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FORMATIVE ASSESSMENT AS A FACTOR IN MODERNIZING THE TEACHING NATURAL SCIENCE SUBJECTS

The relevance of using formative assessment in Ukrainian schools is outlined and confirmed by legal documents. The type of assessment focuses on the learning process and students' achievements, which positively affects the results of teaching of natural science subjects. The scientific articles by foreign and Ukrainian authors on the essence and features of formative education were consistently analyzed. It is noted that the studied pedagogical phenomenon was justified by foreign scientists and has been used in schools for many years. Its effectiveness has been proven in practice. Until recently, formative assessment was not required in Ukrainian schools, so there is no fundamental research and established practice of its use in natural science education. Natural science teachers proactively comprehend its methodology and fragmentarily use it in the educational process. Theoretical and practical readiness of natural science teachers to use formative assessment was investigated by means of an online survey of 400 natural science teachers. Based on the results obtained, it was found out that natural science teachers are motivated, but their theoretical and practical readiness to use formative assessment is not sufficient. The conclusion is made about the need for targeted training of teachers to master the methodology of formative assessment. It is important that further research on the readiness of science teachers to use formative assessment is based not only on self-assessment, but also on expert assessments.

Keywords: *foreign experience, formative assessment, learning outcomes for students/schoolchildren in natural science, natural science teachers, natural science subjects teaching methodology, online survey, reforming complete secondary education, self-assessment, summative assessment.*

INTRODUCTION

The reform of modern secondary education in Ukraine is carried out taking into account the experience of the leading countries of the world and is regulated by legislative and normative documents, namely the Law of Ukraine «On Education» (2017), the Law of Ukraine «On comprehensive general secondary education» (2020), the «New Ukrainian School» Concept (2016), State standard of basic secondary education (2020).

The initiated reform fundamentally differs from previous ones by the student-centered educational process and the competency-based approach to learning; and the ideology of change concerns all components of the educational process, including assessment.

Success of any activity is known to be indicated by its outcomes. Educational activity is the first socially significant activity of a schoolchild. In view of this, the issue of effective evaluation of its results becomes relevant. Compulsory learning outcomes for natural science students, expressed in terms of competence, are specified in the State Standard of Basic Secondary Education (science education branch).

The implementation of the «New Ukrainian School» Concept is being carried out during 2017–2029 in three stages. The first stage was completed in the 2021/2022 academic year. It dealt with the reform of primary education. In basic secondary education (grades 5–9), the second stage starts in the 2022/2023 academic year. Seventh-graders will study natural science subjects at this stage for two years in a row. Natural science teachers seem to have time to prepare for the implementation of the conceptual foundations of the reform. However, due to the novelty of the purpose of education, modern tasks and approaches to learning, the time of active training of natural science teachers to work and evaluate students in a new way has begun.

Due to the fact that educational reforms have a significant impact on the development of the state's economy and the competitiveness of its education at the international level, the implementation of the main provisions of the «New Ukrainian School» Concept has become a priority task of pedagogical science and school practice. Hence, it is necessary for all the parts of the educational process, including the evaluation of educational results, to be methodologically justified and methodically supported.

Therefore, the approach to education envisaged by the «New Ukrainian School» Concept requires adequate resource provision and an appropriate system for evaluating learning outcomes. In teaching of natural science subjects, the assessment of student achievements is being done by current, summative and external independent evaluation. At their own request (certificate in natural science subjects is required for applicants to some universities), graduates of Ukrainian schools participate in an external independent evaluation of their achievements in natural science subjects. It is annually conducted by the Center for External Independent Evaluation of the Ministry of Education and Culture of Ukraine.

The European vector of education development in Ukraine, its harmonization with the standards of the European educational area, encourage teachers not to be limited to the specified types of assessment of student learning, but to perform it taking into account the foreign experience of formative assessment. In our country, this type of assessment of mandatory learning outcomes for students in grades 5–9 is provided for by the Law of Ukraine «On Comprehensive General Secondary Education» (2020, art. 17).

In European practices, formative assessment has become an integral element of the educational process as a motivator of schoolchildren's educational activity, a form of feedback between the teacher, students and parents. According to the conclusions of the Organization for Economic Cooperation and Development (OECD), formative assessment is one of the comprehensively researched strategies for increasing the level of students' learning achievements (OECD, 2005).

However, in Ukraine, formative assessment remains insufficiently developed by pedagogical science, and therefore is implemented in secondary education in a fragmentary manner. At the same time, the strategy of improving the quality of this country's education clearly requires introducing formative assessment, which has been successfully functioning in the educational systems of many countries of the world for more than 50 years. Therefore, formative assessment of student learning, in particular, natural science subjects is of scientific and practical interest for Ukrainian researchers and teachers.

The object of the research is the theory and practice of formative assessment of secondary students' learning outcomes in teaching of natural science subjects.

The purpose of the article is to convey the essence of formative assessment and the readiness of natural science teachers to use it. The objectives of the article are to reveal the essence of formative assessment, highlight the results of the analysis of scientific works on the topic of research, and find out the attitude and readiness of natural science teachers to implement formative assessment in their own methodical system.

Literature Review. The comparative analysis of scientific publications by Ukrainian and foreign authors made it possible to characterize the features of formative assessment. We will briefly reveal the obtained results.

