

Competence as an Object for Assessment and Measurement in Training Quality Control System

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Abstract: In this article, the relation between categories “learning outcomes” and “competence” is analyzed. The authors offer the concept of connecting “measurement system” and “assessment system”. Besides, they describe the differences between these systems in the context of three elements: subject, object and article; and they identify the conditions for measuring and assessing the level of competence as a latent variable. Moreover, they study the application specific of the “competence” notion as an object for assessment and as an object for measurement in the system of training quality control.

Key words: Competence • Learning outcomes • Assessment system • Measurement system • Training quality • Assessment means • Latent variable • Indicator variable • The Rasch model

INTRODUCTION

According to Federal State Educational Standards, a higher education institution is obliged to provide training quality control using methods including:

- working out impartial procedures for the assessment of students’ knowledge and skills and graduates’ competence with high impartiality, validity and comparability;
- Taking into account all connections between knowledge and skills included in disciplines (modules); this makes it possible to evaluate the quality of students’ competence in various kinds of activity and the degree of general readiness of graduates for professional activity;
- The work program of each discipline (module) should clearly formulate end learning results seamlessly connected with mastered knowledge, skills and competence of general education program.

The foregoing allows us to make three basic conclusions. The first one is that the system of training quality control presupposes working out assessment procedures and, consequently, the subsystem of training quality control. The second one is that the quality or the level of competence should be determined by assessing

knowledge and skills. The third one is that there appeared a new term “learning outcomes” used as an integral notion similarly with the notion of competence. This conclusion is supported by new Federal State Educational Standards that order higher education institutions to “assess obtained outcomes and competence planned by educational program”.

As a result, there is a need to decide both on the notion itself and on the question what we should consider learning results in the framework of training quality control system based on the Federal State Educational Standards and what in this case will be an object for assessment and measurement.

In 2005, the work group that was to develop a European qualification structure formulated a notion “learning outcomes”. There is its clear definition in the user’s manual ECTS: learning outcomes are the wording for what a student is expected to know, understand and do after a training period [1; 2].

However, it should be specified that learning outcomes can be both expected and actual. Expected learning outcomes are meant to be a model presentation (for a typical student) of learning results to assess the level of some qualification. Actual learning outcomes are students’ knowledge and competence (general cultural and professional) demonstrated and assessed after an educational program (module) is complete.

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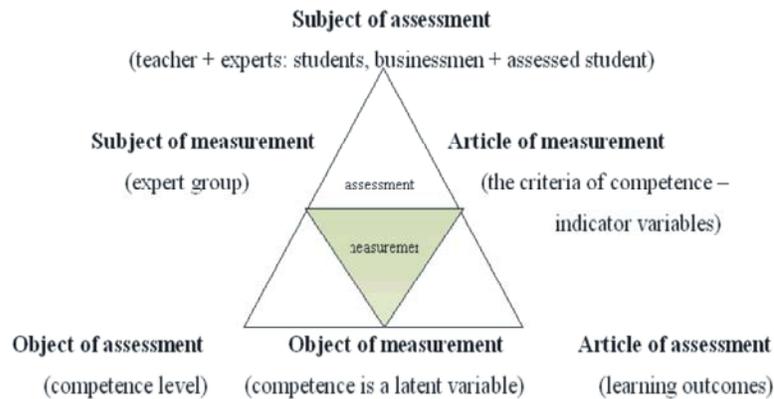


Fig 1: Interconnection between assessment and measurement systems

It should be noted that the term “outcome” means something external, measurable and object, while competence is a latent (hidden, unobservable): it can't be clearly measured as length or weight in physics. This allows us to suppose that it is not correct to use the term “outcome” towards competence.

A number of researchers state the necessity to work out competence assessment procedures [3]. But the requirement for competence to be “measurable” poses the greatest difficulty in theory and practice. These questions form a subject for this article.

The Conjugacy of Measurement and Assessment Systems:

Lack of high school practice of competence assessment determined the need to choose an approach for assessing its level. One of approaches is supported by educational standards of Russian Federation and international (“Bologna”) practice presupposes introducing levels and criteria of competence [4]. At the same time, one should take into account that, according to Federal State Educational Standards, each higher education institution will determine the levels and criteria for competence independently, while not only teachers but students themselves and employers will take part in assessment. That is there will be expert groups that will use expert assessment methods.

The application of “level” category creates the need for addition of measurement procedures to assessment procedures. Assessment procedures on different stages of education are ensured by a wide range of assessment means that help students to show their learning outcomes and competence.

