Supporting Self-Assessment in a Competency Approach to Learning

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Abstract: This paper summarizes the results of a longitudinal research aiming at defining the adult learner's self-assessment process in a competency-based online learning environment. It also presents the strategy unfolded to promote and support the adult's judgment over his (her) own competency assessment. This research is part of a Canadian project called Learning Object Repository Network (LORNET). After a brief description of the research problem and the conceptual framework, a model of the self-assessment process is described as well as the prototype developed to support the learner. Finally, a conclusion and recommendations for further research are given.

1. Context

This research was conducted at LICEF/CIRTA Research Center (http://www.licef.teluq.uquebec.ca/fr/index.htm) within the LORNET project (http://www.lornet.org/eng/themes.htm), a Canadian research network aiming at stimulating the deployment of learning objects and competency-based approaches in the workplace as well as in higher education. Our challenge was to design a generic tool adaptable to various learning scenarios and competency repositories and to formalize the self-management process.

2. Problem Statement

In the LORNET research project, the Explor@ (http://explora2.licef.teluq.uquebec.ca/demo/) online learning environment is a multi-actor environment. This stresses the need for a competency evaluation process shared by all involved actors: designer, tutor, manager, and learner. Among these actors, our attention focused on the learner for many reasons. On the one hand, from a pedagogical point of view, it is well known that the learner must be actively involved in the assessment process in order to progress and succeed. This is especially important in online learning (Baynton 1992; Burge 1994; Ruelland 2004; Ruelland & Brisebois 2003) and in competency approaches (Scallon 2004). On the other hand, it is generally recognized that for the learner self-assessment is a hard and challenging task mainly because the evaluation criteria are unknown or difficult to understand (Allal 1999). Moreover, empirical knowledge stresses that the learner's judgment is unfortunately rarely considered as a relevant and pertinent information source. For the learner himself as well as for other actors, the learner's judgment is seldom used to guide the learning process. This is why our contribution to the LORNET project is centered on the learner's need for support in the self-assessment process.

3. Our Solution

The design of an interactive self-management tool embedded in a learning environment is proposed here as a strategy to support the learner in self-assessing his or her competencies. Main efforts of the research focused on the following questions:

- How can the learner's efforts be supported in the self-assessment process?
- How can the learner's judgment be given a proper value in the learning process?

4. Conceptual Framework

There are four main conceptual domains guiding the research emerging from the usage context as well as research work: cognitive sciences, metacognition, evaluation.

1. From the cognitive sciences, three different types of tools are identified to support a cognitive process (Kommers, Jonassen & Mayes 1992; Brown, Hedberg & Harper 1994; Paquette 2001): conceptual, procedural and strategic tools. Each type of tool supports a different type of knowledge involved in a process: concepts, procedures and rules or strategies.
2. From the metacognitive domain, self-assessment is defined as the first of three steps in the self-management loop, the others being self-diagnose and self-regulation (Noel 1990;). It is also known that metacognitive strategies can be learnt and should be developed to increase learner's autonomy. (Livingston 1997).
3. From the evaluation literature, a new paradigm is emerging where self-assessment is viewed as a formative and a continuous process used to help identifying one's learning needs and to adjust the learning strategies (Scallon 2004). It includes evaluation as well as diagnostic procedures. The main difficulties encountered in self-assessment are due to the fact that the learner is not aware of the evaluation criteria, does not understand them and/or does not know the assessment procedure since it is not part of the traditional learning process. Furthermore, there is a tendency to overestimate or underestimate one's competencies (Allal 1999). In spite of these difficulties, the learner is viewed as the person possessing the most accurate knowledge about his or her competencies. In this new paradigm, the data obtained from the self-assessment are used to stimulate discussions among peers and tutors. These interactions as well as the awareness emerging from this process are more important for the learning process than the actual results of the self-assessment.
4. From the competency approach, developing a competency is a progressive process and many assessment strategies are implemented on various occasions to obtain a useful approximation of a competency. To measure the progress in training, there must be an entry as well as a target competency (Scallon 2004).

5. Methodology

The research methodology was adapted from a Design-Based Research approach (2003), which allows not only to develop a prototype tool but also to improve the design principles, the process model as well as a testbed protocol. Therefore the methodology implemented includes the following four steps as illustrated in the Figure 1.

