

Chapter 6

Estimating Levels of Learning Outcomes Acquirement Based on Fuzzy Sets, Relations, and Their Compositions

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ABSTRACT

New curriculum designers should prepare the set of learning outcomes that will be studied by students, and their acquirement will be verified by teachers. It is not easy to estimate whether students achieved the required learning outcomes even in the range of knowledge and skills, but when the competencies are considered, it becomes harder. Because of the convenience of using the linguistic terms (excellent, poor, good, and so on), it is better to apply fuzzy relations (type 1 if the numbers are chosen or type 2 if the sets are used), which can handle with the linguistic terms better than classical relations. The estimation of the learning outcome's acquirement can be conducted on the bases of a test or tests. For calculating the levels of learning outcome's acquirement, two fuzzy input relations are designed. Experts build one based on their knowledge, and the second one is based on the test results. The output relation, showing levels of learning outcome/outcomes' acquirement, is built with the application of the S-T composition of the first and second relations.

DOI: 10.4018/978-1-7998-3476-2.ch006

INTRODUCTION

Learning outcomes are statements describing what a person should know and be able to do after completing the course. Thus, nowadays, new curriculum designers should prepare the set of learning outcomes that students will learn, and teachers and examiners will verify their acquirement. Moreover, all education entities have to develop their curricula to help their students and teachers fulfill these requirements. It is not easy to estimate whether students achieved the required learning outcomes even in the range of knowledge and skills, but when the competencies are considered, it becomes harder. The problem of learning outcome assessment is not easy for educators and pedagogues but, for other specialty teachers, is highly demanding.

Estimating, for example, the level of the ability to work under stress or in the group should take very much time and preparation to produce the stressful situation and putting students in different groups with various roles. To assess the student's abilities, the teachers and educators use expressions like, for example, "s/he works well," or "his/her work was poor" because that way our language works. However, the head of the school or the rector of the university wants teachers to prepare levels of learning outcomes acquirement, which will be transformed into grades. To deal with these linguistic terms (excellent, poor, good and so on), it is better to apply fuzzy relations (type 1 – if the numbers are chosen or type 2 – if the sets are used) which can handle with the linguistic terms better than classical relations. The application of fuzzy relations can be useful in the case of written tests. Before, the teachers, while preparing tests for students, created the items to check the acquirement of some knowledge and skills. Now they have to take into account the learning outcomes. Most of the teachers were not taught this approach, and now they have to study it by themselves or take part in some workshops. Hence, the method of learning outcomes assessment, referring to knowledge and skills based on fuzzy relations developed for written tests is beneficial. The presented way of the estimation of the learning outcome's acquirement will be presented based on a final secondary school examination test. For calculations the levels of learning outcome's acquirement, two fuzzy input relations are designed. The first relation, between learning outcomes and tasks/items showing the level of learning outcome/outcomes verification by a given item, is built by experts (teachers, educators or other people involved in the designing and realization of the curriculum). Thanks to them, not all teachers must understand the concept of learning outcome acquirement very profoundly, especially in the area of competences.

The second relation, between items and students showing levels of understanding the problem discussed in the given item measured by, for example, the number of marks, consists of the test results transformed to the interval $[0,1]$. The third output relation, between learning outcomes and students consisting levels of learning outcome/outcomes acquirement, is built with the application of the S-T composition of the first and second relations.

BACKGROUND

Presently in Poland, the concept of the European Qualification Framework (EQF) has been introduced in all curricula designed for all levels of education. According to the European Commission, 'the European Qualifications Framework is a European-wide qualifications framework which joins the qualifications of different EU members together' (European Qualifications Framework, 2012). One of the main aims of the EQF is to help institutions (among them higher educational institutions, HEIs), employers and

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