eLearning: Is time for eTaxonomy?

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Abstract: Learning and teaching as supplement processes are parts of education. Instruction is the concrete realization of this process with concrete participants and goals that they set before them and wish to achieve. The overall value of instruction is determined by dynamics, quantity, and quality of the interaction between elements: students, teachers and contents that carry out a concrete tutoring process. In respect to this it is very important how values or quality of each element are assessed and further to this assessment the value of the whole process. Each methodology for determining these values requires the use of certain taxonomy. Bloom's taxonomy is applicable in the assessment of the level the goals level achieved by instruction. The application of ICT technology changes in a more significant way the interaction between the elements of tuition, the manner of realization and indirectly it might affect instruction quality. This paper poses the question of how strong is the need for revising Bloom's taxonomy with the goal being to have the best quality assessment of instruction, especially eLearning and how it can be implemented.

Key-Words: - eLearning, eTeaching, Taxonomy, Assessment, Evaluation, LMS, CMS, CLMS

1   Introduction

Assessment is an exceptionally important activity in the educational process. The manner and form of assessment is usually planned as early as the phase of instruction planning, i.e. in the phase of preparing the detailed realization for realizing instruction contents. In respect to this it is not important whether the instruction contents are carried out in the context of formal or in the context of informal education. Neither is it important whether assessment is made on the level of basic, secondary or higher education.

Instruction on the basic level is determined by the teacher, student and contents around which they have gathered [2]. Higher levels of this model are the goals set forth by the instruction course and program. The manner and forms of achieving these set goals are determined mainly by the quantity and quality of interaction between the elements on the basic level. In general the teacher and the student have the same goal: to encourage the fastest and most efficient transfer of the necessary information with their activities so that the student can fulfill the instruction requirements. Although the goal is common, the role of the teacher is determined by a stressed need for supplementary relations. The student learns and the teacher teaches, but the contents are the same. And the goal is not only to acquire knowledge but also to gain certain skills and competencies. For the needs of this paper let us accept that: "Competence is a mastering of knowledge and skills at a level that is sufficient for their application for doing of concrete work" [1]. As the subject of assessment competencies and their acquiring is of special importance in informal education or learning as someone hobby.

Assessment and evaluation of instruction successfulness is in fact brought down to determining quality and quantity of gained knowledge and acquired skills. However this kind of description is one-dimensional. This viewpoint will be explained later in the paper.

With ICT implementation instruction has evolved into the form generally known as eLearning. Its latter assessment in eEnvironment has gone through changes and amendments, but limitations as well. The basic demand is the existing of good taxonomy that by application of good quality methodology makes assessment and evaluation is of good quality. Can Bloom's taxonomy have good quality solutions to requirements that are set forth and the possibilities offered by ICT technology in the range of eLearning?

2 What kind of taxonomy should be applied?

In what kind of relationship are the assessment and evaluation processes and learning as an overall process? What kind of taxonomy and what methodology should be applied? Assessment and evaluation are usually limited to determining the quality and quantity of acquired knowledge and skills. However, this is only one of the dimensions. In accordance with the mentioned we shall study a model of instruction where the student-teacher-contents with defined goals are positioned in the environment-context of instruction. In this the most important influences of ICT on instruction, i.e. eLearning should be considered, regardless of the form, i.e. whether it is blended mode or on-line mode.

2.1 Instruction goals and assessment

It is obvious that instruction goals and the assessment and evaluation processes are closely tied together. Acquiring of knowledge and skills and gaining competencies are the instruction goals, whereas the reached level is the subject of assessment and evaluation. From the aspect of the mentioned, there is no importance in what the instruction form is: traditional or eLearning.

However, the development and application of ICT in instruction besides the improvement helps those that have a job to maintain competencies that tend to be lost as years goes by. According to Goddard (1998) as cited in O'Neil, Sigh and O'Donoghue (2004), by 2005, 150 million people will demand higher education. Higher level skill, knowledge and qualifications will be required [3].

2.2 Communication, interaction and assessment

The consequences of interaction between the listed elements are activities that in a concrete situation represent concrete realization of instruction. The quantity and quality of these interactions is the subject of assessment and evaluation. Furthermore, assessment and evaluation require metrics and taxonomy that may be applied in an adequate manner. Of course, this goes together with applying the adequate methodology.

In Pratt's instruction model the emphasis of the model is taken into account only in considering the role and significance of certain unit elements. It is quite clear that the emphasis of this may be placed into different positions depending on the quality and the level of stressing certain elements. By shifting the emphasis within the basic triangle, student-teacher-center, we may talk about student-centric, teacher-centric or contents-centric instruction.