It was found out that there is no terminological unity regarding the interpretation of the term «formative assessment». And as the Ukrainian researcher O. Lokshyna (2009) points out, the global pedagogical community generally shares the opinion that «formative assessment is understood as an interactive assessment of student progress, which enables teachers to determine the students' needs and adapt the learning process accordingly». This type of assessment is called formative because it helps to shape the educational environment taking into account the educational needs of each student.

Black, Harrison, Lee, Marshall & Wiliam (2004) in a joint publication characterize formative assessment as follows: «Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting students' learning. It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence. An assessment activity can help learning if it provides information that teachers and their students can use as feedback in assessing themselves and one another and in modifying the teaching and learning activities in which they are engaged. Such assessment becomes «formative assessment» when the evidence is actually used to adapt the teaching work to meet learning needs» (Frunza, 2013).

Formative assessment originates from the American experience. As it is noted in the publications by L. Allal and L. Mottier Lopez (2005), O. Lokshyna (2009) and other authors, the key role in it was played by the American scientists B. Bloom, T. Hasting, J. Madaus. In the book «Guide to formative and summative assessment of student learning» published in 1971, they provided the rationale for the concept of formative assessment. Over the course of half a century, the idea of formative assessment has become widespread and has been adopted by many countries around the world.

From a methodological point of view, the work of R. Black and D. Wiliam (2010) became, in our opinion, is significant for the theory and practice of formative assessment. The researchers, having considered a wide source base on the problem of evaluating the learning outcomes of education seekers, positioned formative assessment as an evaluation for learning and defined its technology in detail.

Long-term foreign practice has proven that systematic use of formative assessment increases the level of students' educational achievements and enhances their confidence in their own educational capabilities (Black, Harrison, Lee, Marshall & Wiliam, 2004; Frunza, 2013).

The report of the Organization for Economic Cooperation and Development (OECD) from 2005/for the year 2005 states that «Formative assessment – while not a «silver bullet» that can solve all educational challenges – offers a powerful means for meeting goals for high-performance, high-equity of student outcomes, and for providing students with knowledge and skills for lifelong learning» (OECD, 2005).

It is stated that teachers who systematically use formative assessment develop their methodological skills. «Teachers using formative assessment approaches and techniques are better prepared to meet diverse students' needs – through differentiation and adaptation of teaching to raise levels of student achievement and to achieve a greater equity of student outcomes» (OECD, 2005).

Formative assessment encourages teachers to care about improving student learning outcomes. They adjust teaching methods, use modern pedagogical technologies. It becomes clear why «formative assessment in many countries is considered one of the most promising areas of education reform. The report of the Organization for Economic Cooperation and Development (OECD) of 2005 proves the success of this method of assessment in terms of improving learning outcomes, preparing students for lifelong learning, and equalizing educational opportunities» (Morze et al., 2013). Formative assessment is not characterized by the derivation of an arithmetic mean grade from all current grades received by the student for a subject or semester. Verbal judgments evaluate the students' achievements on the basis of a comparison of the obtained educational result with the previous ones. With this approach, a low grade is not perceived as a punishment, but as a signal and a chance to improve the learning outcomes. Due to formative assessment, students get to know how effective their learning is. They have a desire to improve their learning outcomes, and teachers provide opportunities to achieve it. For students, the main thing is not the assessment, but the process of learning and working on improving their own educational results. Therefore, thanks to formative assessment, students develop lifelong learning abilities, identify difficulties and overcome them.

«The key elements that have emerged from the case studies and related research are:

1. Establishment of a classroom culture that encourages interaction and the use of assessment tools.
2. Establishment of learning goals, and tracking of individual student progress toward those goals.
3. Use of varied instruction methods to meet diverse student needs.
4. Use of varied approaches to assessing student understanding.
5. Feedback on student performance and adaptation of instruction to meet identified needs.
6. Active involvement of students in the learning process» (Assessment for Learning Formative Assessment, 2009).

Therefore, applying formative assessment makes active both subjects of educational process. Both a teacher and student monitor and evaluate educational activities. The teacher turns

from a translator of knowledge into a facilitator and educational partner. Together, they evaluate, decide what to do and how to work further. Formative assessment can take place during the interaction of the teacher with the student, the students with each other, the teacher with the whole class. For the teacher, it becomes a way of getting new information about the students' understanding of the educational material (Ruiz-Primo, 2011).

Under the conditions of using formative assessment, students develop a sense of self-worth; fear of assessment disappears, and a desire to cooperate with classmates and the teacher grows. For these reasons, formative assessment is assessment for learning, not for control.

Therefore, formative assessment serves to improve learning and teaching. It fully corresponds to the principle of student-centered, person-oriented and competence-based approaches to education. Formative assessment «helps to track the personal development of students and the course of their learning experience as the basis of competence, to build an individual personality trajectory» (On approval of the State standard of primary education. Resolution of the Cabinet of Ministers, 2018).

Despite the undeniable benefits of formative assessment, we believe that it should not be overestimated or absolutized. Let's explain our position. The current regulatory and legal documents provide for conducting not only formative, but also summative and other types of final evaluation (Law of Ukraine «On Education», 2017). Each of them has its own purpose. Summative evaluation informs about the effectiveness of the achievements for the completed stage of education and establishes the extent to which the achieved results correspond to the expected results determined by the standards and educational programs.

