# EXPERT EVALUATION – A COMPONENT OF COMPETENCY-BASED EDUCATION

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**Abstract.** The article discusses the concept of Competency-Based Education (CBE), which is increasingly applied in the preparation of professionals for the knowledge-based economy. The emphasis is placed on expert evaluation as a key form of assessment within CBE. Results are presented from a study with students trained in the profession “Applied Programmer” (AP). The study involved two groups: students from the National Program *IT Career Training*, where CBE was implemented, and students trained through the traditional approach. A competency assessment rubric was developed, including questions related to the development of software engineering skills. The results show that learners under CBE achieved significantly higher outcomes compared to their peers in traditional training.

***Key Words:*** *Competency-based education, Software engineering, programming, expert evaluation, ADDIE model.*

## Introduction

In 2018, Bulgaria introduced the State Educational Standard (SES) for the profession *Applied Programmer* (AP) [34], developed jointly by NAVET [31], the Ministry of Education and Science, and representatives of the ICT sector. It is based on the strategic requirements for implementing the competency-based approach and incorporates international models of the Association for Computing Machinery (ACM) [24], which contain recommended curricula in software engineering for different educational levels [25, 29, 32]. The SES is also aligned with the European Qualifications Framework (EQF) [28], DigComp [26], e-CF [27] and competency models proposed by the Bulgarian Industrial Association [33].

In addition to the SES, Staribratov [16] proposes an alternative model focused on the practical applicability of knowledge. In subsequent works emphasize project-based learning [17] and the transformation of curricula into a competency-based format [18].

CBE has theoretical foundations in the works of White [21], McClelland [10], Boyatzis [2], and Spencer [13]. The European Commission defines it as a combination of knowledge, skills, attitudes, and behaviors, while according to Zwell [22], competencies are developed through high-quality learning and practical experience. Constructivist ideas of Vigotski [16] and Piaget [12] emphasize the learner's activity [8, 9, 11], while critiques of traditional education [1, 5, 20] justify the need for a model oriented toward solving practical tasks [7, 15].

Within CBE, the ADDIE model is widely used [23], and assessment combines formative and summative practices [3, 4], although their integration remains challenging [6]. Among the diverse instruments – tests, practical tasks, self-assessment [14], and 360° evaluation [30] – expert evaluation holds particular importance, as it provides professional and objective judgment of the achieved competencies. The present study focuses on its application in the training of *AP* students.

## Methodology

The main objective was to examine whether CBE positively impacts student outcomes in expert evaluation. For this, a Competency Assessment Rubric (CAR) was developed based on the expected learning outcomes in the SES for AP and competency models in Software Engineering. Each competency included indicators aligned with Bloom's taxonomy, allowing experts to evaluate mastery of knowledge and skills. In CAR are used criteria based on clean code principles, including single responsibility, cohesion and coupling, KISS (*Keep It Simple, Stupid*), DRY (*Don't Repeat Yourself*), and SOLID (five design principles for creating maintainable and scalable software). Additional aspects include naming, formatting, defensive programming, and refactoring. Questions covered modules: Algorithms and Data structures, Functional Programming and Object-Oriented Programming.

Participants were divided into two groups:

- Experimental Group (EG) – 42 students in XI degree (second year of trainning) from Plovdiv, Burgas and Chepintsi village under the National Program "IT Career Training", trained via CBE. These 42 students represent nearly 25 % of all students enrolled in the second year of AP program;

- Control Group (CG) – 41 students trained traditionally in the same profession from same schools.

After completing half of the AP modules, expert evaluation was conducted using the CAR. Experts assessed each competency on a five-point scale (1 – lowest, 5 – highest), with each level including the preceding ones – Figure 1.

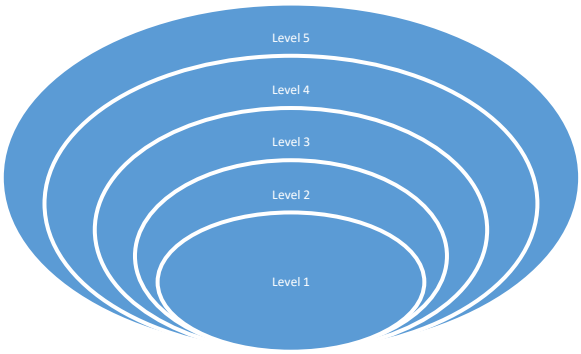


***Figure 1. Competency Levels***

## Results

The results of the expert evaluation are presented through frequency distributions, including absolute, relative, and cumulative frequencies for both groups. The data in Figure 2 and Table 1 reveal clearly expressed differences: in the Experimental Group (EG), a higher concentration of evaluations is observed at the fourth and fifth competency levels (48% and 19%), whereas in the Control Group (CG), the same levels were covered by a smaller share of students (44% and 15%).

To test the hypothesis, a two-sample t-test with unequal variances was applied. The obtained test statistic ($t = 4.78$) exceeded the critical value for a one-tailed test ($t = 1.75$, $\alpha = 0.05$). This allows the rejection of the null hypothesis and confirms that a statistically significant difference exists between the two groups, in favor of CBE.

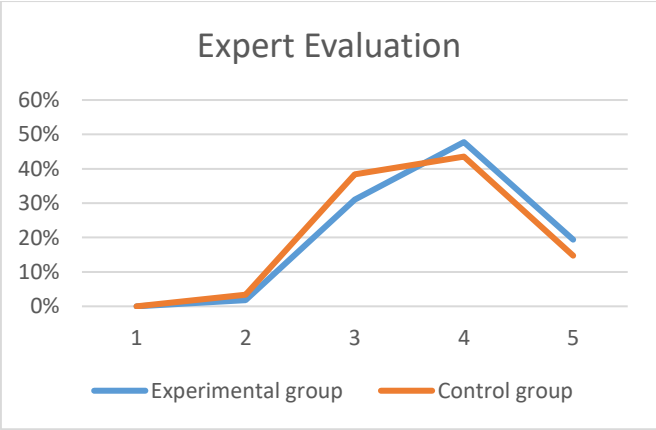


***Figure 2. Percentage distribution of Expert Evaluation***

*Table 1. Frequency Distribution*

| Level | Frequency EG | | | Frequency CG | | |
|---|---|---|---|---|---|---|
| | Absolut | Reference | Cumulative | Absolut | Reference | Cumulative |
| 1 | 0 | 0% | 0% | 0 | 0% | 0% |
| 2 | 35 | 2% | 2% | 63 | 3% | 3% |
| 3 | 610 | 31% | 33% | 716 | 38% | 42% |
| 4 | 938 | 48% | 81% | 813 | 44% | 85% |
| 5 | 381 | 19% | 100% | 275 | 15% | 100% |
| Total | 1964 | 100% | | 1867 | 100% | |

## Discussion

The data shows that CBE develops skills that are difficult to achieve through traditional education – independent problem-solving, teamwork, and higher levels of professional competence. Expert evaluation remains a reliable tool, combining objectivity with professional judgment and providing valuable feedback on the effectiveness of the learning process.

## Conclusion

The study results indicate that CBE is an effective model for preparing specialists in the ICT field. Compared to the traditional approach, it leads to higher levels of competency acquisition and more sustainable learning outcomes.

The ADDIE model is proven to be an appropriate framework for its implementation, while expert evaluation emerges as a key method for objectively measuring achievements. The study confirms that CBE meets the demands of the modern knowledge-based economy, while simultaneously emphasizing the necessity of prior methodological preparation and adaptation of the learning content.

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