It is an indisputable fact that implementation of ICT in instruction has made instruction independent of time and place, but this independency also commits one to stricter organization of both time and place where instruction can be realized. As a consequence, the positions of the student and teacher in eLearning have changed. This applies to their positions only, - not to their roles and significance. In general, application of technology in instruction may change the manner of carrying it out but not the essence of instruction.

2.3 Assessment in respect to the model's point of emphasis

Assessment and evaluation can not be left to remain on the level of assessment and evaluation of the level reached by the student. This is only one of the dimensions of success or failure. Success or failure as final assessment and evaluation are conditioned by the basic instruction elements and the quality and quantity of interaction between them, i.e. not only is the student responsible for the final results. On the contrary, in the teacher-centric model or the contents-centric model his role is equal but the responsibility is less or equal to the responsibility of the other elements.

Further to what has been stated, it is necessary to stress that the student's assessment and evaluation must be preceded or followed up by the teacher's assessment and evaluation, that of the prepared instruction contents, formulations and instruction goals articulation, and finally the context adequacy into which the instruction has been placed.

2.4 eLearning, instruction and assessment

eLearning raises the communication between the mentioned elements to a level that is higher as to quantity and is better as to quality. It may be expected that in a space with better quantity and quality characteristics one can find more parameters whose measuring capability can improve instruction assessment and evaluation, i.e. extend the taxonomy model.

Through eLearning, regardless of whether it is a case of mixed/blended mode or on-line mode, communication consideration may be very complex. The student may communicate in a synchronous or asynchronous manner with one or more students, with one or more teachers, study the proposed contents or investigate other sources with the goal of getting explanations or supplementary

information. If we place ourselves in a straight line with these communications and activities, assessment and evaluation become more complicated.

From the context aspect, assessment and evaluation may vary significantly and will require different taxonomy. This does not mean that the same taxonomy can not be applied in various contexts with different volume. To be specific, we can apply Bloom's taxonomy in different ways in basic education or informal education forms.

2.5 Instruction paradigms and assessment

Application of taxonomy depends on the style of learning. The instruction of some subject does not require the exclusive application of one single style of learning nor is only one style recommended. Exchanging of style should be adapted to instruction goals and brought into coordination with instruction contents. Whether the prevailing approach will be behaviorist, cognitive, or constructional depends on the contents and instruction goals. Although eLearning has in a certain way promoted constructivism as the prevailing approach to learning, it has not been made it the exclusive one.

The application of taxonomy depends on the style of teaching. If we consider the five usual approaches to teaching, i.e.: transfer as the efficient delivery of contents, development as teaching with the goal to develop the way of thinking, teaching with apprenticeship with the aim to form the way of existing, training with encouraging self-efficiency and social reform as the attempt to create a better society, it is evident at first glance that the required taxonomy will vary from style to style and from case to case. However, as is the case with the style of learning, there is no exclusivity nor is it recommended.

2.6 Notes: eLearning as an application

It is necessary to note that eLearning requires a significantly different preparation than is it the case with traditional instruction. Segments of instruction or wholes that are carried out supported by ICT are developed as information systems. It is necessary to develop or apply the already developed systems for managing instruction (LMS) and systems for managing contents (CMS) or in combination (CLMS). The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) is the most well known as an organized process of instruction design that recommends evaluation during all phases of developing complex instruction forms – lessons and courses. Although product/courses quality evaluation is required, it is actually about the evaluation of instruction in the light of experience and satisfaction

of students and teachers, and about the level of achieved goals. The final phase of the ADDIE model needs to give answers and guidelines as to how to improve instruction for future use. The regular evaluation of an on-line course is defined in the model of instruction design named as rapid prototyping. Analogy with the information system development is obvious. A model is the type of continuous spiral development cycle of instruction forms through the following:

✦ Defining key elements of the education system
✦ Rapid development and implementation of system (prototype) basic structures
✦ Evaluation by the students
✦ Re-definition of key elements
✦ Repeated rapid development and implementation of improved system elements
✦ New evaluation by the students
✦ Re-definition of key elements, etc.

The listed shows that eLearning evaluation is a complex problem and that it requires careful choice of measurable parameters that will be the taxonomy for assessment and evaluation of eLearning through the goals reached therein. It is of no importance which mode of eLearning is taken into account: blended/mixed or on-line mode.

2.7 About taxonomies or
Is time for smooth eChange, Mr. Bloom?

Among other things, Bloom's taxonomy has been applied very often in traditional instruction due to its simplicity and for being easily understood. Bloom identifies three areas of educational activities:

✦ Cognitive: mental skills (Knowledge)[4]
✦ Affective: growth in feelings or emotional areas (Attitude)[5]
✦ Psychomotor: manual or physical skills (Skills) [6].