Formative assessment reveals how the result was achieved and how to improve it by improving learning and teaching. Formative and summative types of assessment should be optimally applied in the educational process. That is, «formative assessment should be considered as a component of a holistic system of evaluation of educational achievements, and it should not be in conflict with current and summative evaluation» (Hryvko & Vashchenko, 2021).

As proved by foreign scientific publications of recent years, the phenomenon of formative assessment has not lost its relevance. Various aspects of formative assessment of the results of learning science subjects are actively being researched. Quite often, their subject is the effectiveness of formative assessment and the attitude of teachers towards its use in the educational process. For example, the results of the study Ganajova, Sotakova, Orosova (2021) prove the effectiveness of teaching science subjects using formative assessment. The following result of this study attracts attention: formative assessment stimulates learning of mainly those students who have lower academic performance compared to other students. The researchers also define the role of formative assessment in developing schoolchildren's research skills.

Studying the use of formative assessment by Turkish biology teachers, Bayrak, Çalık, Doğan (2019) confirmed that it allows to see gaps in students' knowledge and fill them. Thanks to this, positive results are achieved in education. The researchers emphasized the importance of providing the educational process with high-quality and diverse educational materials.

Babinčáková, Ganajová, Sotáková, Bernard (2020) in an experimental study of the influence of formative assessment on the results of learning chemistry of Slovak students came to the general opinion that «formative assessment is an interactive process that should serve as a tool for improving the teaching and learning for all who are involved – the teachers, to know how to adapt next lessons, and the students, to know the areas of improvement. FA should make the educational process more dynamic and flexible. Diagnosis and adaptations should be done at the moment when it is still possible to change the learning sequence». The researchers experimentally confirmed that using formative assessment enhances students' positive attitude to

learning chemistry. Stancescu and Draghicescu (2017) noted that science teachers are aware of the need to use assessment for learning and consider formative assessment to be a modern assessment strategy that promotes feedback from participants of the educational process. The authors wrote about teachers' difficulties connected with their insufficient preparation for the implementation of formative assessment.

Yaşar (2020) considering the results of his research, concluded that chemistry teachers are not sufficiently familiar with the technology of formative assessment and therefore focus on the application of summative assessment. At the same time, they positively perceive this type of assessment and are convinced of the need to improve their professional level in matters of assessment of students' academic achievements in chemistry.

It becomes clear that not only Ukrainian natural science teachers experience difficulties using formative assessment.

The analysis of scientific publications by Ukrainian authors proved that most of the papers are devoted to the formative assessment of learning outcomes of primary school students. We consider this quite natural, because primary education was the first to start the reform process. There are only a few publications related to formative assessment at the level of basic secondary and specialized secondary education. There were only isolated pedagogical studies on the teaching methods of specific school subjects, for example, biology and chemistry (Hryvko & Vashchenko, 2021), labor training (Tereshchuk, 2019), the Ukrainian language and literature (Hapon & Petryshyna, 2022), mathematics (Mykhailenko, 2022) and some others. Formative assessment of chemistry students' learning outcomes has not been the subject of targeted research by Ukrainian scientists until now. Only certain aspects (differentiation of tasks by level of complexity, assessment in small groups) are proactively developed by individual Ukrainian specialists in the theory and methodology of teaching chemistry (Yaroshenko et al., 2020; Berezan, 2020).

As a positive thing, it should be noted that institutions of postgraduate pedagogical education have begun to create and use teacher training programs, including natural science subjects, to introduce formative assessment into the educational process. However, the main burden falls on teachers' individual work.

MATERIALS & METHODS

The research is based on the results obtained with the help of questionnaires, interviews, comparative analysis of scientific works of Ukrainian and foreign researchers, analysis of normative and legal documents regulating the educational process in basic secondary education of Ukraine, observation of the assessment activities of natural science teachers, synthesis, comparison, and generalization.

The materials used in the research were normative and legal documents regulating the reform of secondary education in Ukraine, scientific publications of Ukrainian and foreign authors. Attention was paid to publications of different years; preference was given to publications of recent years, including those indexed in scientific and metric databases Scopus and Web of Science.

In order to study the views of natural science teachers on the types of assessment and the experience of their application in school practice, a survey method was used, in which 400 natural science teachers of Ukraine took part. The suggested questionnaire consisted of 7 multiple-choice questions. The survey was conducted in an online format using the Google

Forms toolkit. Measuring the reliability of the questionnaire and proving the internal consistency of the conducted survey was carried out using the α -Cronbach reliability coefficient.

An online survey was conducted to find out natural science teachers' awareness of the essence and methodology of formative assessment, their attitude and readiness to use formative assessment in the educational process. 400 natural science teachers from different regions of Ukraine with different years of teaching experience took advantage of the opportunity to provide their answers (Fig. 1).

