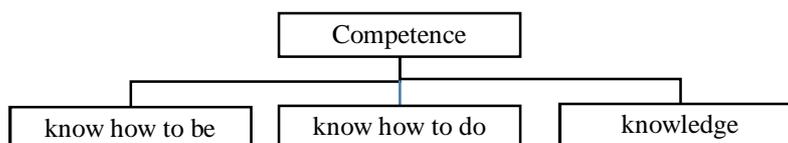


Fig. 1. Components of competence

B. Evaluation of competencies:

V. Landsheere identifies four main components of the competency evaluation: [17] [18]

- The production (competency);
- The indicators of the presence of the competency;
- The adequate measuring instruments;
- The Required level.

If the competency to evaluate is a:

- Knowledge, the indicators of its presence are a declarative statements: knowledge, to tell a knowledge, to know how to do.
- Know-how, the indicators are the necessary actions to success the task.
- Know how to be, an attitude, the indicator of the presence of such competence has to be a behavior, usual or not.

Our proposed model will focus on the evaluation of cognitive competencies as it's indicated in the pyramid of miller which presented in Fig. 2 adapted from [19]

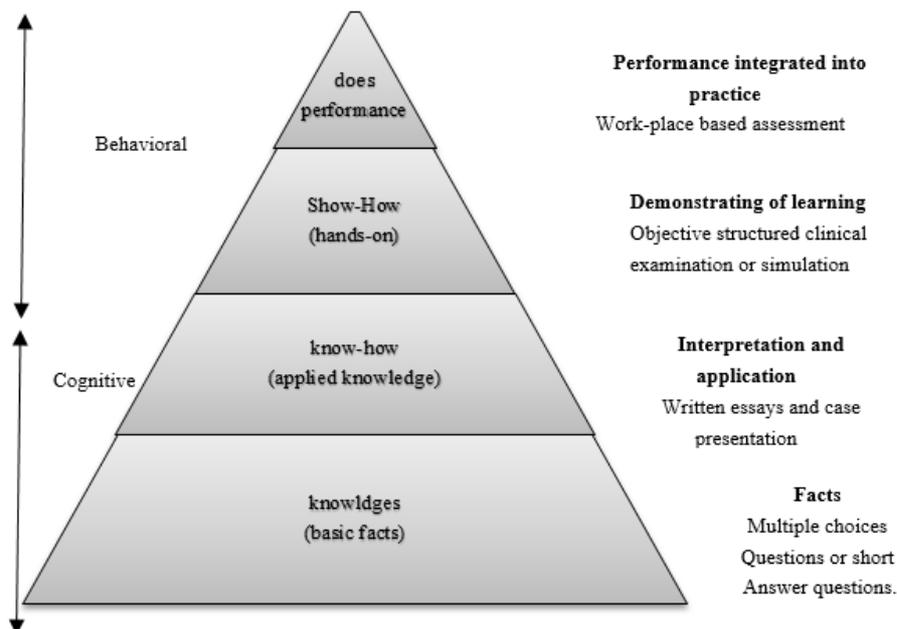


Fig. 2: Miller's pyramid of competence and how different methods of assessment can be used to assess the different levels

V. SCENARIO OF OUR PROPOSAL MODEL PSMCE (PEDAGOGICAL SUPPORTING MODEL OF COMPETENCIES EVALUATION)

A. Two-thirds Rule

The rule of 2/3, proposed by De Ketele (1996), and validated empirically, states that in order to declare a competent learner, each criterion should be respected. And for being respected, each criterion should be verified in three independent occasions, the learner attests his / her mastery in two opportunities in three. For the evaluator, this means that he must provide the learner with three opportunities to verify each criterion. The figure2 presents the principle of the two-thirds rule.

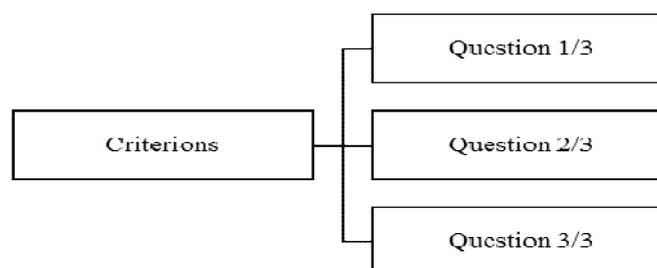


Fig. 3. Principle of 2/3 rule

In other words, if 2/3 questions are correct, the criterion is supposed satisfied and we pass to verify the next one to ensure that the learner has difficulty or not until the last criterion for such competency's resources. If a learner had 0/3 valid question it means that he has effectively a difficulty and we will propose the appropriate support.

B. Adopted model of evaluation by our Approach

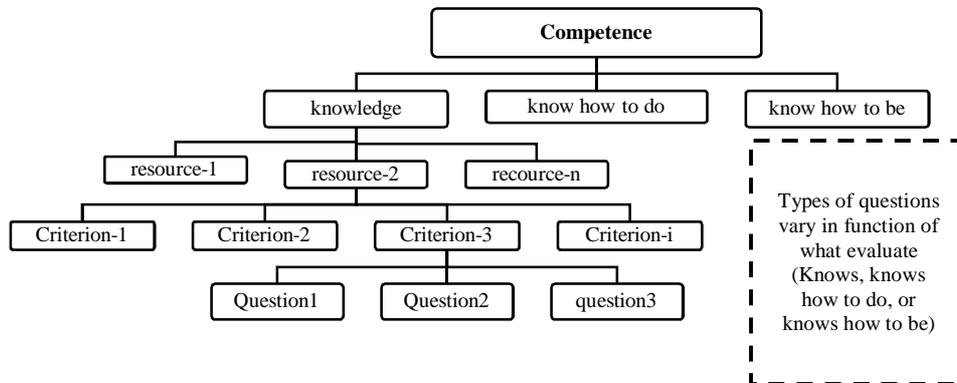


Fig. 4. Structure of Evaluation Competency Components

C. Global Scenario of our proposal model PSMCE

Using our pedagogical supporting system, learner has to respond to three questions that refer to a same competency's resource presented by a set of criterion from 1 to I (it depend of the resource to evaluate) which has to be verified. To ensure that the resource to evaluate is acquired, learner is invited to answer to three types of questions then the appropriate support is proposed to him till the competence will be acquired.