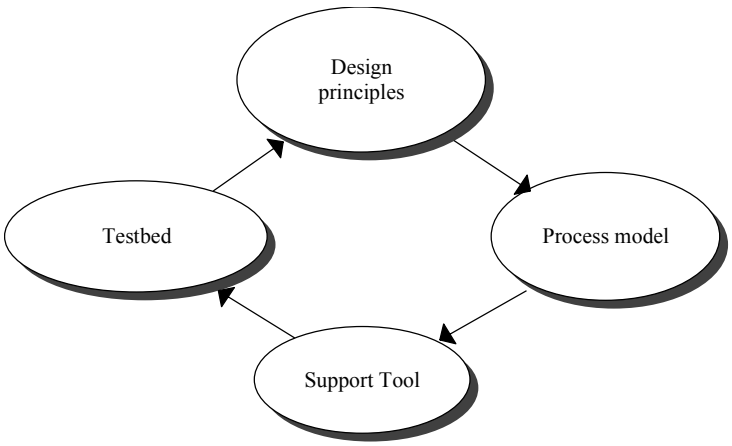

Figure 1: Design-based methodology.

5.1 Design principles

The following set of design principles were derived from the conceptual framework:

1. Use the same competency concept and evaluation criteria for the learner's tool support as for the tutor and the course designer. This allows comparing the multiple evaluation results, which gives a rich view of reality.
2. To improve the significance of self-assessment for the learner,
    a. Support the whole self-management process: self-assessment, self-diagnosis and self-regulation processes.
    b. Link and compare learners' results to
        i. entry and target competencies established by the designer
        ii. previous learners' assessment results to illustrate progress
        iii. the group's assessment results
3. Focus feedback system messages on identifying learner's failure or risk components. For example, if the learner's assessment is below the entry or above the target competency, notify to prevent the decrease in motivation.
4. Keep assessment results confidential; ask authorization to share with the tutor to discuss more subtle situations than the obvious risk components, leaving space for the human in the loop interaction.
5. Implement three types of support: conceptual, procedural and strategic.

5.2 Self-management Model

A first step was to define the self- management process to be supported by the tool. The design principles listed above served to model this process using the MOT (Paquette et al. 2002) application, an object-oriented modeling tool and method to organize and represent the three types of knowledge units as graphical objects. Three main steps have been identified. First, the learner must describe his actual competencies. Secondly, from this self-assessment evaluation, results bring out the learner's strengths and weaknesses compared to entry and target competencies as prescribed by the course designer. Thirdly, the learner identifies within a list of learning activities, those who best suits him/her. Figure 2 illustrates this process. Procedures are identified with ovals; concepts with rectangles and strategies with hexagonals. Arrows show links between knowledge objects and give the direction of the flow of information. Letters associated to arrows specify the nature of the link: c for composition, r for regulation, and i/p for input/output.

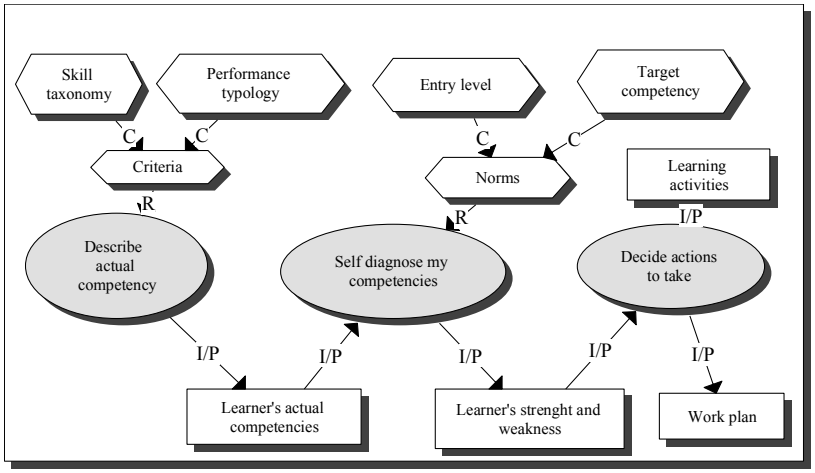

Figure 2: Competency self-management process model.

The concept of competency is here defined as a statement of principles establishing a relationship between a target population, a skill (within a ten level taxonomy) that this population is able to perform, the performance context to which the skill is applied (composed of 5 criteria) and the knowledge object to which this skill is applied (a concept, procedure or rule) (Paquette 2004). Figure 3 below illustrates the four elements of the competency definition implemented in the tool.

