

ҚАЗАҚСТАН
РЕСПУБЛИКАСЫ
ҒЫЛЫМ ЖӘНЕ
ЖОҒАРЫ БІЛІМ
МИНИСТРЛІГІ

МИНИСТЕРСТВО НАУКИ
И ВЫСШЕГО
ОБРАЗОВАНИЯ
РЕСПУБЛИКИ
КАЗАХСТАН

MINISTRY OF SCIENCE
AND HIGHER EDUCATION
OF REPUBLIC OF
KAZAKHSTAN

Zhanibekov
UNIVERSITY

ӨЗБЕКӘЛІ ЖӘНІБЕКОВ
АТЫНДАҒЫ ОҢТҮСТІК
ҚАЗАҚСТАН
ПЕДАГОГИКАЛЫҚ
УНИВЕРСИТЕТІ

ЮЖНО КАЗАХСТАНСКИЙ
ПЕДАГОГИЧЕСКИЙ
УНИВЕРСИТЕТ ИМЕНИ
ӨЗБЕКӘЛІ ЖӘНІБЕКОВ

SOUTH KAZAKHSTAN
PEDAGOGICAL
UNIVERSITY NAMED
AFTER UZBEKALI
ZHANIBEKOV

Өзбекәлі Жәнібеков атындағы
Оңтүстік Қазақстан педагогикалық
университеті Басқарма төрағасы
Ректордың у.м.а.

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Acting Chairman of the Board -
Rector of the South Kazakhstan
Pedagogical University named after
Ozbekali Zhanibekov



Г.Д. Сугирбаева

Хаттама № 02, «28.05» 2024 ж.

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Protocol № 02, «28.05» 2024

БІЛІМ БЕРУ
БАҒДАРЛАМАСЫ

6B01513 МАТЕМАТИКА

ОБРАЗОВАТЕЛЬНАЯ
ПРОГРАММА

6B1513 МАТЕМАТИКА

EDUCATIONAL
PROGRAM

6B01513 MATHEMATICS

Шымкент 2024

Ф 7.02-13

**EDUCATIONAL PROGRAM
6B01513 MATHEMATICS**

Code and Classification of the field of education:	6B01 Pedagogical Sciences
Code and classification of training course:	6B015 Teacher training of in natural sciences subjects
Awarded degree:	Bachelor of Education in the educational program 6B01513 Mathematics
Type of program:	Bachelor, the 6 th level NQF/ SQF / ISCE
Total amount of credits:	240 Academic credits / 240 ECTS

The educational program was reviewed at the Council of the Physics and Mathematics Faculty and recommended for approval by the Academic Council of the University.

Protocol No 08 « 23.04 » 2024


The educational program was reviewed by the Academic Council of the University and recommended for approval by the Board


Protocol No 12 « 06.05 » 2024


The educational program was approved by the decision of the Board and put into effect.


Protocol No 08 « 28.05 » 2024

Agreed:

A.i. Member of the Board-Vice Rector for Academic Affairs,
Director for Academic Affairs Department  Berdaliev D.T.

Dean of the Faculty of physics and mathematics  Ibashova A.B.


Director of the Methodological Center of the
Department of education of the city of Shymkent  G. Maslov

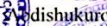
Director of AOO "Orleu" of Shymkent and
Turkestan region  A. Ismailova


Director of NIS of Physics and Mathematics
in Shymkent  I.K. Asmailova

Chairman of the public association
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Director of «Specialized boarding school
№2 with training in three languages»  S.Zh. Sauranbayev

Director of the school-lyceum № 7 named after K. Sypanyev  R. Jumakhankyzy

Director of the IT school-lyceum № 80 of the Department
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PROPOSAL FORM FOR AN ACADEMIC PROGRAMME

Mathematics

Approved for 2024-2032

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1. General information

1.1. Curriculum title	6B01513 Mathematics IP	
1.2. Curriculum developing team:	Leader university	Member universities
	Abai Kazakh National Pedagogical University	Kazakh National Women's Teacher Training University
1.3. Type of curriculum (in accordance with the National Qualifications Framework)	BACHELOR'S DEGREE Level 6	
1.4. Total academic credits	240 academic credits	
1.5. Study mode	full-time	
1.6. Expected program duration	4 years	
1.7. Short curriculum description Curriculum goals and objectives	<p>This Educational Programme (EP) "<i>Mathematics</i>" is a national teacher education curriculum, which has been designed in collaboration by various Kazakh universities and with international consulting. Due to the nature of a national curriculum, the descriptive texts within the curriculum do not provide specific information but highlight general pedagogical principles and cross-cutting themes (see also Annex 1.). The more detailed descriptions of e.g. methodologies and assessment will be identified in the implementation plans of the universities, considering also institutional and regional specific conditions.</p> <p>Educational programme (EP) "<i>Mathematics</i>" is a teacher education programme for pre-service teachers who wish to specialize as a mathematics teacher (in schools, colleges, high schools) who are in demand in modern</p>	