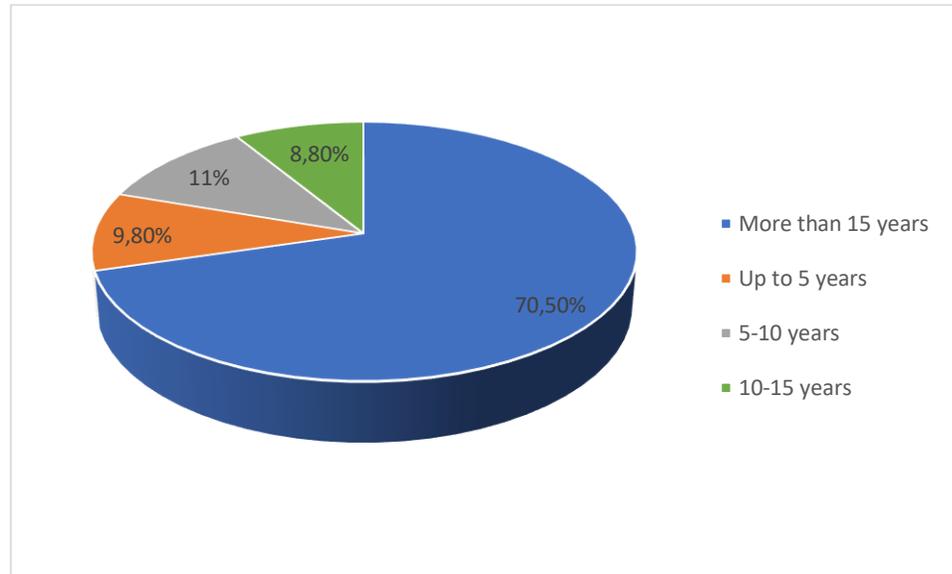


Figure 1. **Distribution of the survey participants into groups by pedagogical experience**
Developed by authors

The analysis of the received data showed, as one can see in Figure 1, that the majority of respondents (80.3%) had more than 10 years of teaching experience. It can be interpreted as the availability of the interviewed natural science teachers with sufficient experience in pedagogical activities. There is every reason to believe that they have already formed their own methodical system for evaluating the results of natural science studies. Therefore, the results of the survey are also important because they show how experienced natural science teachers are determined to diversify assessment activities by using formative assessment.

RESULTS AND DISCUSSION

In order to find out to what extent natural science teachers are aware of the essence of formative assessment and whether they use it in the educational process, the following question was included in the questionnaire: *What do you think of your awareness of the essence of formative assessment?*

Answers to it are illustrated in Fig. 2.

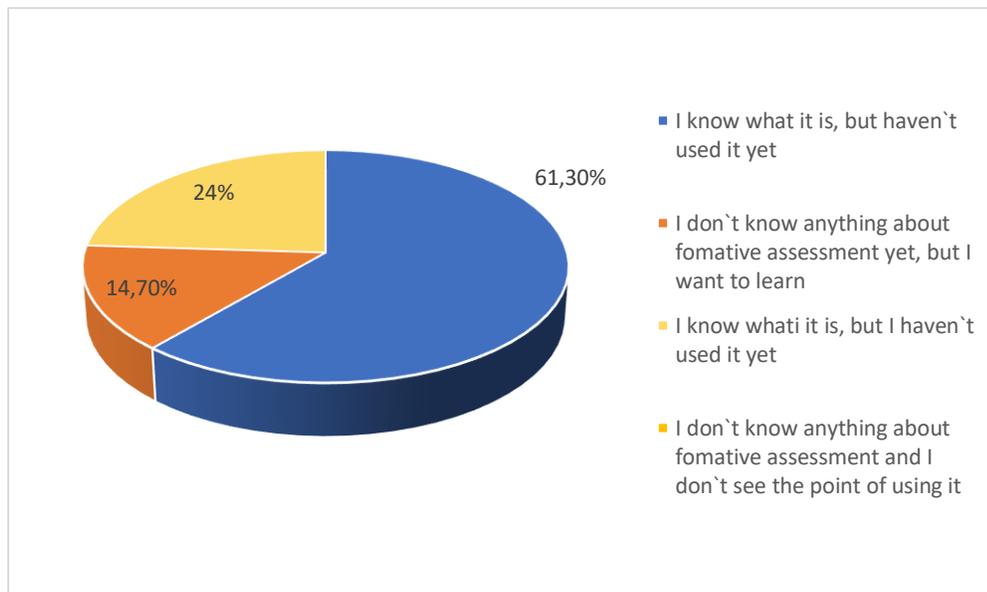


Figure 2. **Self-assessment of natural science teachers' awareness of the essence of formative assessment**

Developed by authors

According to the respondents' self-assessment, their awareness of the essence of formative assessment is quite high. Thus, 61.3% of teachers noted that they know the essence of formative assessment and already use some of its elements. 24% of the surveyed natural science teachers know what it is, but have not used it yet. The fewest respondents (14.7%) belonged to the group of those who do not know anything about formative assessment, but they want to learn. Worthy of special emphasis, in our opinion, is the fact that none of the interviewed natural science teachers stated in their answer that they do not know anything about formative assessment and do not see the point in its use. We interpret the received answers as follows. The respondents are conscious of the reform of basic secondary education and intend to diversify the types of monitoring and evaluating educational activities by formative assessment. The basis for such a conclusion is also the respondents' assessment of the importance of formative assessment of natural science learning outcomes. The assessment was carried out in points (1 point – the lowest, 5 points – the highest). The results show that respondents highly value the importance of formative assessment. Thus, the majority of natural science teachers rated it the highest 4 and 5 points (Fig. 3).

