# A Formative Assessment Model within the Competency-Based-Approach for an Individualized E-learning Path

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*Abstract*—E-learning is not restricted to the use of new technologies for the online content, but also induces the adoption of new approaches to improve the quality of education. This quality depends on the ability of these approaches (technical and pedagogical) to provide an adaptive learning environment. Thus, the environment should include features that convey intentions and meeting the educational needs of learners by providing a customized learning path to acquiring a competency concerned

In our proposal, we believe that an individualized learning path requires knowledge of the learner. Therefore, it must pass through a personalization of diagnosis to identify precisely the competency gaps to fill, and reduce the cognitive load

To personalize the diagnosis and pertinently measure the competency gap, we suggest implementing the formative assessment in the e-learning environment and we propose the introduction of a pre-regulation process in the area of formative assessment, involving its individualization and implementation in e-learning.

*Keywords*—Competency-Based-Approach, E-learning, Formative assessment, learner model, Modeling, pre-regulation process

## I. INTRODUCTION

AT the moment, the majority of the educational systems have agreed to integrate the Competency–Based–Approach within their curricula to respond to both the economic and social needs according to Roegiers, X [1].As reported by Jonnaert, Ph et al [2], these considerations are summarized in: (1)An other conception of knowledge and (2) Social request. This approach is based on the concept of the competency, which has undergone changes in many domains before taking its consensus form after several researches in the science of education [3, 4, 5, 6, 7, 8 and 9]. To operationalize this concept, Paquette, G [10] defines the competency as a statement of principle that determines a ternary relationship between a public target or "actor", knowledge and a skill.

In the case of Learning throughout life, the e-learning environments should address the needs and expectations of the learners on the occasion that they have different expectations and predispositions to attain the target competency .In this way, what suits one does not necessarily appeal to the other which emphasizes the concept of individualization of the learning path for learners.

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However, individualizing the learning paths presupposes a good knowledge of the learners, particularly of their performances relatively to a benchmark of the targeted area, which offers room to the identification of competency gaps to fill. Therefore, during the learning paths, a mapping of competency gaps is derived which invites the use of the formative assessment. In this context, we suggest our proposal, a formative assessment model in the area of e-learning within the Competency–Based–Approach framework addressing the assessment of competencies, the individualization of learning and the semantic referencing of pedagogical resources along with our research opportunities and perspectives in this area.

## II. THE FORMATIVE ASSESSMENT

Assessment takes a focal place in any learning process, whose role, according to Scalon, G [11], is not only to certificate, but it also provides a scholastic democratization, which has been introduces since the 60's, highlighting a concern for assessment as a process of continual verification to guide the teaching and learning demarche. According to Endrizzi and al [12], the objective of reflections is to engage learners and increase their interest to make a progress in addition to accurately measuring them. Besides, it involves a trial in regard to a standard and the challenge is not just exactitude and objectivity, but an invitation to adhere to one's learning and encouragement to share the outcome too. Demeuse, M and al [13] affirm that based on the desired objective, assessment provides a function that determines the type or the nature of the information collected, use and the manner of interpreting the results

Not all the forms of assessment have the same impact on the learner .Consequently; there must be a distinction between the assessment that promotes learning (formative) and the assessment that certificate learners (summative). In our thesis, we lend credence to the formative assessment as an integrated element in the learning process, so the question that has to be asked now, how does it intervene in the adaptation, re-orientation, regulation and individualization of the learning process?

The concept of the formative assessment was first introduced by Scriven in 1967 [14], then enhanced by Bloom in 1971[15] to make it keystone of Learning for Mastery [16].

According to Perrenoud, Ph [17]; "*is formative all the assessments that help the learner to learn and improve*. In other words, that participates in the regulation of learning".

How does the formative assessment help the learner and what are the tools it uses to re-act the learning process?

The formative assessment, through the literature, involves a cycle composed of three levels:

1) *Observation:* the role of this stage is to construct a reality of learning, conditions, modalities and their results. According to Perrenoud, Ph. [18], the observation is formative when it is used to guide and improve learning regardless of ranking, certifying or selecting the learner. It is rather to expose the state of knowledge and skills, instead of confining himself to be on a scale and compare it to other learners.

2) *Intervention*: it separates the symptoms to address the sources of the difficulties. It involves analyzing metacognitive knowledge that is very mysterious as stated by Perrenoud, Ph. [18]. Indeed, he believes that assessing competency by only observing the learners reach limits very quickly, especially in a training exercise: say "you can do better" does not help the learner to do it better. To be useful, the observer must identify, isolate mental functions or specific actions and identify their weaknesses.