Furthermore, Bloom identifies six levels within the cognitive domain, from the simple recall or recognition of facts, as the lowest level, through increasingly more complex and abstract mental levels, to the highest order which is classified as evaluation. Each level of intellectual activity is marked by a certain concept.

Bloom's taxonomy is mainly linked with the mentioned domains of cognitive activities. In the psychomotor area there is a still finer division of levels.
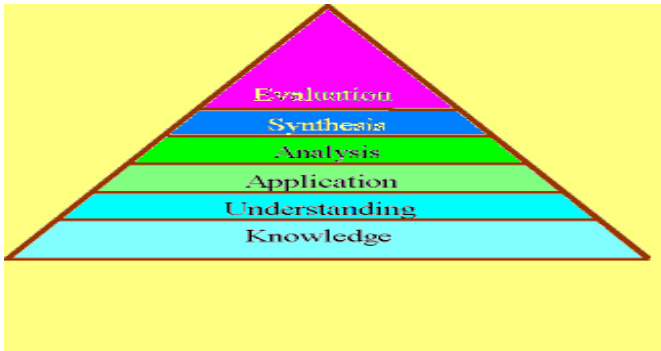
Picture 1: Levels of Bloom's taxonomy

Dave additionally proposes the following division in the domain of Developing and Writing Behavioural Objectives:

- ✦ Imitation: Observing and copying others. The execution may be a formal one and on a low level.
- ✦ Manipulation: To acquire the capability of carrying out certain activities by following instructions and earlier acquired practice.
- ✦ Precision: Being more precise in more exact terms. Few errors are apparent.
- ✦ Articulation: Coordinating a row of activities with the goal of harmonizing and consisting knowledge
- ✦ Naturalization: Achieving a higher and more natural realization level without the necessity of additional contemplating about it [7].

Harrow additionally proposes the following division in the psychomotor domain for developing behavioral objectives:

- ✦ Reflex movements: reflex reactions that have not been learned.
- ✦ Fundamental movements: Basic movements such as walks and similar.
- ✦ Perception: Reactions stimulated for the differentiation of visual, audio, kinaesthetic, or tactile actions.
- ✦ Physical abilities: Stamina that must be developed for further development such as strength or agility.
- ✦ Skilled movements: Advanced learned movements as one would find in sports or acting.
- ✦ No discursive communication: Effective body language, such as gestures and facial expressions [8].

If we limit ourselves to the proposed taxonomical raster, we will not cover all the aspects that should have been

considered in the range of some single paradigm of learning or teaching.

In general, we may define education/instruction as the area determined by the following vector:

$$E = (S, T, C_o, G, C_x, L, T_m)$$

The first five components are Pratt's model guidelines, whereas the last two are location and time in which instruction is carried out. In the range of eLearning the vector may be brought down to five basic components because in eLearning it does not depend neither on the time nor location where instruction is carried out.

By applying taxonomy, the vector value is determined at any moment of time, i.e. instruction beginning – initial conditions, through instruction – controlled assessment and at the end of instruction – evaluation of reached results. The fact that Bloom's taxonomy has been in force since its appearance, i.e. for more than half a century provides the possibility to extend the set of its parameters or to modify the one defined earlier. In fact, assessment and evaluation in instruction should be a continuous activity with special emphasis on the evaluation of final results.

3   The Way of eChanging of Taxonomy

ICT implementation in instruction has as a consequence different forms of mixed instruction and with a tendency towards on-line forms. Problems that come up in such circumstances should be carefully classified bearing in mind to make a strict distinction between the causes generating them. Distinction is necessary due to the need to find taxonomic and methodological framework for solving them. While doing this the methodology must be and is sufficiently leaning on taxonomy.

3.1. What should be changed and how?

Should taxonomy in instruction be changed, and if so – how should it be changed? Let us limit ourselves with our proposal to Bloom's taxonomy and the need to modify it.

Bloom's taxonomy suggest for certain levels sets of key words used as to determine the acquired knowledge. For instance, the category Knowledge in the cognitive area as the lowest one presumes that there is a level that may be labelled as the level Recall data or information. When forming the tasks for evaluation on this level the following key words are proposed: defines, describes, names, outlines, recalls, recognizes, reproduces, selects,

states, identifies, knows, labels, lists, matches. With the highest category Elevation the student must be capable of making judgments about the value of ideas or materials. The following reserved words are used when determining tasks for this level: evaluates, explains, interprets, compares, concludes, contrasts, justifies, relates, summarizes, supports, appraises, criticizes, critiques, defends, describes, discriminates, etc. [4].