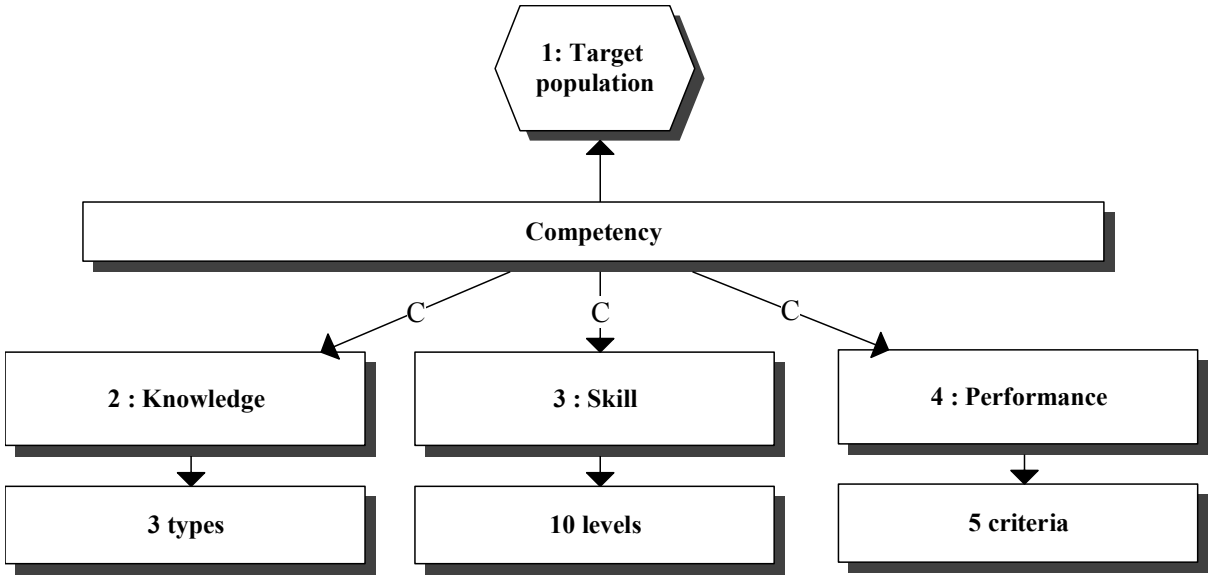

Figure 3: Competency concept definition.

The target population is for example the adult learner. The three types of knowledge are concept, procedure and strategy or rule. The skill taxonomy includes ten levels of skill: pay attention, memorize, identify, transpose, apply, analyze, repair, synthesize, evaluate and self manage. The performance typology includes the five following criteria: in a guided or autonomous manner, in a partial or complete manner, in a irregular or regular manner, in a simple or complex situation, in a familiar or new situation.

5.3 The Support Tool

A prototype was developed to illustrate and evaluate the process model. The required functionalities were implemented within three main screens as illustrated in Figure 4.

