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MONITORING THE DYNAMICS OF STUDENTS' INDIVIDUAL GROWTH VIA FORMATIVE ASSESSMENT TECHNOLOGIES

Abstract. This article examines the issues of monitoring the dynamics of students' individual growth using formative assessment technology in the higher education system. The author analyzes the shortcomings of the traditional assessment system and substantiates the importance of feedback and a diagnostic approach in improving the quality of education. The article analyzes modern monitoring technologies that allow tracking students' personal achievements and their effectiveness in the educational process.

Keywords: formative assessment, monitoring, individual growth dynamics, feedback, quality of education, cognitive development, diagnostics, competence.

Annotasiya. Ushbu maqolada oliy ta'lim tizimida formativ baholash texnologiyasidan foydalangan holda talabalarning individual o'sish dinamikasini monitoring qilish masalalari yoritilgan. Muallif an'anaviy baholash tizimidagi kamchiliklarni tahlil qilib, ta'lim sifatini oshirishda qayta aloqa (feedback) va diagnostik yondashuvning ahamiyatini asoslab beradi. Maqolada talabalarning shaxsiy yutuqlarini kuzatib borish imkonini beruvchi zamonaviy monitoring texnologiyalari va ularning ta'lim jarayonidagi samaradorligi tahlil qilingan.

Kalit so'zlar: formativ baholash, monitoring, individual o'sish dinamikasi, qayta aloqa, ta'lim sifati, kognitiv rivojlanish, diagnostika, kompetensiya.

Аннотация. В данной статье рассматриваются вопросы мониторинга динамики индивидуального роста студентов с использованием технологии формативного оценивания в системе высшего образования. Автор анализирует недостатки традиционной системы оценивания и обосновывает важность обратной связи и диагностического подхода в повышении качества образования. В статье проанализированы современные технологии мониторинга, позволяющие отслеживать личные достижения студентов, и их эффективность в учебном процессе.

Ключевые слова: формативное оценивание, мониторинг, динамика индивидуального роста, обратная связь, качество образования, когнитивное развитие, диагностика, компетенция.

The rapid integration of digitalization and person-centered educational technologies into the modern higher education system necessitates innovative approaches to student assessment. The Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030 identifies the implementation of transparent and equitable quality control mechanisms as a priority task. However, the traditional (summative) assessment system, which has been utilized for many years, primarily records final outcomes and fails to fully reflect a student's individual growth dynamics or the developmental stages of their intellectual potential during the learning process.

Formative assessment technology plays a crucial role in addressing this challenge. Formative assessment is not merely a tool for measuring a student's level of knowledge; it is a system that allows for the identification and rectification of deficiencies within the instructional process itself, thereby guiding the student toward the next stage of learning. Furthermore, technology for monitoring students' individual growth dynamics enables educators to design personalized educational trajectories, enhance student motivation, and elevate educational efficiency to a qualitatively new level.

The concept of formative assessment and its role in the educational process have been extensively researched in global pedagogical science. The fundamental principles of this field were developed by scholars such as P. Black and D. Wiliam, who define formative assessment as “the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there” [1; 45]. According to their findings, regular feedback significantly increases a student’s motivation for self-improvement.

Regarding the application of monitoring technologies in the educational process, B. Bloom, through his taxonomy, emphasizes that assessment is not only a means of verifying knowledge but also a tool for developing higher-order cognitive skills, such as analysis, synthesis, and evaluation [4; 112]. The diagnostic approach is of particular importance when monitoring the individual growth dynamics of students.

Studies by Uzbek scholars, including R. Safarova and N. Muslimov, emphasize the specific role of monitoring in developing the professional competencies of future specialists. In particular, they establish that mechanisms for the continuous correction of a student's learning activities are essential for achieving educational effectiveness [7; 34]. Furthermore, the implementation of modern pedagogical technologies reduces subjectivity in traditional assessment and enables accurate forecasting of a student’s personal development trajectory [2; 89].

Recent research also indicates that implementing formative assessment through digital monitoring systems (e.g., LMS, Moodle) allows for ipsative assessment - where students compare their current performance with their own past results. This serves as the technological foundation for precisely measuring individual growth dynamics [5; 56].