The same procedure may be taken with the remaining categories within the other domains: affective and psychomotor, as well as additional psychomotor domains linked with student behaviour [8], [7].

What should be changed in eLearning? The set of proposed key words depends from level to level. It also depends on other factors such as concrete instruction contents, age and capabilities of the students, their existing knowledge, capabilities and skill of the teachers, etc. The listed parameters are in general the same in all forms of instruction. eLearning is carried out in virtual form with application of ICT as a powerful instruction means or aid (and even more than aid). ICT has some limiting characteristics as well, but this is not the subject of this paper.

When determining the manner of evaluating the level of acquired knowledge in eLearning, i.e. the concrete CLMS the set of key words might have a different meaning especially if the meaning is linked with technology or evaluation methodology or application of instruction aids.

eLearning as an institution shifts classes into virtual framework so that all instruction elements, the manner of realization and communication between the instruction elements acquire a new quality. Reducing or extending the set of key words within the taxonomy will, firstly depend on the technological possibilities, i.e. on the applied LMS and manner of organizing educational objects within the CMS, and especially on the communication and it's moderating in carrying out instruction.

Therefore, the evaluation will also depend on teachers' behaviour, or in the range of eLearning that of the activity tutor/moderator.

All of the above mentioned will depend very highly on the context in which instruction is done, i.e. whether it is a case of formal (primary, secondary, high school) or informal (education according to job needs, or as a hobby).

3.2. Tradition vs. eEnvironment
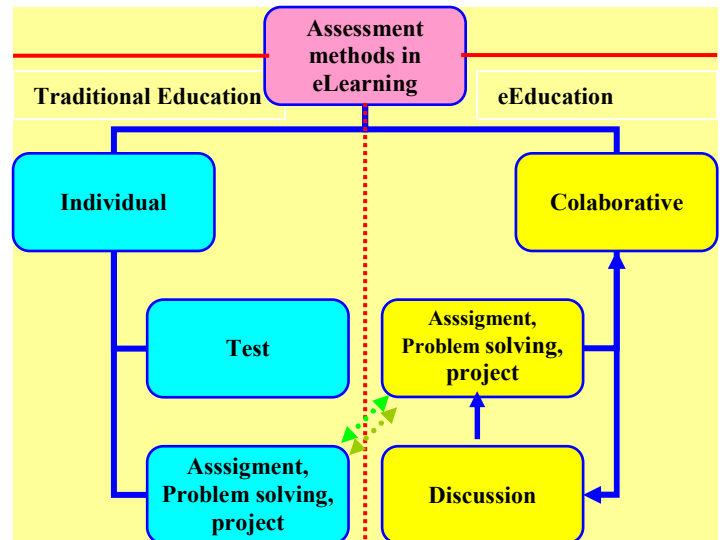
Picture 2: The conceptual model of assessment

A model for certain assessment activities should be proposed by the assessment concept well as well as the methodology for carrying it out (Pic. 2) [9]. The necessary parameters – input data – represent common characteristics that are at the same time prerequisites for the choice and implementation of the assessment activities:

- ✦ learning objectives,
- ✦ criteria for success and
- ✦ learning styles [9]

The conceptual assessment model should further have the following clearly defined characteristics:

- ✦ Structure, order and type of assessment activities.
- ✦ The intend of the activities and reflection of their results in the learner's portfolio:
    - self-assessment
    - pre- assessment
    - formative assessment
    - summative assessment
- ✦ evaluation and grading
- ✦ The weight of the each assessment activity in the final grade
- ✦ The grade scale
- ✦ The time and duration of the each assessment activity, included in the assessment unit.[9]

Each of the listed activities in Picture 2 must have its conceptual model and strictly defined characteristics. They also have the mentioned common characteristics.

One can see how complex assessment is from the very setting of basic pre-requisites and common

characteristics. The mentioned model is in [9] studied on the level of an educational unit by which the authors have set a distance from the collective assessment at the level of a collegiate body, for instance. It is quite clear that this level is the most complex one because it requires precisely set criteria, and it is directly dependent on the teaching style.

It is necessary to stress that in the part concerning eLearning an «opposite» sequence of activities raised to the level of the group and require strict defining and should be adequate for the group in question. Activities modeled in the area marked as Assignment, Problem solving, Project and similar have two levels: the first one which must be individual and the second one that must be the result of some group – collaborative activities. Therefore this model has points that may be avoided by team work and repetition of important activities.