society, who can quickly navigate the constantly changing conditions in the field of education and meet the requirements for a competitive teacher. EP consists of a pedagogical component 60 academic credits (incl. pedagogical practice), a compulsory component 56 academic credits, and a subject component 124 academic credits (incl. a final attestation of 8 academic credits).

Subject component consists of 4 modules: “Functions nature: cause and effect”, “Mathematical challenges and solutions in society”, “Mathematical thinking and personal development”, “Interdisciplinary research”.

EP takes into account student orientation and strengthens the subject preparation of pre-service teachers and the development of their research skills and the implementation of interdisciplinary connections.

EP provides an equal opportunity for learning without compromising pre-service teachers' rights and interests, preserving the principles of equality, respect, tolerance. It is interdisciplinary, student-oriented, scientifically integrated and problem-oriented by nature, and the selection of courses is guided by the topical issues of history and society and corresponds also to the international course descriptors.

EP is based on the principles of constructive alignment, where teaching and assessment methods, as well as subject-specific courses are selected to ensure the achievement and measurement of the competences outlined in the EP. The EP also follows an inclusive approach considering the multi-ethnic and multi-confessional composition of pre-service teachers and their versatile needs for support of learning.

1.8 Main principles of the curriculum

Competence-based teacher education

A teacher’s expertise combines competence in pedagogy and their own subject-specific field with theoretical and practical teaching competence in different kinds of operating environments. A teacher has mastery of the knowledge and

skill requirements of their subject-specific field and thus is able to teach and supervise young people and adults studying for the same subject.

The competence of a teacher is focused on planning, guidance, teaching and assessment. For this reason, teacher must have sufficient theoretical knowledge of learning and competence development. In addition, modern working life emphasises cooperation and networking, development skills, and the support and maintenance of the well-being of oneself and one's community.

A teacher's competence is influenced by changes in the labour market, the structures of education and society as a whole, and all these elements are emphasised in the dynamic nature of a teacher's work. Work characterized by continual change in the variety of working environments places an emphasis on the teacher's ability to assess and adjust their own activities. Self-assessment skills are an essential part of developing one's professional identity. A teacher is making value decisions all the time, which means that the consideration of questions of professional ethics is one of the professional skills needed. Change requires the development of expertise, the ability to learn, as well as the ability to reform and renew the way things are done as part of a community.

Competence-based teacher education curriculum

The competence-based teacher education curriculum is formed of three entities: 1) Pedagogical studies, 2) Subject-specific studies 3) Compulsory studies. Each of the entities includes modules and related courses. The courses' learning outcomes describe the competences required in teaching work and are placed in the NQF system's (National Qualifications Framework) reference level six.

The curriculum is guided by the following main principles:

- Competence-based learning
- Constructive alignment
- Student-centred learning and active learning methodologies
- Research-based teaching
- Interdisciplinary learning
- Inclusion
- Teacher professional development and change management

(see Appendix for more details)

2. Programme rationale

In the context of the Education Modernization Project funded by the World Bank, several universities providing pre-service teacher education have designed and revised in international collaboration thirty (30) pre-service teacher education curricula according to the principles of competence-based education that ensure a holistic development of pre-service teachers' competences. Moreover, the student-centered approach better prepares pre-service teachers to teaching profession by providing practical examples, experiments and experiences, which pre-service teachers can transfer to their classroom practices considering better the versatile needs and wellbeing of their students.

In order to match the requirements of the renewed primary and secondary education, teachers' professional competences need to be re-evaluated and completed. The new approaches in secondary education need to be reflected in pre-service teacher education and the pre-service teachers' profiles. Furthermore, these thirty (30) revised or new pre-service teacher education curricula have been designed to better improve pre-service teachers' various generic competences that are essential in teacher's profession. Several important and cross-cutting pedagogical principles that Kazakhstan education system aims to develop, such as inclusiveness and interdisciplinarity, have been taken into consideration in the design and implementation of the curricula. In addition, these curricula emphasize the development of pre-service teachers' research skills in a way that they become practitioners who are constantly reflecting and evaluating their own practices and the practices of their schools to develop their own work and their work community, and the whole sector of education.

