



META-SUBJECT POTENTIAL OF A FOREIGN LANGUAGE IN TEACHING NATURAL DISCIPLINES AT A PEDAGOGICAL UNIVERSITY

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ABSTRACT

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Teaching a foreign language in the process of preparing future teachers is guided by the needs of the modern school system, in which reforms are being actively implemented. The meta-subject approach at school serves as the basis for planning learning outcomes. For example, in biology, foreign language, and physics classes, students are not only expected to know the laws and principles of a particular field of science but also to be able to embed this knowledge into an integral system of worldviews. The implementation of the idea of tri-lingualism in school education increases the role of a foreign language in the cognitive process of students. When using the meta-subject approach, English serves not only the communication needs but also for contributes in the development of meta-cognitive processes. The study of natural disciplines in Kazakh pedagogical universities is carried out not only in the Kazakh and Russian languages, but also in English. Future teachers of biology, chemistry, mathematics, and physics ought to master the basics of the natural sciences and methods of teaching them, by using the knowledge of a foreign language as a source of relevant scientific facts. This article analyzes the possibilities of a meta-subject approach in the practice of teaching a foreign language to future teachers of natural sciences. By substantiating the concept of the meta-subject potential of a foreign language, the main categories associated with meta-cognition through diagnosing students' readiness to use these ideas, one can build a foreign language education program for future teachers.

Contribution/Originality: This is study about the readiness of future teachers to use the meta-subject potential of a foreign language in their professional activities. This study shows how to develop a target module of the program for foreign language training of future teachers for teaching natural sciences in English. The developed program was subsequently implemented in the process of teaching natural sciences to students of a pedagogical university.

1. INTRODUCTION

In the Republic of Kazakhstan, where the education system is under a reform process, the paradigm of teaching a foreign language is changing. For foreign language teachers, these changes are special, since English is actively included in the life of the education system, implementing the requirements of the multilingual program. Since

language is not only a means of communication but also a means of cognition, its meta-subject potential seems to be very promising.

The theoretical basis of this research is formed by the works of philosophers, teachers, and psychologists on metacognition. [Vygotsky \(2005\)](#), for example, theorized processes by developing the idea of a proximal development zone. This category points out the differences between what the learner can achieve independently (the level of actual development) and what they can do under a teacher's guidance. At the same time, the level of actual development is determined by the processes forming in the zone of proximal development. This means that the students first act with the help of the teacher, and only after that, they can repeat the action themselves without any support.

Meta-cognition refers to "thinking about thinking" and was introduced as a concept by [Flavell \(1979\)](#) who wrote that metacognition means knowing one's cognitive processes (one's thinking). A person can control his thought processes through various strategies such as organization, monitoring, and adaptation. It is the ability to reflect on the tasks or processes that a person is performing, as well as the ability to select and use the appropriate strategies necessary for the interaction. Meta-cognition is considered a critical component of successful learning. It includes self-regulation and self-reflection of strengths and weaknesses and the types of strategies one creates and uses.

A teacher initially takes responsibility for monitoring progress, setting the appropriate goals, planning activities, and distributing attention. Gradually, responsibility for these cognitive processes is transferred to the students, who becomes more and more eligible to regulate their cognitive activity. This transition, described by Vygotsky and his followers, is called meta-cognitive development. Modern researchers use these ideas for the development of education theory and practice of education reform, including for the development of educational standards and educational programs ([Asmolov, 2008](#); [Galyan, 2014](#); [Khutorskoy, 2012](#); [Kraevsky & Khutorskoy, 2003](#); [Ratikova, 2013](#); [Zair-Bek & Mushtavinskaya, 2011](#)).