In eLearning it is necessary to have assessment as well as evaluation of contents/subjects within a concrete Learning Content Management System (LCMS), i.e. within the technological system limitations. These activities assume testing of the software assessment of communication, prepared data files and similar, but it is not the subject of his paper.

3.3. Assessment Tools – some more dilemmas

Complete virtualization of instruction is achieved by on-line instruction. In such a framework there is no communication of the f2f type, but this is not always so. If we carry out instruction in a local, narrower geographical context, a part of the instruction may organized where f2f communication will be also present. It is clear that in national and international scope this form requires additional financial means and as such is not wanted.

Furthermore, the on-line course is a kind of software application with all advantages and disadvantages software can have. Instruction is also a process where information is processes in a specific way – by their transfer to the students. LCMS = LMS (Learning Management System) + CMS (Content Management System) is such software that in physical realization represents the scope of eLearning. Each product of this type should meet the basic psychological, pedagogical, didactic and methodological settings. As a consequence it must contain also the mechanism for assessment or the possibility of modular connecting of some independent mechanism with the adequate taxonomy.

Name of activity	Property of activity
Test	Type of the test with Criterion or Normative Reference
	Validity of the test
	Adaptability
	Number, type and weight of the test items
Individual assignment	Number of task, implementation and decision of the assignment
	Weight for each task
	Common number of scores for whole Assignment.
Collaborative assignment	Number of task, implementation and decision assignment
	Weight for each task
	Common number of scores for whole assignment
	Schedule of the responsibility of each team member for implementation of the assignment
	Criteria for evaluation of individual achievements of each member of the team
	Criteria for evaluation of the achievements of the whole team
	Possibilities for pear to pear assessment
Discussion	Topic of discussion
	Role of the teacher/tutor moderator: Passive or Active
	Type of discussion
	Object for assessment: speed of answers, quality of collaborative work, finding of optimal decision etc.

Table 1: Activities and assessment characteristics

Last but not the least important fact is the possibility of using open source tools either as a whole as CLMS with the belonging assessment tools or a separate form of

software designed solely for assessment. The most popular solution in respect to the facts is that an open source today is, for instance Hot Potatoes.

4   Conclusion and recommendations

Education today is a constant necessity, i.e. a continuous process. Different reasons may be the motive for being positioned in one of the basic axis poles of instruction as education realization. Most often we will find ourselves in the position of a student – whether it is a case of obligatory or voluntary education, education as a hobby or education as a necessity, and less often we will be in the position of an instructor/teacher. In the same way we may find ourselves in the roles of the assessed or the ones assessing.

Any instruction always requires assessment of the achieved results and determination of the level of achieved goals. Assessment id a process that must be objective, i.e. it must be protected from subjective viewpoints of the one assessing and the one being assessed.

Taxonomy that might be applied in assessment must be brought into coordination with paradigms of learning and teaching that is used in a concrete teaching process.

We are of the opinion that Bloom's taxonomy is an exceptionally good starting point that may be applied in eLearning, but that it must be adapted to eEnvironment, i.e. the weight of each parameter must be carefully checked out, as well as the possibility of its application in ICT supported instruction. Of course, standardization is necessary here. The internet, i.e. web environment sets forth the traditional grade into a global context raising good communication to a very high level.

If it seemed that taxonomy was in the teacher's competency in traditional education, eLearning makes the student be evaluated by his colleagues through collaborative forms of work throughout instruction time and also be forced to make objective self-assessment. Thus the taxonomy parameters gained another good dimension.

Assessment is usually crowned by some sort of diploma or certificate backed up by those having carried out the assessment, whether it had been the teacher or someone else, and declaratively the institution as the context in which instruction is carried out. In the scope of eLearning, LMS taxonomy must be transparent and recognizable. Transparency of assessment is closely tide

to the instruction declared goals and must be clearly defined as early as the beginning of instruction.

eLearning proclaims constructivism more prominently as the paradigm of learning and the collaborative type of work as favorable points with the help of which it is easier to achieve the set goals. Once more it is necessary to stress that exclusiveness in instruction is not wanted regardless of the instruction type. In such circumstances taxonomy such as Bloom's must be closely studied on all levels from the individual, tandem level, to the level of small groups and all the way to the level of a complete educational group.

As the assessment process in eLearning becomes dependent on application of LMS software, its modification becomes more inert, i.e. taxonomy modification may require LMS modification or vice versa, and in this way extend the necessary time and, of course, expenses. This a reason more for finding standards that must be met when choosing CLMS and the belonging tools for assessment and evaluation in eLearning environments.

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