3. Teacher's professional competences

Teachers' professional competences are defined as consisting of **pedagogical competences** and **subject-specific competences** as well as **generic competences**. The competence-based teacher education curriculum is thus formed of three entities: 1) Pedagogical studies, 2) Subject-specific studies 3) Compulsory studies. Competence areas and competences have been defined separately for each entity.

3.1. Pedagogical and Generic Competence Areas/Learning Outcomes

- **Competence area for pedagogy and didactics**

1. Pre-service teachers have basic knowledge and understanding of learning and students and are able consider the diversity of students in learning/teaching process and support their well-being in

psychologically and ethically sound manner considering their life and learning contexts.

2. Pre-service teachers are capable to design, implement, assess, and develop learning and guidance processes in different kinds of learning environments in a pedagogically meaningful way including ability to utilize different digital resources in a manner that supports learning.

- **Competence area for interaction**

3. Pre-service teachers are able to communicate in different interactive relationships and partner networks in a meaningful manner both in face-to-face and online settings with regard to the goals set for the activity in question.
4. Pre-service teachers are capable of working in different collaboration networks and have the ability to create new professional relationships that are appropriate for the development of one's own and one's community activities.
5. Pre-service teachers are able to teach in accordance with the tri-lingual approach in secondary education and participate in the global professional community.

- **Competence area for teachers' work environment**

6. Pre-service teachers are familiar with the international and national agreements and documents as well as legislation that affects his/her institution's and his/her work.
7. Pre-service teachers are able to (a) to perceive his / her own activities in relation to the activities of his/her organization, and (b) work in a meaningful way to create positive relationships between the partners outside the school (families, regional actors, working life).

- **Competence area for professional development**

8. Pre-service teachers are able to reflect and critically assess their values, attitudes, ethical principles and work methods as a teacher and are able to set new goals to his/her own and his/her organization's pedagogical development.
9. Pre-service teachers are able to develop his / her own and his / her organization's pedagogical activities in relation to the anticipated changes at regional, national and international level.
10. Pre-service teachers are able to produce, seek and critically select theoretical knowledge that, combined with experiential knowledge, serves the development of both him/her and his/her community's theory-in-use, and the ability and willingness to use knowledge to promote learning and own professional growth.

3.2 Subject-specific and Generic Competence Areas/ Learning Outcomes

- **Competence area for fundamental mathematical knowledge**

1. Pre-service teachers are able to understand the nature and structure of mathematical knowledge.
2. Pre-service teachers have a mathematical language for proving mathematical statements and solving mathematical problems.
3. Pre-service teachers have the skills to integrate knowledge from various branches of mathematics to build mathematical models of tasks and their solutions, as well as to analyze and interpret the results obtained.

- **Competence area for practical skills**

4. Pre-service teachers can use mathematical methods in the analysis, synthesis and evaluation of observed processes and phenomena.
5. Pre-service teachers have the skills to work with computer mathematics systems, dynamic algebra systems, as well as with online digital tools for using them in professional activities.
6. Pre-service teachers have the skills to develop educational and didactic materials in mathematics, including differentiated school math problems.

- **Competence area for research skills and interdisciplinary interactions**

7. Pre-service teachers have the skills to search and analyze information about current problems of teaching mathematics to schoolchildren for the development of their own pedagogical activity.
8. Pre-service teachers have the skills to conduct pedagogical research in the field of mathematical education of schoolchildren
9. Pre-service teachers can competently draw up and issue documents, including academic and mathematical reports for the publication of research results
10. Pre-service teachers can identify and use interdisciplinary connections of mathematics with other subject areas to organize and conduct lessons with STEM and STEAM elements
11. Pre-service teachers have a stable positive attitude to learning mathematics throughout their lives.

3.3 Compulsory component: Competence Areas/ Learning Outcomes

- **Competence area for worldview, historical, and moral development**

1. Pre-service teachers are able to assess the surrounding reality on the basis of ideological positions, formed by a knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge.