Due to the fact that each higher education institution must work out assessment methods independently, the urgency for working out and substantiation of methodological basis for competence

assessment. This basis will make it possible not only to compare learning outcomes of one field of study but also to contribute to the development of educational services export.

The first step towards this methodology is the correlation between assessment system and measurement system of competence in the framework of training quality control system. We will consider both systems in the context of three basic elements: subject, object and article. On default, we presuppose that both systems work in a situational field. That is they are determined by a concrete situation as a sum of all external and internal factors and the one-act character and uniqueness of all events taking place in the moment of assessing or/and measuring. The interconnection between these two systems is shown on Figure 1.

According the scheme shown on Figure 1, the system of measurement is embedded in the system of assessment as its essential part. We will differentiate these notions in order to look into all these nuances.

Assessing is an expert or formalized process of comparing actual learning outcomes demonstrated by a student with the “model” (expected learning outcomes). This process ends with assessing the level of educational achievements of a student (learning outcomes).

Assessment is the result of assessing, the judgement about the quality of performed work, the success and failures in obtaining results. The system of assessment can unfold simultaneously in three assessment planes: achievements, progress and capacity.

Achievements assessment is the result of comparing present facts with what is supposed to be by the moment of assessing.

Progress assessment is the result of comparing present facts with what was achieved before this period of education.

Capacity assessment is the result of comparing present facts with what can be in future (career guidance, individual educational strategy, choosing field of study).

Mark is a graded quantitative expression of assessment (for example, excellent < good, satisfactory and poor).

In assessment system, both external expert(s) and assessed student himself form the *subject of assessment*. External experts can include teachers, members of examination board and other students. So, a “complex” subject of assessment potentially provides the unity of two elements (expert assessment + self-assessment) or three elements (expert assessment + mutual assessment + self-assessment). At the same time external expert marks individual achievements of each student and identifies the circle of solved and unsolved problems for him. Student being a subject of assessment performs a self-assessing: he becomes aware of his individual achievements, progress, increase of knowledge and skills and his “blank spots”, gaps and problems to work upon.

Assessment object is a level of developed competence that makes it possible to assess the individual level of education achievements, progress and capacity of a student.

Assessment Article Is the Result of Studies: Hence, one should understand that assessment is not an outcome fixing, but a “point” followed by a new stage of development [5]. Assessment system is actually the formative one. It is oriented to a specific student identifying his individual education achievements without comparing them with other students’ outcomes. Formative assessment makes it possible to differentiate student’s level of knowledge and skills, to perform a qualitative analysis of mistakes, to provide a constructive feedback and to plan the prospects of further development.

Measuring can be defined as a process of positioning (locating) respondents on uninterrupted number axis according their marks on interval scale. From the mathematical point of view, number axis is a straight horizontal line reflecting different development levels of considered latent variable (competence). This axis enables us to imagine considered latent variable as a number. In other words, *measure* is a point in the line and measuring is a process of building a line and searching for a place of respondents on this line depending on their outcomes [6]. The one-parameter model of G. Rasch is

used as a mathematic tool for the “measurability” of latent variables. This model helps to connect the qualification level of respondents and the difficulty of tests [7; 8].

During measuring, the assessment approach described above allows us to consider:

- Competence as a latent variable that needs a certain field of force - a “situation” realizing the possibility of fixing values of latent variable (competence) through indicator variables (indications);
- The criteria of competence with values monotonically increasing from level to level considered as indicator variables. The values of indicator variables are obtained as the results of using assessment means (tests, questions, tasks, cases, etc).

So, measuring finds out what interval the numerical equivalent of latent variable (competence) gets into. Thereafter, interval scale is used for measuring the level of competence by indicator variables. This scale has a number of characteristics:

- *Interval indicator variable has a quantitative measure - certain quantitative limits of existing in this quality.* For example, if we consider a communicative competence, then such its indicator variable as communicative activity can be measured by the quantity of displayed initiatives for interaction per time unit. The small amount of contacts per time unit will be interpreted as shyness and reticence, while the big amount of contacts per the same time unit will be interpreted as obtrusiveness and excessive sociability.
- *Interval scale does not have an absolute reference point.* Let us study this characteristic again by the example of communicative competence, but in this case we will use such indicator variable as “the ability to express one’s own opinion”:
 - He does not have his own opinion even in simple questions;
 - He usually avoids to express his own opinion even in secondary questions;
 - He expresses his own opinion rarely, even if he has one;
 - He is ready to express his own opinion in question he knows much about;

- He often expresses his own opinion even in question he does not know much about;
- He always insists on his own opinion as the only correct one [9, C.35].