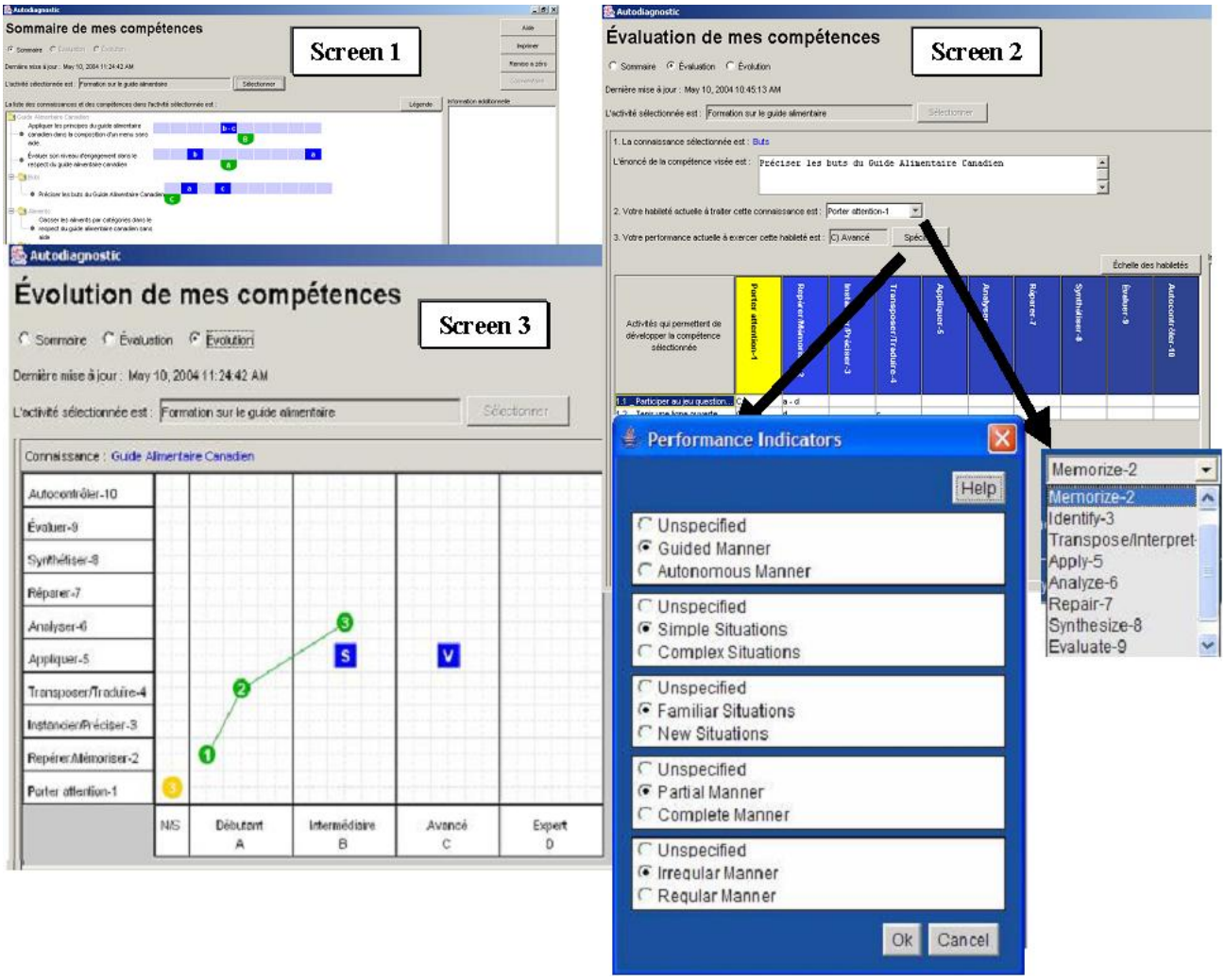

Figure 4: Screen shots of the self-diagnosis tool

The learner accesses this tool within the Explor@ eLearning environment. The first screen proposes a list of the competencies associated to the selected learning activity. Each competency is matched with a graphical bar positioning his/her own assessment in relation to the entry and the target competencies prescribed by the course designer. Those are conceptual support feeding the learner with information needed to start the self-diagnosis procedure. The learner selects one competency and obtains a diagnosis made by the system showing his/her strengths and weaknesses. The learner then proceeds to select either the evaluation or evolution functionalities.

If the user selects the evaluation functionality, the second screen appears. The self-assessment is a three-step procedure, where the learner is guided through these steps. After reading the competency statements, the user has to select his own skill level in the window presenting the skill taxonomy. The learner is then invited to communicate his/her own performance level choosing among a set of criteria presented in a second window. When the learner has completed these steps, visual clues inform him/her of his/her progression among learning activities linked to the development of the competency.

If the learner requests to see his evolution, the third screen appears. It offers a table illustrating the position of the actual and past learner competency levels along with the entry and target level competency and the group level of competency.

5.4 Testbed Protocol

A testbed was conducted with thirteen participants to validate the design decisions, the process model and the user interface. There were seven students from various backgrounds with previous experience in self-assessment and six experts in interface design, pedagogical design and training management. All participants were asked to perform five different scenarios using the prototype tool over a period of 45 minutes to cover the self-management process described above. They completed an appreciation questionnaire after finishing all the activities. The expert participation mainly aimed at validating the design principles. Three of them were invited to discuss the main problems in a focus group.

The distance learning engineering research laboratory called LORIT (Laboratoire-Observatoire de Recherche en Ingénierie du Téléapprentissage) was used to conduct and observe the testbed participants. A facilitator guided the participants and the activity flow was videotaped including screen movements, interactions among facilitators and participants. Meanwhile, two observers monitored each participant's performance on videoscreens and charted observations from the control room.

Laboratory

Control room

6. Results

Results from the testbed validate the design principles, the prescribed process, the interface and the terminology used in the prototype. In general, the data collected show positive aspects as well as need for improvement in designing the support tool. The positive aspects can be summarized as follows:

- In general, participants demonstrate interest in this type of tool by suggesting original usage alternatives. They also report satisfaction of using the tool.
- The graphical aspects of the interface is most appreciated.
- No technical problems arose contributing to the overall positive impression

In terms of the design principles, the concern was to ensure that all actors share the same evaluation process, competency concept and evaluation criteria. This strategy proved to be useful, learners where able to self evaluate in an efficient manner. However, the results show that the terminology used in the skill taxonomy must be made more explicit to fully reach learner and designer comprehension levels. Also, the learner and the designer interpreted the performance criteria differently.