2. Pre-service teachers are capable to interpret the content and specific features of the mythological, religious and scientific worldview
 3. Pre-service teachers have deep understanding and scientific analysis of the main stages, patterns and characteristics of the historical development of Kazakhstan.
 4. Pre-service teachers are able to analyse the causes and consequences of the events in the history of Kazakhstan.
- **Competence area for social, cultural, and civic development**
 5. Pre-service teachers are able to develop their own moral and civic position and able to operate with the social, business, cultural, legal and ethical norms of society.
 6. Pre-service teachers have knowledge and understanding of the basics of socio-political, economic and legal studies and are able to demonstrate personal and professional competitiveness.
 7. Pre-service teachers are able to assess situations and provide arguments for their own assessments of developments in the social and work environment.
 - **Competence area for interpersonal social and professional communication**
 8. Pre-service teachers are able to assess situations in various spheres of interpersonal, social and professional communication and enter into communication in oral and written forms in Kazakh, Russian and foreign languages.
 9. Pre-service teachers are able to use in their personal activities various types of information and communication technologies: Internet resources, cloud and mobile services for searching, storing, processing, protecting and distributing information.
 10. Pre-service teachers are able to maintain a healthy lifestyle to achieve productive social and professional activities through the methods and means of physical education.
 11. Pre-service teachers are able to select methodology and analysis, use scientific research methods and techniques, and synthesise new knowledge.

4. Program structure and learning outcomes

4.1. Structure of the pedagogical component

The extent of the Pedagogical Component shall be 60 academic credits, including teaching practice. This component is common for all curricula in initial teacher education. The Pedagogical Component has been jointly created by all the involved universities in a collaborative design process. The

component is flexible and leaves space for individual universities to implement it according to their specific situation and needs.

The overall structure of the pedagogical studies component:

Module name and main disciplines	Academic credits
SUPPORTING LEARNERS AS INDIVIDUALS	17
Psychology in Education and Concepts of Interaction and Communication	3
Educational Science and Key Theories of Learning	3
Age and Physiological Features of the Development of Children	4
Inclusive Educational Environment	3
Teaching Planning and Individualization of Learning	4
TEACHING AND ASSESSMENT FOR LEARNING	9
Teaching Methods and Technologies	5
Assessment and Development	4
TEACHER AS A REFLECTIVE PRACTITIONER	9
Pedagogical Research	4
Research, Development and Innovation	5
TEACHER AS A FACILITATOR OF LEARNING (PEDAGOGICAL PRACTICE)	25
Introduction to the teaching profession (1st year pedagogical practice)	2
Psychological and pedagogical assessment (2nd year pedagogical practice)	2
Pedagogical approaches (3rd year pedagogical practice)	6
Research and innovation in education (4th year pedagogical practice)	15
Total academic credits	60

The modules, courses, their learning outcomes, and relation to competence areas in more detail:

Supporting learners as individuals 17 Academic credits

This provides an overview of psychological theories, concepts, and models which help to understand the pupils' individual needs and individual differences in learning. provides the pre-service teachers with competences to acknowledge individualization of learning and the diversity of learners in teaching. The module highlights the importance of enhancing learner well-

being through creating and maintaining a psychologically safe educational environment.

Course title	Psychology in Education and Concepts of Interaction and Communication
Component	Pedagogical component
Cycle	Core disciplines
Module	Supporting learners as individuals 17 Academic credits
Academic credits	3
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (1) • Competence area for interaction (3, 4) <p>Pre-service teachers are familiar with the modern psychological theories and models, as well as personality functioning and individual properties. They can apply the knowledge in their teaching in diverse educational contexts. Pre-service teachers support positive development of learners by fostering dialogue, interaction, and communication in the educational process. They are able to communicate, interact, and collaborate with pupils' families as well as in various other partnership networks and create new relationships suitable for the development of their own pedagogical activity.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the basic concepts and terms of educational psychology, and the main practical applications of psychological knowledge; • understand the patterns, facts, and phenomena of cognitive and personal development of a person in the processes of education and upbringing; • apply an integrated approach to design, implementation, evaluation, and development of educational environments; • understand the concept of continuous learning as a part of the process of cognitive and personal development of a person. • apply basic communication and interaction concepts and theories at the individual, community, and network levels;

	<ul style="list-style-type: none"> • select the methods of communication and interaction that are most appropriate to facilitate learning in various forms (offline, online, blended, hybrid); • recognize the patterns of group dynamics and act in ways that promote community development and well-being.
Course title	Educational Science and Key Theories of Learning
Component	Pedagogical component
Cycle	Core disciplines
Module	Supporting learners as individuals 17 Academic credits
Academic credits	3
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (1, 2) <p>Pre-service teachers explore the basics of educational science such as the conceptions of man leading to various learning theories and pedagogical models. Based on their understanding of the theoretical concepts, pre-service teachers are able to make appropriate pedagogical choices for various learning situations.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • distinguish between concepts of human and their importance for understanding learning and the design of an educational process; • differentiate between learning theories and their importance for understanding learning and the design of an educational process; • apply learning theories and pedagogical models suitable for versatile learning processes.
Course title	Age and Physiological Features of the Development of Children
Component	Pedagogical component
Cycle	Core disciplines
Module	Supporting learners as individuals 17 Academic credits
Academic credits	4