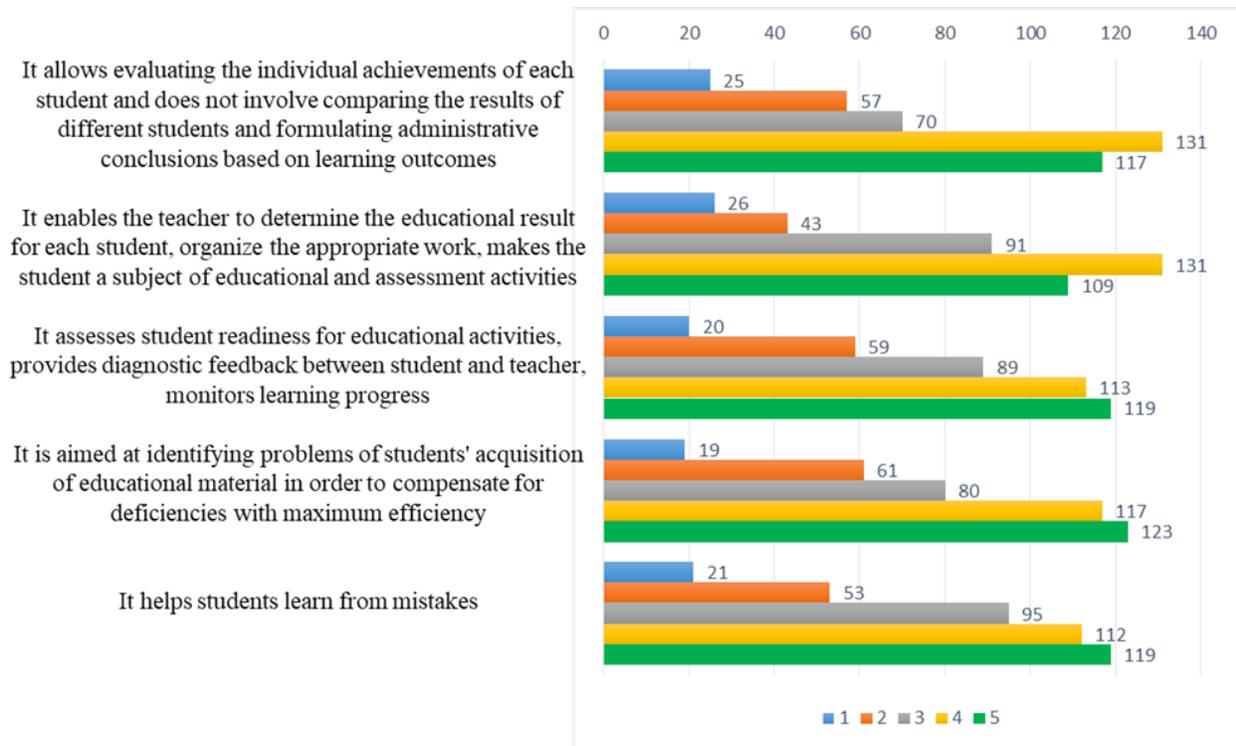


Figure 3. Evaluate in points the significance of the formative assessment of secondary education students' learning outcomes*

*(1 point – the lowest, 5 points – the highest rating)

Developed by authors

The result of natural science teachers' survey about presently dominant current and summative assessment was completely different and distinctly different (Fig. 4). For this purpose, the respondents were offered a list of shortcomings of the current assessment, which are eliminated thanks to the use of formative assessment. In this way, the number of characteristics of formative assessment offered to respondents was increased.