The study of meta-cognitive processes stimulates the emergence of new phenomena and concepts associated with meta-cognition, which, in turn, influence the emergence of new ideas. [Krichevets \(2012\)](#) considers the meta-subject as the basis for the emergence of "new theories and approaches." These new theories indicate the interest of researchers in meta-cognitive personality development, especially in the use of these ideas in the pedagogical process. Based on more than 50 studies, [Perry, Lundie, and Golder \(2019\)](#) have prepared a systematic review that shows the effectiveness of the impact of teaching meta-cognition in school on students' outcomes and well-being. In the Republic of Kazakhstan, the reform of the content of education is based on the use of a meta-subject approach, but there is not enough research on the well-being of students in a rapidly changing environment. The available works consider the peculiarities of the influence on students; in these works, teachers are not considered as subjects of the pedagogical process, possessing certain abilities and qualities.

[Yu and Birney \(2019\)](#) presented in their work a theoretical model of cognitive flexibility as meta-competence reflected in adaptive activity that arose as a strategic response to novelty in a dynamic environment. Such works in the process of reforming education in Kazakhstan help improve the organization of the educational process in the context of innovation, while researchers are studying and developing new ways of designing lessons, determine results and methods for assessing these results. It is assumed that teachers are already prepared to use the theory of meta-cognition for the development of the student's personality; therefore, according to [Shute \(2019\)](#) offering a theoretical basis for application in practice will be totally enough. Many such studies are available. For example, [Merkulova \(2016\)](#) through the study of "comparison as a universal meta-subject educational action," proposes a discussion of the problem of its formation. Conversational learning strategy relevant to education is associated by [Smith and Mancy \(2018\)](#) with the idea of meta-cognition. As a result of the research, they summarize: "collaborative meta-cognition arises from combined individual and group processes".

The proposed teaching strategies and approaches allow solving the problems of the formation of meta-subject competencies in students. Teachers play an important role in this process, they must be ready to implement the principles of the meta-subject approach, since they are the ones who have to use new approaches and methods in order to develop the ability of students to meta-cognition. [Gunstone and Northfield \(1994\)](#) tried to draw attention to this, emphasizing in their study: "a particular approach in which developing greater meta-cognition (understanding and controlling one's own learning) is central to the changes appropriate to teacher development." Thus, students interact with the teacher, exchange opinions among themselves in line with the ideas of meta-cognition, but the teachers themselves, including future teachers who study at the university, are rarely considered as subjects of meta-cognition. [Zohar and Barzilai \(2013\)](#) take this idea as a problem in their research: "there are very few studies of teachers' knowledge and professional development regarding meta-cognition". Researchers propose a solution to this problem in specific works, saying that strategies can meet the needs of teachers who support students in mastering sciences through a foreign language. [Lo \(2020\)](#) believes that one of the ways of such support could be through the Content and Language Integrated Learning (CLIL) approach.

At the same time, it is the achievement of one's own meta-subject results in the process of obtaining professional education, the formation of readiness for this activity that causes significant difficulties for future teachers. This issue is not sufficiently disclosed in the studies, since the attention of researchers was focused on the methods and forms of readiness, and not on the content. In this regard, the problems of methodology of achieving meta-subject results in the process of mastering educational programs, complicated by the requirements of a high level of foreign language knowledge.

As a result of our research into meta-cognition processes, it can be concluded that the effective use of basic cognitive processes is a fundamental part of learning. These cognitive processes include memory and attention, the activation of prior knowledge, and the use of cognitive strategies to solve a problem or complete a task. For the learners to make sure that they are making the best use of these basic cognitive processes, they need to have awareness and the ability to control and adapt them. The meta-subject potential means the possibility of using the available universal, integrating means of the academic discipline and inter-subject connections for the development of the pedagogical process, the phenomenon, and the ability of subjects of cognition for reflection.

Features of meta-subject potential:

- 1) Universality, i. e. ubiquity, generality; for example, in pedagogy, the means, methods, and forms that are used in teaching one subject can be successfully used in teaching another.
- 2) Integrability in teaching means the restoration of the natural integrity of the cognitive process based on establishing connections and relationships between artificially separated components of the pedagogical process.
- 3) Interdisciplinary connections mean the interaction between the content of individual academic subjects, through which the internal unity of the educational program is achieved, as well as the sequential combination of several different programs into one whole.
- 4) Reflexivity means a state or quality with the help of which the subject pays attention to themselves and their consciousness, in particular, to the products of their activity, as well as some kind of rethinking of them ([Kotelova, 1984; Vishnyakov, 1999](#)).