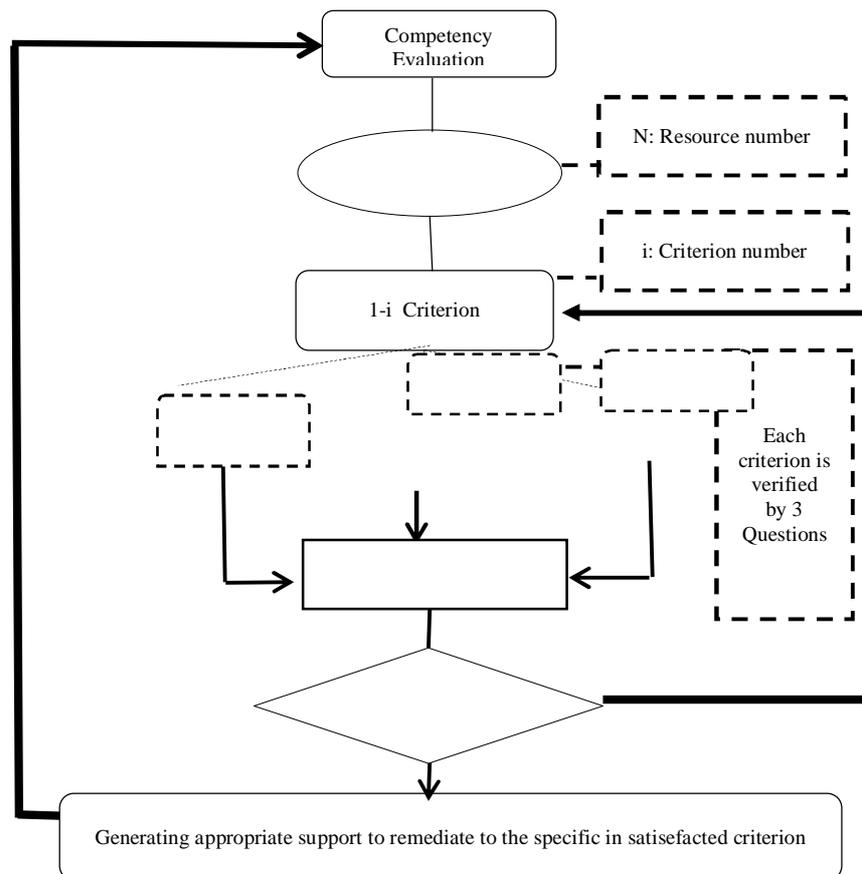


Fig. 5. Global Scenario of our proposal model PSMCE

D. Overview of the evaluation ontology

For the description of information processed by our approach, we used the semantic web ontologies by the advantages they offer in terms of complete and semantic formalization of information.

For this we have developed Competencies evaluation ontology which aims to represent the evaluation of a competence under an interoperable form to guarantee its reuse and sharing between different learning platforms. For that, we used the OWL (ontology web language) at the basis of IMS-RDCEO specification.

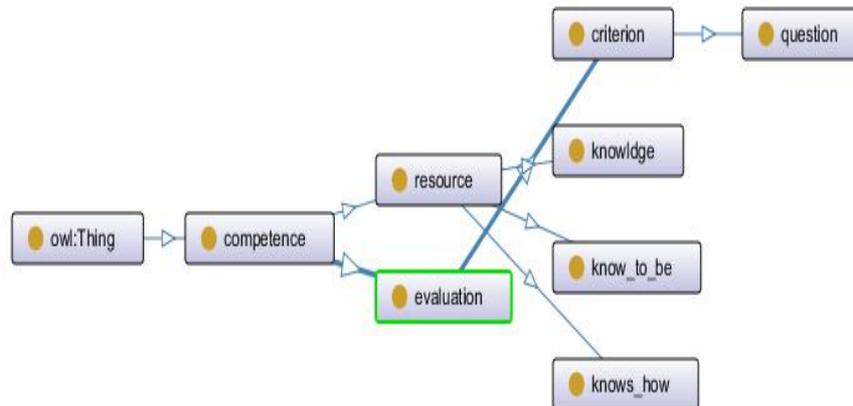


Fig. 6. Overview of the competence evaluation ontology

VI. CONCLUSION AND PERSPECTIVES

Presenting an appropriate supporting for our students requires two important tasks, firstly we have to do an efficient diagnosis to precise where lies the imbalance and then to present the adapted remediation. In this paper we proposed a solution based on ontological engineering and pedagogical strategies for modelling a competency evaluation. The proposed solution allows to get information about the real cognitive level of learner which ensure to situate the proximal development zone of learners, then specific remedial situations will be available to learners in difficulties in order to fill their gaps. The model could be integrated in educational adaptive systems to offer an efficient supporting. A complete comparative study between our proposal and other tools is already achieved, and we are trying to put it into a real experiment to promote our Moroccan educational system by considering the whole importance of supporting within the combatting of school failure. In perspective, to ensure the extension of our proposal with new features for meeting the future needs, we will benefit of the multi-agent systems approach.

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