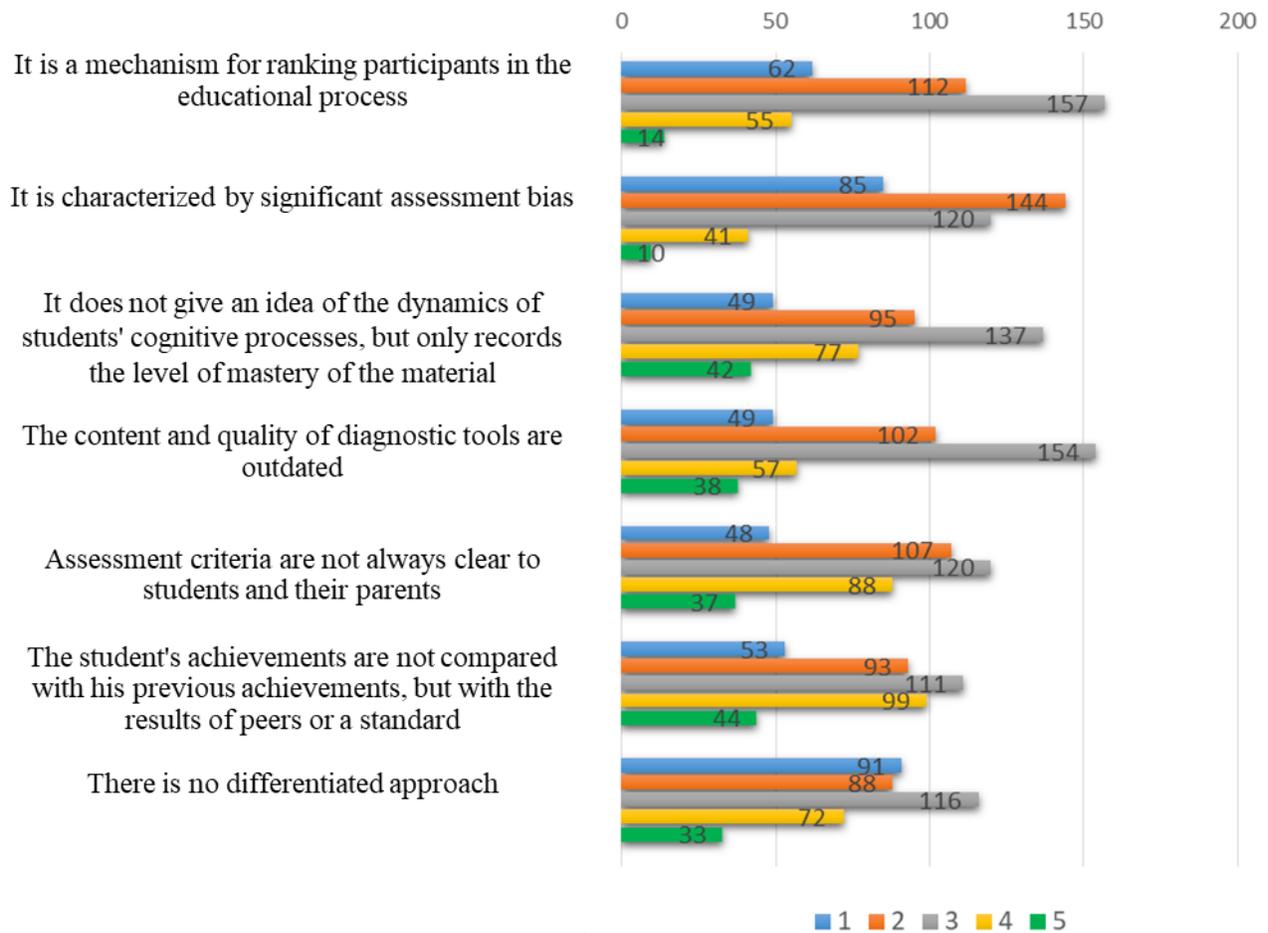


Figure 4. Evaluate in points the shortcomings of the current assessment of secondary education students' learning outcomes*

*(1 point – the least shortcomings, 5 points – the most shortcomings)

Developed by authors

The given results of the survey regarding formative and current/summative assessments confirm our opinion that natural science teachers distinguish the didactic possibilities of the considered types of evaluation of the results of teaching of natural science subjects; therefore, they are aware of formative assessment and its didactic value.

Being aware of formative assessment and seeing the difference between it and current/final assessment does not mean being ready to use formative assessment in the educational process. Therefore, it was important for the study to find out the level of theoretical and practical readiness of natural science teachers to use formative assessment. While interviewing the teachers, we asked them to assess the level of their theoretical and practical readiness to use formative assessment. The obtained results (Fig. 5) clearly illustrate the distribution of respondents into three groups: with high, mediocre and low levels of theoretical and practical readiness to use formative assessment.

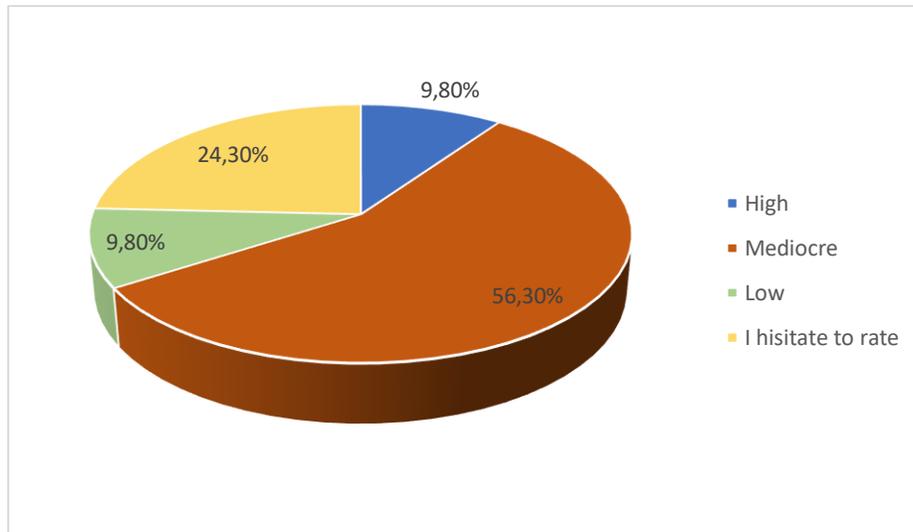


Figure 5. **Self-assessment by natural science teachers of their level of theoretical readiness to use formative assessment**

Developed by authors

The majority of respondents (56.3%) consider their theoretical readiness to use formative assessment to be mediocre. The same number of interviewees indicated high and low levels of theoretical readiness. There was 9.8% of them. Such a relatively small number of respondents with a high level of readiness indicates, in our opinion, the need to create conditions for natural science teachers to master the theoretical foundations of formative assessment. The relatively small number of respondents with a low level of theoretical readiness gives reason to assume that natural science teachers are not indifferent to the new type of assessment for Ukrainian practice and proactively study its theoretical foundations.

The results of self-assessment by natural science teachers of practical readiness to use formative assessment are shown in Fig. 6.