2. LITERATURE REVIEW

The changes taking place in education are explained by modern models and theories of learning. One of these models is the Allosteric Learning Model (ALM) developed by [Giordan \(1996\)](#) at the Laboratory of Didactics and Epistemology of Sciences. This is a model known today as the ALM (for Anglo-Saxon countries). Far from being ideal, this model, nevertheless, has undoubted advantages, such as allowing one to identify problems, explicate the main characteristics of the learning activities, and make a forecast for the future. Finally, and this is the main reason why it is of certain interest, it provides practical recommendations for those educational environments that are

designed to facilitate learning processes. It, therefore, allows putting forward heuristic hypotheses about specific educational projects. For example, Turkish researchers [Berkant and Baysal \(2017\)](#) conducted an experiment using this model, during which they determined the compatibility of the views of English teachers and the instructions of the curriculum, as well as the content of English education for 4th grade with the principles of the ALM. This work has a practice-oriented nature, as it presents sample lesson plans for using the ALM in English lessons. Teachers' opinions and curriculum data show that most of the ALM principles are implemented both in regulatory documents and in teaching practice.

With the trend towards a shift from knowledge-based education to competency-based education, assessment is not only the process but the learning itself. In competency-based education, competency-based assessment (CBA) is the process of gathering evidence and judging whether competence has been achieved and regulating teaching and learning. The integration of CBA into teaching allows students to self-shape their competencies, applying academic knowledge to solve assessment problems that are well connected to real-world contexts. [Duong \(2019\)](#) presented a study that described the international discussions of the term CBA, as well as the meaning of CBA integration in learning and testing the process of integrating CBA into learning for developing core competencies of students. This study analyzed the development of problem-solving and presentation competence in food technology and sewing technology students after completing assessment assignments integrated into teaching general psychology and vocational education. The author made proposals for the development of the core competencies of students of technical and vocational education through the integration of CBA into educational pedagogical subjects, carefully taking into account the consistency of learning outcomes, teaching and methodological activities, and assessment.

The study of theories and models of teaching made it possible to clarify the concept of the meta-subject potential of a foreign language and identify the criteria that characterize the meta-subject. Vygotsky, with the idea of a zone of proximal development, laid the foundations for taking meta-cognitive development into account in planning a teacher's work. The work of such researchers as John Flavell and his followers influenced the use of the meta-subject approach in designing results.

The integrative component of the educational process includes several aspects that characterize its different aspects and procedural elements. Firstly, in the holistic educational process, when viewed from the position of a systematic approach, two relatively independent subsystems can be distinguished, namely educational work and cognitive activity, which are differentiated, first of all, by the nature of goals and objectives, as well as the totality of external conditions and subjective characteristics of students. The essence of integration lies in the fact that when organizing the educational process, educational and cognitive goals form a single goal, during the achievement of which, didactic, educational, and developmental tasks are solved. In the course of foreign language training, an integrative approach to the target component of the process is determined by the specifics of the process of learning a foreign language, the peculiarities of the content of didactic material (its individual and creative orientation), the variety of options for solving educational problems, and the variability of the result. We consider productive the idea of [Sochneva \(2011\)](#) who writes in her research that the quality of the potential "poly-disciplinary nature" of a foreign language as an academic discipline. This is the most mobile didactic object that can perform an integrating function for the synthesis of diverse knowledge based on the actualization of interdisciplinary connections in the learning process, becoming, as it were, a kind of an integrating core that ensures the development of practical competencies.

Secondly, in terms of its content, the integration of higher education is the interconnection of national education systems, their complementarity, and the transformation of higher education into a global social system. The integration of higher education, responding to the growing need for intercultural understanding, caused by the global nature of modern communication media, consumer markets, is, of course, a favorable trend. Along with other trends, such as the growth of the scale of higher education, diversification of higher education by institutional

levels, forms, and content, internationalization, and universalization, integration is an objective process that should not develop spontaneously.