In the above example, it is impossible to identify an absolute reference point (the moment when an opinion arises), but we can identify a relative reference point (the readiness for expressing one's opinion in questions he knows much about).

- *Interval scale has a basic unit of measurement.* In the context of mathematical measurement theory, such unit is called logit. These units can be transformed into grades with the help of linear transformation. In the majority of cases, an average value of indicator variable grades is taken as a relative reference point (logit zero) [10]. In our point of view, a successful example of the level of measuring tolerance as a social guideline in logits is given in the paper of A.A. Maslak and S.A. Pozdnyakov [11].
- *The values of interval scale are not connected by proportion, that's why they may not correspond to proportion of measure, variable, indicator or characteristic of researched object.* For example, if we consider a competence "skills of collecting and analyzing information", it is impossible to derive a proportion about correlation between the number of conclusions and the volume of analytical report in pages, though both these parameters can be considered as indicator variables in this example.
- *The boundaries of intervals determine the level of competence.* Competence is measured by the achievement of a certain level preset by educational institution. Levels are characterized by name and description that explains the name of the level but is not used directly in measuring and the basic features of the level in qualitative and quantitative form (textual and numeric format) and their gradations. So, the measurement of level in the system of control and assessment presupposes creation of passport for each kind of competence. Besides, one can single out a threshold level (necessary for all main curriculum graduates), an advanced level and a high level [3].

Measurement subject is an expert group that consists of employers, teachers of closely related fields of study and specialists in developing and certifying measurement means.

Measurement object is competence. Kinds of competence are the point where the main vectors of general and professional training and student's potentialities, abilities and motives meet. They are used for designating learning outcomes [12]. Depending on the direction and field of training, applicable educational standards can include up to several dozens of kinds of competence.

Measurement article can be indicator variables (indications). For example, there is an experience of measuring latent variable "students' satisfaction of education quality in their educational institution". This experience is described in the article of E.Y. Vasilyeva and E.P. Bakay [10]. In situation when latent variable is set by a number of indicator variables, it is very important to check out whether they are concord that is to what extent they determine one and the same latent variable. The appropriateness and concordances of the list of indicator variables is obtained by using expert judge method and concordance coefficient computation.

It is confirmed by experimental investigation that if there are many indicator variables taken into account and if there is a low correlation of indicator variables (the statistical interconnection between indicator variables), then the accuracy of measurement is high. Moreover, investigations show that we can increase the accuracy of measurement not only by increasing the number of indicator variables but also by increasing the number of their gradations [10; 13].

Such "indicator" approach towards measuring competence is widely used in business sphere, but, in education, there is a row of limits including high labour intensiveness in creating measurement tools and the need for involving employers and practical specialists in forming the list of indicator variables.

CONCLUSIONS

- The conjugacy of assessment and measurement systems can be considered in the context of three elements: subject, object and article shown in Table 1.
- We considered categories "competence" and "learning outcomes" that are in different coordinate systems. Besides, they belong to different levels: competence is considered an object of both assessment and measurement, while learning results are considered only an article of assessment.
- Competence as an object for assessment is considered from the point of view of its level for individual assessment of learning achievements,

Table 1: Pairing of the assessment system and the measurement system

	Assessment system	Measurement system
subject	Expert(s) (teacher, committee, learning group) + student himself	Expert group (employers, teachers of closely related fields of study, specialists in working out and certifying measurement means)
object	Respondent (student) demonstrating his actual learning outcomes and competence	Competence as a latent variable
article	Learning outcomes (actual and expected)	Indicator variables

progress and capacities of a student. Competence as an object for measurement is considered a latent variable that reveals itself under the influence of indicator (assessment tool) by indicator variables (indications).

- It is necessary to use interval scale for measuring competence as a latent variable by indicator variables taking into account a number of its characteristics: the quantitative limits of existing in this quality; the presence of relative reference point and the absence of absolute reference point; using a unit of measurement (log it); the absence of relations between scale values; and the determination of boundaries for intervals (levels of competence).
- When we conjugate the systems of assessment and measurement, we get the possibility to use mark “excellent” for the high level of competence, mark “good” for advanced level and mark “satisfactory” for threshold level. Thereafter, while a higher educational institution works out the main curriculum, it should create a detailed passport for each kind of competence. This passport should include the description of level (threshold, advanced or high), the main indications for each level (indicator variables), indication gradations and possible types of indicators (the collection of assessment tools), intervals of numeric equivalent for indications and the “model” (expected learning results).

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