3) *Regulation*: the concept of regulation has been developed to describe the mechanisms that provide guidance, control and the adjustment of cognitive activities, emotional and social as well as their relationship with a learner [16].L. Endrizzi, Rey O. [12] states: " the regulating of learning process involves all operations of the metacognitive learning and interactions with the environment that influence learning process in the sense of a defined objective."

In medical area, for example, a cure is ineffective when there is no relevant diagnosis while in learning the individualization is not an aim in itself, but it is a cure, a result imposed by the expectations and the ways of the learner towards a learning activity. Individualization involves an optimal path in learning, which requires the use of a device for feedback that reflects the current state of the learner in relation to a competency.

### III. ASSESSMENT OF COMPETENCIES

The term competency is both abstract and hypothetical [19], so how can it be the object of an assessment?

Assessment is a salient moment in the Competency-Based Approach where it both assesses academic knowledge in a school situation and engages in an unappreciated situation, and sometimes close to real life, resources, skills and competencies.

Demeuse, M. and al [13] regret to see "*the reference or profiles distributed without the skills to be systematically accompanied by guidelines for their evaluation. Indeed, they follow with some delay*". Perrenoud, Ph [18] endorses this gap and describes unusual thinking assessments at the same time

that the programs, "*because it relates to other specialists, other committees according to other schedules*".

Demeuse, M. and al. [13] consider that the assessment focuses on the skills of learning products, but also reserves special attention to the modus operandi of the learner, the way it mobilizes and organizes the various resources (cognitive, conative and motor) to solve the problem situation which is asked. Indeed, assessing how the matter proceeds to overcome an obstacle is to evaluate the degree of adaptation and autonomy.

To achieve the objective of the evaluation, the learner must be aware of its terms (contract), and the criteria and indicators of evaluation should be a dialogue's object between the tutor and learner.

In our proposal, we focus on formative assessment to regulate the learning process in a Competency-Based-Approach. This requires firstly a model of the learner in a spirit Competency-Based-Approach. Fig1 presents the modelling that we borrow from Moulet, L [20] and where competency is divided into two competencies; domain and transversal which are gathered in database of personal and professional information which are collected throughout the life of the learner. The place of e-portfolio is very important as a potential actor in the learning system. The e-portfolio must be designed in a Competency-Based-Approach and will include mapping the skills of the learner throughout his life. It is a witness to the evolution of skills and support is essential to customize not only the evaluation but also learning.
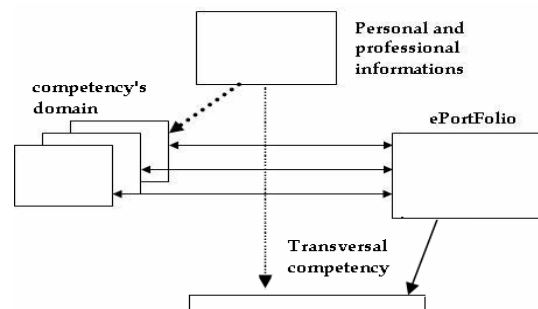


Fig. 1: Modelling the Learner for a Competency-Based Approach [20]

Implementing formative assessment need a modelling skills as an operational viewpoint. In this way, Paquette, G [10] presents modelling skills in which competency is defined as a relation linking three areas:

1) Knowledge: may be concepts, procedures, principles or specific events such as to define the performance of a role or task. Knowledge is related to an area that qualifies for: domain knowledge.

2) Skills: describe the processes that can be applied to domain knowledge to perceive, remember them, assimilate them to analyze, synthesize or evaluate. These processes are, in fact, "metaprocesses" which present a generic domain independent of the application. From these skills has been the subject of taxonomy (taxonomy

integrated skills) to define a scale of difficulty levels on the cognitive, affective and motor.

3) Public Target: description of actors, their characteristics, their functions and tasks.

## IV. THE INDIVIDUALIZATION OF LEARNING

In education, to individualize means to offer the learner a path that responds to both his expectations and predispositions [21].Individualization provides the learner with an adaptive path that appeals to his level ,needs, expectations ,personal rhythm and his way of learning.

Nonetheless, individualization is built on the identification of the learner's capacities, his previous knowledge and his current performance so as to attain the target competency through the learning system. Thus we have to take into two major components :( 1) the learner's model that should have a map tracing the level of the level of the learner's knowledge in different domains. (2) A pertinent diagnosis of current activity .Based on these two elements, there must be an adaptive system proposing individualized learning situations.