Thirdly, the integration of the content of a foreign language in non-linguistic universities as an academic discipline with the content of professional training allows the student not only to acquire competencies that will ensure their competitiveness in the labor market but also to develop their approach (strategy) of mastering other foreign languages in the framework of raising the level of professionalism. Sadchenko (2004) understands the strategy of mastering a foreign language as "a multitude of hierarchically organized metacognitive and cognitive techniques that make up a way that provides activation, accumulation, improvement, and automation of linguistic knowledge and their actualization in different types of speech in a foreign language". Sadchenko (2004) notes that the specificity of learning a foreign language, in contrast to general learning strategies, is due to the peculiarities of a foreign language and performs the functions of forming an intermediate language, ensuring the accumulation, improvement, and interconnection of linguistic and extralinguistic knowledge.

This point of view seems fair to us, but the quality of teaching a foreign language at a pedagogical university can be brought to such a level when English becomes a language with a higher degree of use. Then its intermediate status will allow future teachers to fully use the meta-subject potential. Moreover, the regulatory documents require this from modern teachers. Thus, in the state compulsory educational standards of basic general education of the Republic of Kazakhstan in the context of reforms, a special place is occupied by requirements for meta-subject results of mastering the basic educational program. Meta-subject results include the interdisciplinary concepts and universal educational actions (regulatory, cognitive, communicative) mastered by students, the ability to use them in educational, cognitive, and social practice, the independence of planning and implementation of educational activities, and the organization of educational cooperation with teachers and peers, building an individual educational trajectory. Such results declared in state educational standards, put forward special requirements for the teacher's activity.

3. PROBLEM STATEMENT

One of the key problems of learning a foreign language by future teachers is the problem of preserving and building the potential of foreign language competencies. For a full-fledged entry of a professional into work after completing training at a pedagogical university, a professional needs to know a foreign language. However, as noted above, the program of studying a foreign language at a university is often limited to the 2nd or 3rd year, and the subsequent development of foreign language communication skills takes place outside the classroom and mainly depends on the activity of the student. In this regard, it was concluded that teaching a foreign language should be largely inherent in a developing character. We know that any training in one way or other solves the problems of student development. However, according to Vygotsky (2005) only within the framework of the developmental approach, the independence and activity of the subject reach a high degree due to the high motivation to use the meta-subject potential of a foreign language. In this regard, it becomes necessary to diagnose the readiness for its use in future teachers.

3.1. Study Goal and Objectives

The aim of the study was, based on a literature review and analysis of diagnostic results, to develop a target module for a foreign language teaching program for future teachers based on a meta-subject approach.

In accordance with this goal, we set the following research tasks:

- 1) To determine the level of students' understanding of the essence of the meta-subject approach.
- 2) To reveal the level of proficiency in the skills to differentiate the signs of the meta-subject potential of a foreign language.

3) To determine the degree of readiness of future teachers of natural sciences to implement the meta-subject potential of a foreign language.

4. METHODS

The study used a questionnaire being a reliable and direct tool for identifying the point of view on the subject under study. The logic of constructing the questions of the questionnaire allowed solving the main task: identifying the degree of readiness of future teachers to use the meta-subject potential of a foreign language. The questionnaire was distinguished by the speed of obtaining information, the ability to obtain information within a given subject, the possibility of mathematical processing of the information received, and the availability of obtaining the required amount of data. Mathematical data processing allowed presenting the results of the questionnaire in a generalized version. The analysis of the data obtained allowed comparing the results of the study with those already available, as well as allowed focusing on finding and eliminating the problem. Descriptive analysis was used in the study which allowed quantitative data to be presented in a manageable manner and also provided an opportunity to summarize the results obtained.

4.1. Participants

The study involved 120 4th-year students of pedagogical specialties of the Pavlodar Pedagogical University. Students of the Higher School of Natural Sciences were invited to participate in the research; these were future teachers of biology, chemistry, mathematics, physics, and computer science. This category of respondents was selected because these students had studied a multilingual program.