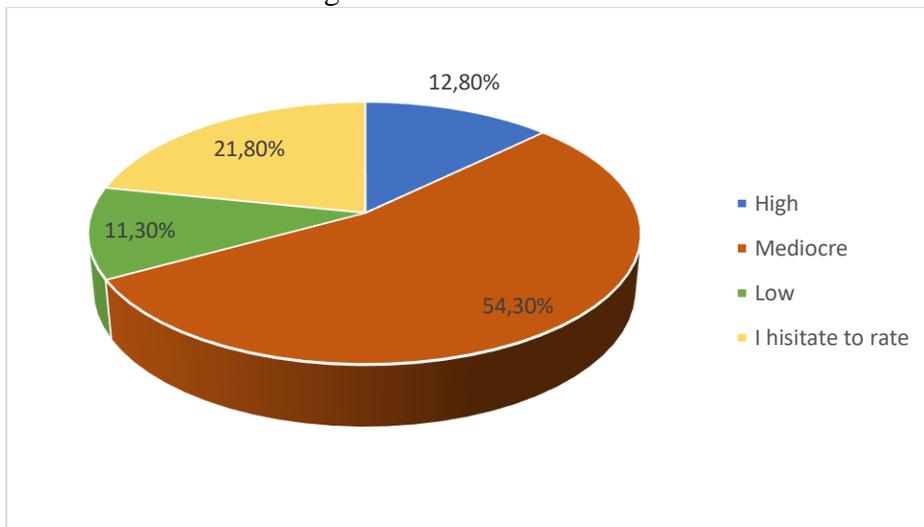


Figure 6. **Self-assessment by natural science teachers of their level of practical readiness to use formative assessment**

Developed by authors

The mediocre level of practical readiness turned out to be the leader. 54.3% of respondents indicated it in their answers. It is only 2% less compared to the percentage of teachers with a similar level of theoretical preparation. Groups of teachers with a high level of theoretical and practical readiness turned out to be close in terms of their quantitative composition. The percentage of natural science teachers who hesitated to assess their theoretical and practical readiness turned out to be quite high and approximately the same (24.3 and 21.8%, respectively). The obtained results confirmed our opinion that in this survey it was inappropriate to offer the answer option «I hesitate to evaluate». It does not represent information as to whether this fluctuation is between high and mediocre or mediocre and low levels.

But the fact that approximately 10% of the surveyed natural science teachers indicated a high level of readiness to use formative assessment confirms our belief that conducting fundamental and applied research on the problem of introducing formative assessment, developing instructional, methodological and didactic materials to help natural science teachers in mastering the technology of formative assessment is urgent.

Defined by the respondents' levels of their readiness to use formative assessment was confirmed the information provided by them about the use of assessment methods (Fig. 7). In a first approximation, it coincides with the number of teachers with a high level of readiness to use formative assessment.

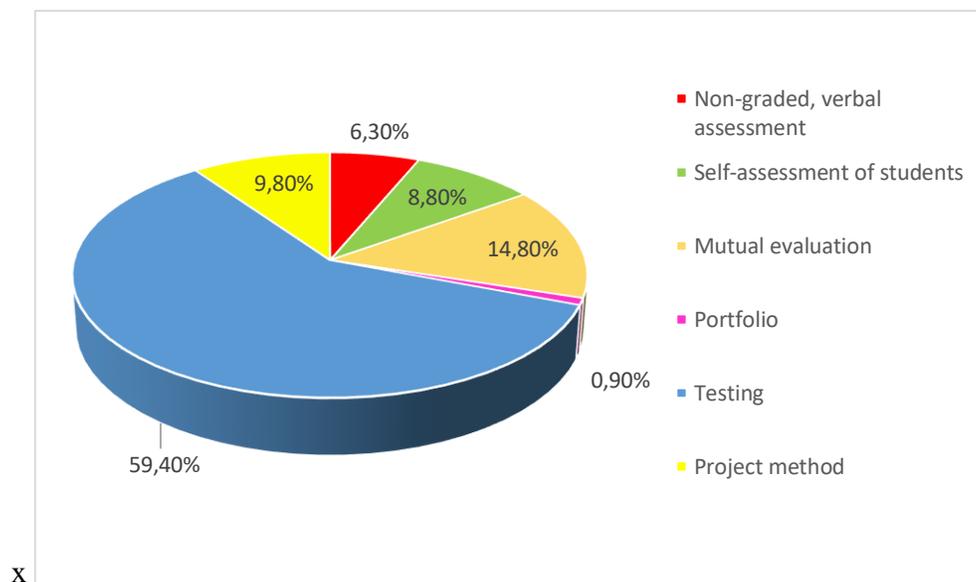


Figure 7. **Methods of evaluating the learning outcomes of secondary education students used by natural science teachers**

Developed by authors

Only 6.3% of natural science teachers use verbal assessment characteristic of formative assessment, self-assessment of students – 8.8%, mutual assessment – 14.8%. The fact that the average value of these indicators is approximately 10.3% is quite consistent with the number of natural science teachers with a high level of both theoretical and practical readiness to use formative assessment. Analyzing the obtained data, we conclude that the use of various assessment methods by natural science teachers is corresponding to the levels of practical readiness indicated by them.

The reliability of the obtained results of the survey was confirmed statistically. To measure the reliability of the questionnaire and prove the internal consistency of the conducted survey, the α -Cronbach reliability coefficient was used. In all cases, it was greater than the lower limit of permissible values of 0.7. In particular, in the survey regarding the assessment of the significance of formative assessment, the reliability coefficient of α -Cronbach is 0.93. In the survey regarding the assessment of the shortcomings of the current and final assessment, its value was 0.84. This indicates a sufficiently high quality and reliability of the questionnaire, and the internal consistency of the conducted survey is acceptable.