The individualization is dynamic adaptation of the content of the services offered by a system in regard to increasing the interactions of the user with the system [22]

In our proposal, we stipulate that the individualized treatment has to pass through an individualized diagnosis.

The aim of modeling the formative assessment is to provide pertinent methods to be integrated within the learning system to adopt an individualized learning, taking into consideration the characteristics and the learner's predispositions by reference to the target competency in the Competency-based-Approach.

## V. THE SUGGESTED MODEL IMPLEMENTING THE FORMATIVE ASSESSMENT IN E-LEARNING AREA

### A. Presentation of the Model:

As it is mentioned by Perrenoud, Ph in an interview [18]: "individualization of formative assessment is needed because it participates in identifying and solving problems …differentiated pedagogies demand more personalized diagnosis, which need a personalized response." a personalized treatment needs a personalized diagnosis. To address this problem, we suggest an assessment model semantically rich, scalable and interoperable [Fig 2].

The model is designed to make the Competency –Based – Approach as a framework of reference. This approach relies on the notion of competency which is semantically rich for adjusting resources for learners.

The model integrates formative assessment, which is the heart of our model. This assessment must be preceded by: (1) A breakdown of competency in basic procedure (skill) and knowledge (knowledge) as stipulated Paquette, G [10] in his modelling skills and (2) verification of the mastery of skills to be at what stage are the difficulties, which is possible to use a taxonomy. Our model adopts the taxonomy of generic skills

[10] to define a wide level of difficulty on the cognitive, affective or motor.

### B. Model Processes and their interactions:

The proposed model consists of three more stages of the cycle of formative assessment advocated by Allal, L. and al [23] a stage that we deem necessary to insert between the interpretation and regulation: the pre-regulation, for us, is an essential step for personalization of diagnosis and consequently the production of relevant measures of the competency gap and individualization of learning path. Thus, we find [Fig 2] on:

a) Observation Process: The purpose of this step is to construct a reality of learning to a learner. These establish the state of knowledge and skills, instead of simply placing the student on a scale and compare it to others.
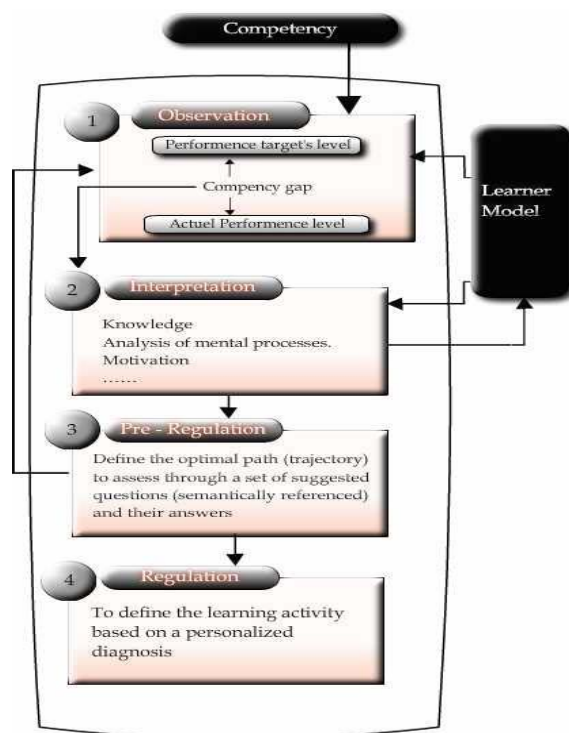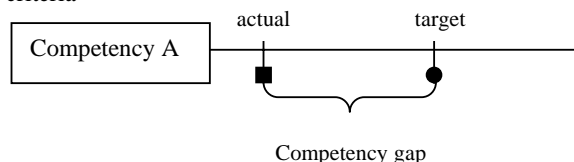


Fig. 2: Suggested Model for Formative Assessment to be implemented in E-learning Environment

In this step, we compute the performance level (target or current) which is to clarify the skill in associating performance criteria



- Competency gap: is the difference between a specified level of performance and level of current performance.

- Target performance's level: For each skill, a degree of control should be required. This is the benchmark against which we will measure the skill difference to a learner.
- Actual performance's level: the learner in a situation must raise skill and knowledge (competency) interpreting the competency statement. The degree of control of competency is the level of current performance.

At this level, it is necessary to both identify and measure the actual performance level using a number of criteria and indicators introduced by Paquette,G [10] (We can also draw on others) and compare it to the target level fixed by the learning process. Nevertheless, while measuring, both the required degrees of difficulties and the mental functions (generic skills) must be taken into account. In this suggested model, the taxonomy of generic skills [10] aims at constructing and classifying the questions in terms of their difficulties to get the desired competency. However, other taxonomies can be referred to achieve this classification.