Time of the study: the end of the 7th semester, when the theoretical course of study had ended and the general subject-related and special competencies had been formed. This category of students was familiar with the meta-subject matter, as they had studied the normative documents that governed the content of school education. 1st, 2nd, and 3rd-year students had mastered the content of such disciplines as Foreign language guage in the professional context. According to the requirements of the educational program, students had foreign language skills at the B2, C1 levels (CEFR, 2020). As part of the multilingual program for the 7th and 8th semesters (4th year of study) these students had been trained in special disciplines in English.

Research base: the Pavlodar Pedagogical University Joint Stock Company.

4.2. Procedure

The research was conducted in December 2019. Students who participated in the study were invited to one classroom before the winter examination session. The written questionnaire was completed within 15 minutes.

4.3. Measures

Especially for the realization of the research goal, we developed a questionnaire "Readiness to use the meta-subject potential of a foreign language in the professional activity of a teacher", consisting of three questions.

The first question aimed at identifying the understanding by future teachers of the essence of the meta-subject approach through the organization of teaching the subject. A question with the following alternatives was asked: "Does the meta-subject approach in teaching biology (physics, chemistry, computer science, mathematics, etc.) contribute to the formation of a holistic view of the world around and a person's place in it?"

- Yes, since the meta-subject approach integrates knowledge from different fields of knowledge.
- I am not sure, because to master the content of education in biology (physics, chemistry, computer science, mathematics, etc.), there is enough knowledge and skills that make up the foundations of this science.
- No, since the meta-subject approach limits views of the world.

The second question, which was formulated with alternatives was as follows: "Do the following features (universality, integrability, presence of inter-subject connections, reflexivity) reflect the properties of the potential of a foreign language?", helped to identify the ability to differentiate the features of the meta-subject potential of a foreign language.

- Yes, since the specificity of meta-subjectivity is manifested through them.
- Not sure, since the listed properties are not enough to indicate the signs of the meta-subject potential of a foreign language.
- No, since these features cannot characterize the specifics of the meta-subject approach.

The third question helped to identify the degree of one's own readiness to implement the meta-subject potential of a foreign language in the perception of future teachers. The question with five alternatives was formulated as follows: "What is the degree of your readiness to realize the meta-subject potential of a foreign language? Rate your level of readiness in points, where

81-100 points mean a very high level.

61-80 points mean a high level.

41-60 points mean an average level.

21-40 points mean a level below average.

0-20 points mean a low level.

5. RESULTS

5.1. Understanding the Essence of the Meta-Subject Approach by Future Teachers through the Organization of Teaching the Subject

According to Table 1, 29.1% of the respondents believed that the meta-subject approach in teaching contributes to the formation of a holistic view of the world around and a person's place in it, 50.8% were not sure about this, and 20% did not agree with this statement.

5.2. Understanding the Signs of the Meta-Subject Potential of a Foreign Language

According to Table 1, 48.3% of the respondents believed that the listed features do not reflect the specifics of meta-subjectivity, 30% thought that the listed properties are not enough to indicate the features of the meta-subject potential of a foreign language, and 21.7% believed that these features can characterize the specifics of meta-subject approach.

Table-1. Understanding of the essence and features of the meta-subject potential of a foreign language in professional activities by future teachers (N = 120).

	N	%
1. Understanding the essence of the meta-subject approach through the organization of teaching the subject		
Yes	35	29.1
Not sure	61	50.8
No	24	20
2. Knowledge of the signs of the meta-subject potential of a foreign language		
Yes	26	21.7
Not sure	36	30
No	58	48.3

5.3. The Degree of One's Own Readiness to Realize the Meta-Subject Potential of a Foreign Language in the Perception of Future Teachers

According to Figure 1, 27 students (22.5% of the respondents) assessed their level of readiness to realize the meta-subject potential of a foreign language in the perception of future teachers as low, 32 (26.7%) recognized their

readiness as below the average level, and 40 (33.3%) believed that they had an average level of readiness. Fifteen students (12.5%) assessed their readiness at a high level. Six students (5%) believed that they had a very high level of readiness.

