Remote engineering implies a new strategy of assessment?

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REMOTE ENGINEERING IMPLIES A NEW STRATEGY OF ASSESSMENT?

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Abstract

When we spoken about remote engineering as a new methodology used in the cyberspace with the final goal of the teaching/learning improvement and cost sharing, we are obliged to approach all of the process sides. Assessment is one of these sides and there is considered the most powerful tool for illustration, in the qualitative and quantitative ways, the learners responds at educational objectives offered by the remote engineering learning environment.

In the present paper the authors have the intention to explain what we do really different when we introduce remote experiment in the learning environment in the comparison with face to face learning, problem based learning or project courses from assessment point of view. Also they have the intention to put in discussion how does this technology to reconsider the content or the delivery steps in teaching. It is of great importance to stress on the variety of the audiences who will be involved: students, lecturers, curriculum designers, employers, administrators.

Introduction

This paper is not the first one dedicated by the authors to the peculiarities of the assessment in cyberspace. Why we stress so much on this subject? Remote engineering is in fact only a new methodology. It has the power to modify the learning environment in a wrong direction? It needs a special strategy for design and implementation of assessment?

Assessment and evaluation

For answering at above questions the authors have start from the finding that the assessment is *a form of communication*. In the mean time, the remote engineering is also manifested in a virtual space as a communication environment. Since, in all of communications situations, first of all we must to define the audience in the table 1 will be present a comparison between audiences in the classic space and in the cyberspace:

Tab.1

Audience in the **face to face** teaching environment	Audience in the **remote engineering** environment	Commentary
Students	Students and all of the persons interested in the remote work (e.g. SME's employee)	Enlargement of the audience area will introduce new requirements and supplementary levels of quality
Teachers	Teachers and tutors involved in system	Appearance of the tutor, a new actor in system, will require supplementary purposes in the quality assessment
Managers as stakeholders	Managers as stakeholders and managers as clients from all of locations connected in the network	Having different rules about the resources administration and taking into account that remote engineering utilize sharing endowment, the management and resources assessment will be

		distributed and, as a result, the quality of the management will be of several levels and point of view assessed.
Employers	Employers	Globalization will not made differences regarding quality of job applicants

It is obvious that regarding audience, the remote experiment has introducing the new aspects which implies the supplementary assessment criteria. In our opinion, these supplementary criteria would be defined after a deep analyze as the following:

- *Supplementary motivation in learning* due to the increased employability as a result of the remote experiment environment which add a supplementary skills from teaching period;
- *Increasing confidence in the learning outcomes* as a result of the possibility to compare the experiments made up in several universities regarding the same topics;
- The *flexibility of the designed experiments* allow the students to find new challenges as new possibilities for learning, apart of those that they put into practice as a result of acquired knowledge;
- *Skills development* as a result of the relationship between educational theory and practice because the remote experiment ensure that action and practical experience is the basis of the learning.