CONCLUSIONS

General secondary education in Ukraine is at the stage of the fundamental reform. One of its directions is the improvement of the assessment of required student learning outcomes. Taking into account many years of foreign experience, mandatory use of formative assessment should be provided. This type of evaluation is not opposed to other current types of assessment, but makes the control and evaluation process personally oriented.

Formative assessment corresponds to the principle of student-centered teaching, the paradigm of competence training, and develops the ability to learn. The focus of the evaluation is not the result achieved for a certain period of time, but the learning process and the student's educational progress. The specific features of this type of evaluation are verbal evaluations, feedback, self-evaluation and students' mutual evaluation. Therefore, formative assessment is not so much a way of recording students' educational achievements as it is a component of the educational process. In contrast to the summative and current assessment, it has a formative function and not an ascertaining one. It explains its positioning as the assessment for learning rather than for control.

The use of formative assessment allows building students' individual development trajectories, diagnosing their achievements at each of the stages of the knowledge acquisition process, and making timely adjustments to the teaching methodology.

Scientific publications of foreign authors, OECD reports sufficiently convey the gist, technologies of formative assessment application and provide the educational and methodological materials necessary for it. All the problems have to be solved in methodology of teaching natural science in Ukrainian schools. For this reason, the study of foreign experience of formative assessment and the application of its ideas in Ukrainian secondary education becomes relevant.

Formative assessment has already been introduced in primary education. Next, according to the principle of continuity, it is to be applied in basic and senior specialized education.

The issue of substantiating the methodology of teaching of natural science with the use of formative assessment, the creation of teaching and methodical materials and the systematic targeted training of natural science teachers in the system of professional development of pedagogical workers is getting urgent.

The results of a survey of natural science teachers from different regions of Ukraine made it possible to find out several key points, namely, a positive attitude of natural science teachers to the use of formative assessment of students' learning outcomes and awareness of some characteristics of formative assessment, but in general there is a low level of theoretical and practical readiness to implement formative assessment technology in their own methodical system. The internal consistency of the survey was confirmed statistically.

The scientific novelty of the research lies in defining the essence and didactic possibilities of formative assessment of the results of learning natural science subjects as a two-subject

activity of the student and the teacher. The practical significance of the obtained results is identifying the characteristic features of the formative assessment of students' educational achievements compared to the summative one and defining the levels of theoretical and practical readiness of natural science teachers for its application.

The sooner natural science teachers become ready to use formative assessment, the higher the quality of student learning will be. Today, there is no need to convince Ukrainian natural science teachers of the effectiveness of formative assessment. Instead, they need a methodology, educational and methodological materials and recommendations on introducing formative assessment into the educational process. Therefore, in the future, we consider it expedient to combine the efforts of scientists and teachers to conduct targeted studies of theoretical aspects and the practice of modernizing the educational process through the implementation of formative assessment. It is no less important that further studies of the readiness of natural science teachers to use formative assessment are based not only on self-assessment, but also on expert evaluations. We consider the research of the impact of formative assessment on the results of natural science subjects learning and the educational process in general to be relevant.

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ФОРМУВАЛЬНЕ ОЦІНЮВАННЯ ЯК ЧИННИК МОДЕРНІЗАЦІЇ ВИКЛАДАННЯ ПРЕДМЕТІВ ПРИРОДНИЧОЇ ОСВІТНЬОЇ ГАЛУЗІ

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Актуальність використання формувального оцінювання в українських школах окреслена та підтверджена нормативно-правовими документами. Цей вид оцінювання фокусується на процесі навчання та досягненнях учнів, що позитивно впливає на результати викладання предметів природничого циклу. Послідовно проаналізовано наукові статті зарубіжних та українських авторів щодо сутності та особливостей формувального навчання. Зазначено, що досліджуваний педагогічний феномен був обґрунтований зарубіжними вченими і вже багато років використовується в школах. Його ефективність доведена на практиці. Донедавна в українських школах формувальне оцінювання не було обов'язковим, тому відсутні фундаментальні дослідження та усталена практика його використання в природничій освіті. Вчителі природничих дисциплін активно осмислюють його методологію та фрагментарно використовують в освітньому процесі. Теоретична та практична готовність вчителів природничих дисциплін до використання формувального оцінювання досліджувалася за допомогою онлайн-опитування 400 вчителів природничих дисциплін. На основі отриманих результатів з'ясовано, що вчителі природничих дисциплін вмотивовані, але їхня теоретична та практична готовність до використання формувального оцінювання є недостатньою.

Зроблено висновок про необхідність цілеспрямованої підготовки вчителів до оволодіння методологією формувального оцінювання. Вважаємо важливим, щоб подальші дослідження готовності вчителів природничих дисциплін до використання формувального оцінювання ґрунтувалися не лише на самооцінюванні, а й на експертних оцінках.

Ключові слова: *вчителі природничих дисциплін, зарубіжний досвід, методика викладання природничих дисциплін, онлайн-опитування, підсумкове оцінювання, результати навчання учнів/студентів з природничих дисциплін, реформування повної загальної середньої освіти, самооцінювання, формувальне оцінювання.*