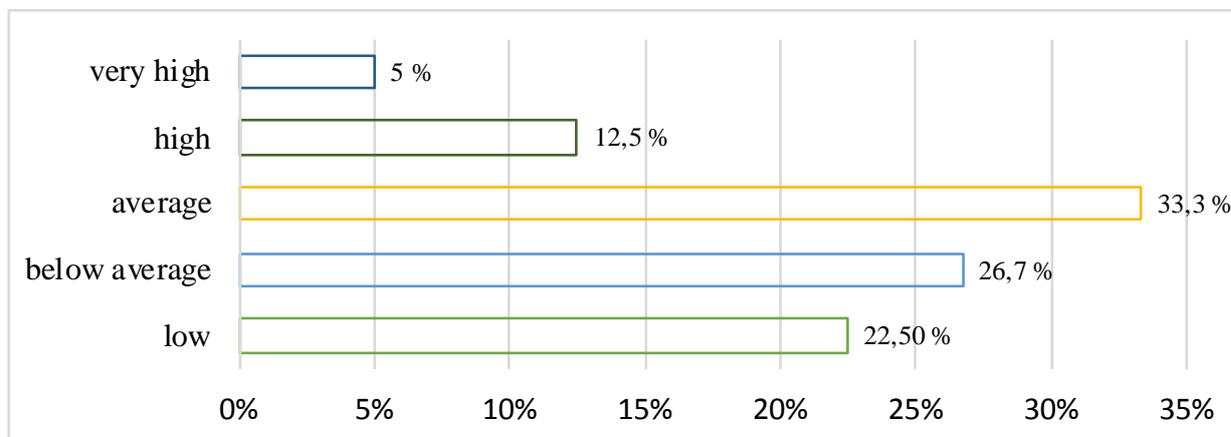


Figure-1. The results of diagnostics of the level of readiness to realize the meta-subject potential of a foreign language in the perception of future teachers.

6. DISCUSSION

Our practical study of the readiness to realize the meta-subject potential of a foreign language in the perception of future teachers showed the following.

The first question included in the questionnaire aimed at identifying the understanding by future teachers of the essence of the meta-subject approach through the organization of teaching the subject. We found out how students understood the essence of the meta-subject approach. Two-quarters of the respondents believed that the meta-subject approach in teaching biology (physics, chemistry, computer science, mathematics, etc.) contributed to the formation of a holistic view of the world around and a person's place in it, as it integrated knowledge of different fields of knowledge. Less than a quarter of the future teachers from among the respondents believed that the meta-subject approach limited their views of the world. More than half of the teachers surveyed were not sure if the meta-subject approach contributed to the formation of a holistic view of the world because to master the content of education in biology (physics, chemistry, computer science, mathematics, etc.), there are enough knowledge and skills that form the basis of the relevant science.

The second question was related to the identification of understanding of the features of the meta-subject potential of a foreign language. During the questionnaire survey, it was found that more than a quarter of the respondents considered that universality, integrability, presence of inter-subject connections, and reflexivity reflected the properties of the meta-subject potential of a foreign language. Two-quarters of the respondents were not sure if those properties were signs of the meta-subject potential of a foreign language. Slightly less than half of the respondents believed that those features cannot characterize the specifics of the meta-subject matter.

The third question provided an opportunity to judge the self-assessment of the readiness of future teachers to apply the meta-subject potential of a foreign language in their future professional activities. Slightly more than a quarter of the students surveyed assessed their readiness to implement the meta-subject potential of a foreign language in a high and very high degree, while two-quarters of the respondents showed an average level of readiness. A little more than half of the students rated their readiness to implement the meta-subject potential at the low and below the average level.

Diagnostics of the readiness of future teachers to perform their professional duties is an urgent problem. One of the well-known studies was carried out by [Mohamad, Valcke, and De Wever \(2017\)](#) who conducted a series of studies of students' readiness "in terms of 11 competencies" accepted in the world education system as necessary

ones for future teachers. These researchers used a questionnaire to determine how the characteristics of pedagogical education were related to the readiness of future teachers to work. Although the results obtained were not related to the meta-subject potential of a foreign language, some of the diagnosed competencies could be attributed to meta-cognitive ones. The results obtained also demonstrated the relationship between the content of pedagogical education and the readiness for future professional activities.