Consequently, this result, competency gap, forms an input that is going to be analyzed and interpreted in the coming phase.

b) Intervention Process: In this step, we identify symptoms to address root causes of problems. It involves analyzing metacognitive knowledge (the mental functions) which remains mysterious [18].

Assessing competency in observing only reaches limits very quickly, especially as training: say "you can do better" does not help the learner to know the way. To be useful, we must identify, isolate mental functions (Generic skills) and highlight their weaknesses.

Whereas it is a must to have a map of the learner's competencies throughout his life; in this context, many learner models are considered, but what suits us is the one that is designed according to the Competency-Based-Approach [fig1]. This model will interact with our proposal, so how does this model collaborate with the interpretation process to achieve a pertinent analysis of the deep causes to fill the competency gap?

In the following, we are going to explain the mechanisms which are involves in the interpretation process in an operational manner illustrating this interaction with the learner model. First, the process begins by intercepting the competency gap calculated in the previous step. Second, it compares the deviation to the permissible scope. If the difference is not tolerated (a margin of tolerance should be defined for each competency) we should consult the learner model. Third, the generic skill and knowledge that construct the competency must be compared to the competencies map from the learner model: (1) compare the knowledge of the learner with knowledge of the subject learning courses, and (2) compare the levels of mastery of generic skills (in different areas in the learner model) at current performance in the same skill.

A decision will be taken to extract de deep causes of the gap, which will be transmitted to the Pre-regulation process.

c) Pre-Regulation Process [fig 3]: it is a step we propose to implement an individualized formative assessment, it is at this stage that the trajectories (sequence of questions) proposed to the learner will be customized to the previous stage (interpretation). It is to design the path (trajectory) for optimum evaluation from all items proposed (semantically referenced) within constraints: time and overvaluation.
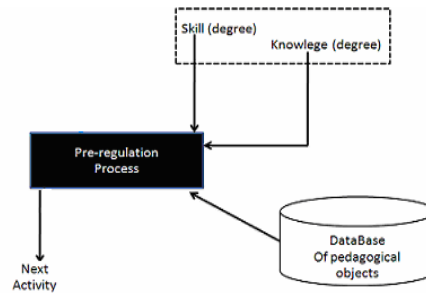


Fig. 3: The pre-regulation process environment

In this process, we will decide the next question that the learner must meet. After his answer, the information is transmitted to the first stage; the observation process. Thus, the questions map will be constructed gradually.

The pre-regulation process uses a database of semantically referenced questions and each of them is separated into; Knowledge and generic skills. In addition, there generic skills will be classified according to their difficulties using taxonomy.

The formulation of the questions should be based on the above separation of the competency, and include criteria and indicators allowing the measurement of the actual performance level in the observation process.

The question's database will be used until the end of the assessment to build the individualized path for each learner. In this way a semantic reference should be implemented to achieve this objective.

Once the assessment is completed, the results of the pre-regulation will be used in the last process, the choice of activity following learning

d) Regulation Process: here, a mechanism that provides guidance and adjust learning activities will be implemented and its main role would be to choose the activity (content referenced semantically) [Fig 4], that is most suited to the learner and be treated by the pre-regulation personalizing his diagnosis for the learning of a competency [23].
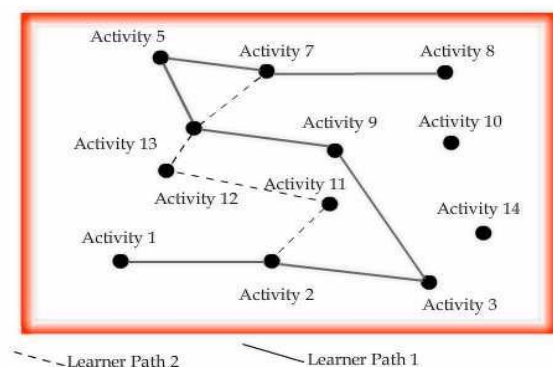
Fig. 4: Construction of Learning's Paths

## VI. CONCLUSION

The integration of the formative assessment in e-learning is certainly beneficial in the learning process. And its implementation within the competency –based approach results in the individualization of the learning path. The one that is pertinent to the enrichment process though the proposed pre-regulation, which leads to a personalized diagnosis of the adapted treatment. As we suggest opportunities in the first operationalization through a prototype containing the various processes and their interactions, this operationalization will be followed by the specification and the design of a solution that supports the definition of the trajectory of formative assessment at the level of pre-regulation.

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