The second design principle focused on improving the significance of the learner's evaluation results by supporting the whole self-management process and by focusing the attention on differences among learners and other actors' evaluations. The results show difficulties in completing some scenarios mainly where procedural support was absent in the prototype. In fact, the procedural support was centered on the self-assessment procedures leaving the other tasks with merely conceptual support. These results show the need for a more complete support tool to facilitate self-diagnostic and decision procedures. Further, comments from participants show a difference in perception of the self-assessment process itself. Most participants expect to be tested and receive feedback on their competencies from the tool. This finding leads us to reconsider the process model and reflect on the "self" part of the whole process. Finally, the evolution screen is the main success, where the graphic curves help to locate one's competency state in

comparison to previous results, entry and target competencies established by the course designer as well as with the group's mean calculated from the results of all learners involved in the course.

The third design principle was to inform the learner of potential failure risks. The results show a lack of support for the learner to efficiently use the feedback information given. A better interface with a complete support to this procedure must be added, including tools to permit human interaction between learner and facilitator.

Results related to the process model allow identifying new procedures in the process, namely remembering and selecting experiences illustrating a competency. A new version of the model was elaborated . Modifications are pointed out with bolded graphic objects in figure 5.

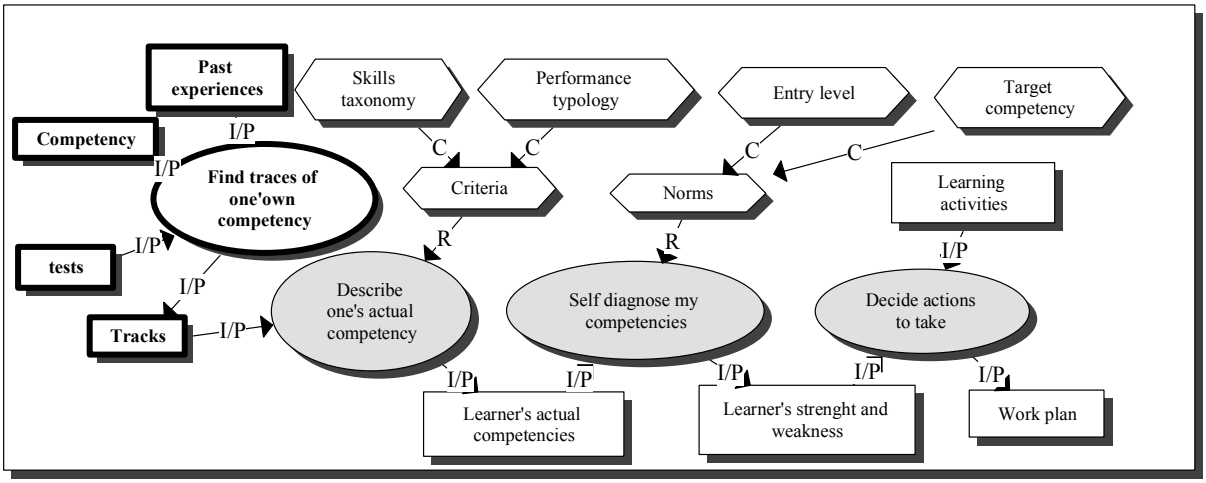

Figure 5 : Competency self-management process revised model.

Results related to the tool itself show that the screens must be better structured and organized to follow the cognitive process model in order to be more intuitive. Moreover, the terminology used needs to be clarified, especially to fully explain the skill taxonomy. For example, most participants used the skill level 5 "Apply" because it was a verb with a common meaning and not because they could really apply knowledge. Some of the performance criteria were confusing for the participant because they do not have the same meaning for all participants, e.g., *new situation* and *complex situation,* appeared to vary from one person to another.

7. Conclusion and Recommendations

In this paper, we have described a strategy implemented to support self-assessment process for the eLearner in a competency-based approach. The design methodology, the prototype tools and the results of the testbed were presented. The latter pointed out the need to stabilize the definition of the self-assessment process in an online situation, to reorganize the interface to better respect the cognitive process model and a more user-friendly communication. It was also found that there is a need to clarify the terminology in used in the tool. To alleviate some difficulties of online learning, it is important to pursue this research strategy by integrating the facilitator's evaluation into the learner's tool, thus identifying which parts of the process need to be supported as well as identifying various use cases to complete the generic features of the support system.

This competency self-management tool can be useful to monitoring progress both for individual and organizational management purposes. It can guide learners and facilitators in identifying learning needs at the beginning of training program as well as giving feedback on the adequacy of the training program. It can serve to support adults in their career planning, skills' assessment, and discussion with their supervisor in the workplace.

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