The results of the conducted research demonstrated the following: most of the students admitted that they were not ready to realize the meta-subject potential of a foreign language in their future professional activities. The lack of readiness was caused by the lack of understanding of the relevance of the meta-subject approach, as well as insufficient knowledge of the features of the meta-subject and its manifestations in cognitive activity. Having only a general idea of the meta-subject method and the meta-subject approach, students demonstrate the need to consider the scientific and methodological substantiation of the use of the meta-subject potential of a foreign language. We also see the need to introduce into the educational process a practical course of a professional foreign language based on a meta-subject approach in the training of future teachers. These conclusions are supported by the results of the analysis of the normative documents of the system of higher pedagogical education, as well as by the research of modern scientists.

The system of higher pedagogical education is implementing changes in approaches to teaching. A higher school teacher has to revise the specifics of their subject concerning those requirements that are already being introduced into the practice of a modern general education school. In the State Educational Standard of Higher Professional Education of the Republic of Kazakhstan, among the requirements for the level of training of students, "the requirements for the readiness to change social, economic, professional roles, geographical and social mobility in the context of the growing dynamism of changes and uncertainties" are stated in the following way:

"1) to be able to navigate in modern information flows and adapt to dynamically changing phenomena and processes in the world economy.

2) to be flexible and mobile in various conditions and situations related to professional activities.

3) to possess the skills of making decisions of an economic and organizational nature in conditions of uncertainty and risk" (Order of the Minister of Education and Science of the Republic of Kazakhstan, 2018).

These requirements can be met provided the future teacher's meta-subject competencies have been developed. The situation when the pedagogical personnel training subsystem does not outrun but tries to catch up and adapt to the demands of the secondary education subsystem practice does not work for the development of the entire system as a whole. It is also impossible to fulfill the requirements of the State Educational Standard of Higher Professional Education of the Republic of Kazakhstan in these conditions. The prevailing views on the model of a pedagogical university graduate have little in common with the requirements for a modern school teacher.

The revealed signs of the readiness of future teachers to realize the meta-subject potential of a foreign language are a variant of analysis and are offered for discussion. The task of the authors of the educational program is to systematize the collected data and analyze possible strategies for improving the practice of teaching a foreign language.

A survey, which was conducted among practicing teachers of a foreign language, shows that teachers understand the importance of the meta-subject potential of their subject and are ready to use these features in the context of the updated content of school education.

The requirements of the State Educational Standard of Higher Professional Education of the Republic of Kazakhstan for the meta-subject results of mastering the educational program can be implemented, focusing on the following results:

- The future teacher can independently determine goals and make plans, realizing the priority and secondary tasks.

- A graduate of pedagogical specialties can independently carry out their activities, using various resources to achieve the goal, and be able to choose the necessary strategies, including in a foreign language.
- The future teacher can demonstrate the ability to independently assess the situation and make decisions, as well as possession of the skills of cognitive reflection.

The analysis of the survey conducted among students indicates the presence of problems in the preparation of future teachers. A graduate of the "Mathematics at School" pedagogical field can solve problems in several ways, but they are not ready to explain the connection between mathematical phenomena to a student. A bachelor majoring in the Russian language and literature knows the history of literature and samples of the best works of literature from different countries, but they cannot apply this knowledge to help a student in forming a holistic picture of the literature of a particular period in human history. A young biology teacher knows representatives of all biological species and how to classify them, but is not ready to teach a student to see the connection between natural phenomena and the causes of changes in other biological systems. Here are examples of intradisciplinary relationships. A difficult situation is developing with the search for relationships between school subjects. This can also be observed in the example of the skills of graduates of pedagogical universities. A young math teacher sometimes cannot solve a physics problem. A teacher of history, geography, biology, and other specialties writes and speaks in a way that violates the norms of the culture of writing and speaking. In the examples presented, we see that pedagogical universities, in an attempt to solve the crisis of professional education, forget about the main task of preparing a future teacher, i. e. the task of developing pedagogical thinking, which is formed not only based on knowledge of the theory and methodology of a certain science, but also on the tools that will be used in practice to apply this knowledge.