After definition of the audience, we must to define the assessment purpose in the case of existence of the remote experiment, which must be more complete than in the case of the face to face learning. In the figure 1 we present the new component of the assessment purposes:
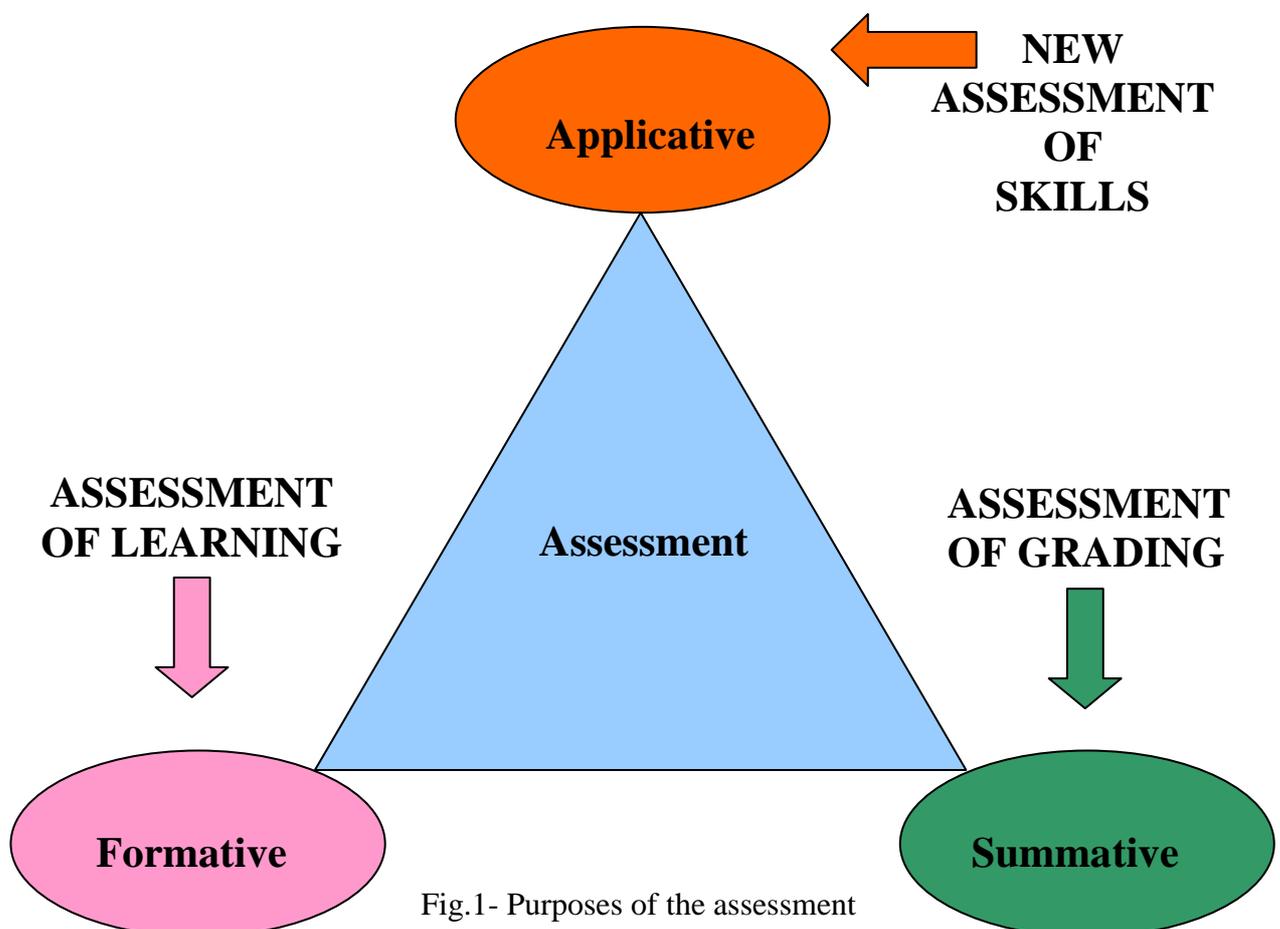

Fig.1- Purposes of the assessment

Formative assessment (assessment of learning) is applied in all of the assessment cases with the role to provide the feedback to the learner. Its results are used for the improvement of the teaching/learning environment and its performances. The remote experiment as a new learning environment, have as the greatest contribution in the formative assessment, *the increased interactivity offered by the network.*

Summative assessment (assessment for grading) is applied in all of the assessment cases with the role to appreciate the pass or fail, the rank of the students, to tell to the students what they have achieved, to give credence to a course, and so on. The remote experiment in the summative assessment, help the students *to develop their skills of the self-assessment.*

New applicative assessment (assessment of skills) is added by the remote experiment at the above two purposes of the assessment. What must be followed in this assessment of skills? Using the Bloom's taxonomy, we consider that assessment of skills is a balance between competences and developed skills. A synthesis there is presented in the table 2.

Tab.2

Skills developed in remote engineering	COMPETENCES					
	Application	Com prehension	Analysis	Synthesis	Evaluation	Knowledge
Knowledge of facts, data, places from different learning environments		X Summarize and classify data, facts, places	X Compare and categorize of the patterns	X Organize and relate knowledge from several learning environments	X Compare and discriminate between ideas	X Verifying and validating the acquired knowledge
Application of acquired methods, theories, concepts to the new learning environments	X Recognition of the components of the new experiments meet in the network	X Grasping meaning of local experiments in correlation with those offered in the network			X Assess value of ideas, theories etc. sustained by the experiments	X Increasing capacity to show and relate
Use old ideas to create new ones	X Design and invent	X Predict new possibilities offered by the network			X Evaluation of the level of the own labs. and of the labs endowment	
Integrate acquired knowledge in the new experimental environment			X Arrange, order and explain the place of the home experiments in the network	X Formulate the peculiarities and integrate the home experiments in the network	X Made ranking between experiments as a result of their developed skills	X Development of the knowledge quantity
Make judgements	X Demonstrate the superiority in skills developing	X Interpret data and their correlation with knowledge	X Conclude, discriminate and elaborate of recommenda-tions		X Critical comparisons between teaching environments and ranking	X Enlargement of the area of judgements

As we observe in the table 2, in the case of the remote experiment notion of "skills" has an extended meaning. It is not referred only at practically abilities but also at analysis, synthesis and comprehension. In this situation the assessment in the case of the remote experiment becomes regarding objectives more complicated than the assessment of practical skills, as in the case of laboratory applications.