During the research process, a systematic approach and diagnostic analytical methods were employed to monitor students’ individual growth dynamics. The monitoring technology was implemented based on the following phased algorithm:

Phase I: Pre-assessment. The initial preparation level of students was determined at the beginning of the course, serving as the “baseline” (point zero). The results obtained at this stage provide the basis for calculating the student's subsequent growth coefficient [6; 42].

Phase II: Selection of Formative Tools. To conduct a deeper analysis of student knowledge, the following technological tools were utilized during the monitoring process:

Criteria-based assessment rubrics: Enabling students to identify specific areas of improvement (e.g., analysis, presentation, creativity);

Digital portfolios: To visualize weekly achievements and compare dynamics;

Self-assessment cards: To enhance students' metacognitive skills [3; 78].

Phase III: Feedback Mechanism. Following each monitoring stage, the instructor provides descriptive recommendations addressing three key questions: “*What was done well?*”, “*What needs improvement?*”, and “*What is the next step?*”. This process facilitates the correction of the student's learning trajectory [2; 95].

The results of the experiment conducted within the framework of this study demonstrated that the achievement coefficients of students in groups where the formative assessment system was implemented differed significantly from those in traditional groups. The experiment involved 50 students (25 in the control group and 25 in the experimental group).

Comparative Analysis of Student Achievement Levels

Groups	Low Level (Knowledge)	Middle Level (Skills)	High Level (Competence)
Control Group (Traditional)	20%	55%	25%
Experimental Group (Formative)	8%	44%	48%

The monitoring technology facilitated a comparative analysis between the “start” and “finish” points of each student. In the group where formative assessment was applied, the average

Individual Growth Rate reached 32%, whereas this figure did not exceed 14% in the control group [8; 22].

When examining the error correction coefficient among students in the experimental group, the following positive trends were identified:

85% of students reported that, due to regular feedback, they no longer feared making mistakes and instead proactively sought to rectify them [5; 62].

In the traditional system, identifying and comprehending an error typically took 2–3 weeks (often until the exam period); however, under the formative system, this duration was reduced to 1–2 days.

The statistical reliability of the obtained results was verified using the Student's *t*-test. The difference between the results of the experimental and control groups was proven to be significant at the $p < 0.05$ level. This confirms that the formative monitoring technology does not result in random improvements but rather systematically fosters student growth [6; 48].

The proposed formative assessment technology is implemented through four primary "Monitoring Points" designed to track and enhance student progress:

Stage I: Baseline Assessment. At the beginning of the session, students are given a brief (5-minute) test or logical puzzle. To determine the students initial proficiency level. For instance, a score of 3 out of 10 marks the student's "Start Point."

Stage II: Real-time Diagnostic Monitoring. During or at the conclusion of the lesson, students respond to two reflective questions:

1. What was the most comprehensible concept for me today?
2. Which part remains "foggy" (unclear) for me?

This allows the instructor to immediately identify students exhibiting growth versus those experiencing stagnation.

Stage III: Criteria-Based Task Execution. Students are assigned a complex algorithmic task accompanied by an Assessment Rubric:

Sample Assessment Rubric for Algorithmic Tasks

Criterion	Low (1 pt)	Middle (2 pts)	High (3 pts)
Logical Consistency	Numerous errors	Minor inconsistencies	Completely accurate
Code Optimization	Excessive/Redundant	Moderate efficiency	Most efficient path

By evaluating their own work against this rubric, students develop critical self-analytical skills and recognize specific areas for improvement.

Stage IV: Digital Tracking and Automated Support. Instructors record each task result in a digital spreadsheet (e.g., Google Sheets or LMS). If a student's performance trend declines, the system automatically triggers a "Supplemental Recommendation" (such as a video tutorial or additional literature).

In a traditional system, a student might simply receive a final grade of "3" or "4" at the end of the semester without understanding their underlying weaknesses. Under this formative technology, however, the student:

1. Identifies errors during the instructional process.
2. Visualizes expectations clearly through structured rubrics.
3. Receives personalized feedback and a directed learning trajectory from the instructor.

A student's score may rise from 3 to 9 points. In this study, the distance between "3 and 9" is defined as the Individual Growth Dynamics.

By comparing a student not with others, but with their own previous results (ipsative approach), formative assessment technology fosters healthy competition and sustainable motivation. The widespread integration of this technology into higher education institutions enables instructors to provide a truly individualized approach while empowering students to maximize their potential. Ultimately, this serves as the pedagogical foundation for preparing independent, self-improving, and competitive specialists for the modern labor market.