A foreign language, the global goal of studying which at this stage of the development of the education system is aimed at solving the problems of integrating the country into the world educational space, like other disciplines in the content of training teachers, can provide tools for the implementation of the meta-subject approach. In preparing curricula in a foreign language, a university teacher is guided by general professional competencies that correspond to the State Educational Standard of Higher Professional Education of the Republic of Kazakhstan and by qualification characteristics. Studying English, students can rethink the content of the complex of knowledge that they receive through the development of compulsory, basic, and optional disciplines. For example, modern discoveries in the field of natural sciences (physics, chemistry, biology) are presented in the language of international communication, i. e. in English. For the future teacher of physics, mathematics, chemistry, and biology to be able to talk about these discoveries and help find materials for a deep understanding of new phenomena in the natural sciences, they must speak English. The subject content that a university teacher of a foreign language uses in their lessons should motivate for a deep study of both the main subject of their specialty and for the development of competencies related to a foreign language. Knowledge of a foreign language influences the perception of these subjects. The skills and abilities obtained in teaching certain subjects turn into strong educational skills and abilities and create strong ties that allow students to independently solve life-connected and professional problems.

Based on these conclusions, we developed a target module for the program of foreign language education of students in the process of teaching natural sciences at a pedagogical university. This module is a part of the educational program for the preparation of students at a pedagogical university. In the process of teaching natural sciences, the use of the meta-subject approach to a foreign language is regulated by meta-subject indicators. In the expected results, signs of the meta-subject potential of a foreign language filled the content of special competencies. For example, universality should be manifested in the skills of using methods, forms, and means of teaching various disciplines, regardless of the language in which the training is conducted, Kazakh, Russian, or English. Integrity should be manifested in the ability of future teachers to holistically perceive the objects of their work. Interdisciplinary connections are considered in the content of competence, which refers to the skill to detect

internal connections between objects of natural sciences. Reflexivity is equally the most important competence of a teacher who analyzes their work and the results of interaction with students.

In light of the above, we emphasize the importance of working on the formation of the aforementioned special competencies through the use of the meta-subject approach in foreign language classes. The results of the questionnaire, which showed the relevance of the use of the meta-subject potential of a foreign language and, at the same time, the insufficiently high level of readiness of future teachers to use it due to the lack of practice of using it in higher education, directing the focus of further research to find optimal ways to realize the meta-subject potential of a foreign language. The analysis of regulatory documents and modern scientific research shows the productivity of the idea of introducing foreign language training programs into the educational process, which will develop the readiness of future teachers to use the meta-subject potential of a foreign language in the process of teaching natural sciences.

7. CONCLUSION

In our article, we presented the results of the analysis of theoretical and practical aspects of using meta-subject potential in the training of future teachers. Clarifying the features of meta-subject potential allowed us to conduct a practical study among practicing teachers and future teachers to understand the significance and, therefore, readiness to use this potential in their work.

Learning English at a pedagogical university becomes one of the essential requirements for training future teachers. The implementation of this task means learning a foreign language and mastering the content of individual subjects in this language by future teachers in higher school. In contrast to research by Sadchenko (2004); Sakenov, Kushnir, Shnaider, and Abdulkhamidova (2012); Sarsenbaeva et al. (2015); Zholdasbekov, Zholdasbekova, Abitarova, Sakenov, and Ahmuldinova (2018); Zhubandykova. et al. (2020) and Mombek et al. (2017) we revealed the specifics of using the meta-subject approach in teaching a foreign language at a pedagogical university. The result of pedagogical education at the present stage should be a future teacher with a complete system of knowledge, skills, and competencies from the future professional sphere. Ensuring inter-subject communication in the process of training future teachers will help to solve this problem.

Understanding the specifics of the meta-subject potential of a foreign language in the training of future teachers makes it possible to actualize the need to learn a foreign language. In our future work, we consider it necessary to develop optimal ways to use the meta-subject potential of a foreign language in future teachers' training.

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