Being special assessment, in connection with a special computer assisted environment, in his designing we consider that three main issues needed to be taking into account (table 3):

Tab.3

ISSUES	APPROACHES	WHO UNDERTAKE
Assessment methods (usual)	♣ Self-assessment	♣ The students themselves
	♣ Peer-assessment	♣ Teachers and tutors
	♣ Collaborative assessment	♣ Managers and employers
	♣ Negotiated assessment	♣ Customers and parents
	♣ Network assessment	♣ One of the functions of the portals in connection
	♣ Work-place based assessment	♣ External agencies
Computer assisted evaluation	♣ Wide range media catering all of learning stiles used in remote experiments	♣ Teachers and tutors
	♣ Long term observation of the management, administration and reporting	♣ Stakeholders of high education system
	♣ Short term observation with immediate feedback to the students	♣ Students, because allow tailoring of the individual needs

Remote engineering methodology assessment is in correspondence with computer assisted evaluation because in addition of the fact that it is a communication tool in virtual environment, it is also relationship environment:
- ❖ The environment of the relationship of the student with themselves;
- ❖ The environment of the relationship of the student with other student;
- ❖ The environment of the relationship of the student with the teacher of tutor;

The above consideration leads to the conclusion that assessment considered traditionally as interaction between the student and the institution becomes, in the case of the remote engineering in the virtual space, **the interaction between individuals.**

Who was the beneficiary of the assessment results, in the classic face to face environment? Institutions! After application in the curricula of the feedback conclusions, students will be the beneficiary.

Who will be the beneficiary of the computer assisted assessment results if the above conclusion regarding the interaction between individuals is valuable? Evaluation!

The above statement seems to be strange. Remote experiment and virtual space stress the existed difference between evaluation and assessment. Many times these two notions were merged into one another. In virtual environment where is not speaking about institutions and student interaction, *the assessment* has the role to appreciate the learning outcomes which students undertake to do if the specific tasks established by the teachers are fulfilled, while *the evaluation* is referring at the broad range of evidence in order to gauge the effectiveness of teaching/learning process. It means that evaluation contains assessment data that is just one aspect of the evaluation.

The evaluation in the case of the remote engineering contains the following approaches:
- ❖ The evaluation of the authenticity of the contents;
- ❖ Range of data and information sources;
- ❖ Level of the integration in the network;
- ❖ Complete assessment of the learning environment (as input data);
- ❖ Focus on individual and situational implications;

All of the above approaches will be quantitative and qualitative. *Quantitative evaluation* focuses on measurements: student progression, student pass rates, student retention, etc. *Qualitative evaluation* focuses on student comments and evidence for reasons of changes (what student do and feel).

The virtual environment and the remote labs offered will move the evaluation from institution towards the network. Instead to evaluate only one institution and teaching offer, we must to evaluate quite all of remote labs from Internet? It seems to be an impossible task. Because computer assisted evaluation in based on the powerful tool, we consider that is better to give to the institutions, managers, customers, parents, students etc. a software tool, with the following functions (table 4):

Tab.4

Actors	Functions offered
Teacher	➢ Clear and explicit criteria of assessment regarding experiment
	➢ Measurement of the achievements of a experiment against specific learning outcomes and skills
	➢ The position of the new resources of learning appearing on the Internet
	➢ Quality assurance criteria meet by the experimentation materials
	➢ The time spent on the experimental activity
	➢ Suitability of the experiment with the institutional curricula and with technical resources
Students	➢ The time required and the resources
	➢ Whether the experiments will help them pass their assessments
	➢ Whether the experimental resource is easy to use
	➢ Whether the experiment has influence on the future needed learning outcomes
Managers	➢ Efficiency regarding the best use of time and resources
	➢ Cost/benefits justify the resources access?
	➢ Students retention and progression
	➢ Development of employability skills
Funding bodies	➢ Remote experiment network connection contributes to the institution strategic mission?
	➢ Who give the quality?
	➢ Sharing of equipments in remote experiment increase the value of money?
Support staff	➢ What additional support and maintenance is required and what is the cost sharing?
	➢ Is the resource properly integrated with other services of the institution?

All of above functions might be put in the software database, for the beginning as experimental case study and after validation as evaluation tool on the network. The partner agreement is needed and the transparency of the process is a condition of success. Some impediments must be mentioned:
➢ Cultural diversity of the network;
➢ Language;
➢ Prerequisite knowledge from which is network setting up;
➢ To make uniform the used software;
➢ To have the comparable speed of data transfer and of access;
➢ To have large opportunities to respect local laws;

Conclusions

1. In the case of remote experiment, assessment and evaluation must be differentiate stronger that in the case of face to face learning;
2. In the case of the remote experiment in the virtual space, assessment is considered as **interaction between individuals;**
3. Between the known assessment methods i.e. assessment of learning and assessment of grading, remote experiment has introduce **new assessment of skills**;
4. In the case of the remote experiment, notion of "skills" has an extended meaning. It is not referred only at practically abilities but also at analysis, synthesis and comprehension.

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