Course/ competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (2) <p>Pre-service teachers are familiar with the formation of psyche, its functioning, and the patterns of development. Pre-service teachers can observe the development of their students, and accordingly, plan and implement age-appropriate learning processes considering individual needs of students. Pre-service teachers act creatively and appropriately in different situations and support learning and well-being of the learners.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • recognize the individual starting points of different students, their learning potential and specific support needs; • consider the individual needs of their students for specific support, guidance, teaching and assessment; • introduce various methodological solutions for inclusion and for providing specific support.

Course title	Inclusive Educational Environment
Component	Pedagogical component
Cycle	Core disciplines
Module	Supporting learners as individuals 17 Academic credits
Academic credits	3
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (2) • Competence area for teachers' work environment (6, 7) <p>Pre-service teachers have the ability to consider the diversity of learners and identify their individual needs in the learning / teaching process. Pre-service teachers support students' learning and inclusion in the educational process by using suitable ICT, teaching and assistive technologies. Pre-service teachers maintain students' well-being from psychological and ethical perspective in collaboration with the community (teachers, students, parents/guardians) considering the context of students' life and learning.</p>

Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • identify the individual educational needs that affect participation and learning in a diverse group of students; • use ICT and assistive technologies to support students' learning and inclusion in the educational process. • teach values and attitudes beneficial to collaboration and inclusivity; • support collaboration in the community (teachers, students, parents/guardians).
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Course title	Teaching Planning and Individualization of Learning
Component	Pedagogical component
Cycle	Core disciplines
Module	Supporting learners as individuals 17 Academic credits
Academic credits	4
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (1, 2) <p>Pre-service teachers are familiar with the curriculum in their area of teaching and the guiding pedagogical principles and cross-cutting development themes of a specific level of education, such as entrepreneurship and sustainable development. Pre-service teachers possess the necessary skills of individualization of teaching, considering the diversity of students and their inclusion to the learning process, as well as the use of teaching technologies, based on pedagogical and independent research.</p>

Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the main principles and requirements of the curriculum in their area of teaching and apply them in planning and conducting educational activities; • identify factors and conditions that affect students' learning; • apply in practice the principles of inclusion as well as individualized teaching and guidance (adapting curricula, developing differentiated lessons) by considering the needs of the students and support the development of their personality and self-esteem, including career guidance.
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Teaching and assessment for learning 9 Academic credits

This module provides the teacher students with competencies to carry out interactive and student-centered teaching and assessment aligned with learning objectives. The module highlights the use of digital tools and technologies and the ability to update and apply teaching technologies in the context of ongoing changes in the society and the educational environment. This module supports the pre-service teachers' competence to communicate and collaborate in various partnership networks to enhance own pedagogical activity.

Course title	Teaching Methods and Technologies
Component	Pedagogical component
Cycle	Core disciplines
Module	Teaching and assessment for learning 9 Academic credits
Academic credits	5
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (1, 2) <p>Pre-service teachers have a comprehensive understanding of teaching strategies and methodologies, and can apply them in planning, teaching, and assessment in innovative ways matching the specific pedagogical situations, conditions of a specific school and the capabilities of students. Pre-service teachers are able to design suitable inclusive physical and online learning environments at different stages of the educational process. Pre-service teachers understand and can apply the regulations of copyright and data protection in their learning material planning. Pre-service teachers possess necessary knowledge of didactics, learning technologies and methods of motivating students being able to provide necessary pedagogical assistance to students.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • select pedagogical models suitable for teaching; • apply teaching methods in a creative and varied manner, considering the opportunities offered by learning technologies; • use a suitable inclusive learning environment in their teaching; • acknowledge and apply the norms and principles of copyright and data protection;

	<ul style="list-style-type: none"> • apply guidance methods to motivate students and to support their learning achievements.
Course title	Assessment and Development
Component	Pedagogical component
Cycle	Core disciplines
Module	Teaching and assessment for learning 9 Academic credits
Academic credits	4
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for pedagogy and didactics (2) <p>Pre-service teachers have a thorough understanding of the meaning of assessment in learning process and are able to provide constructive assessment in ethical manner in different phases of learning processes and engage learners in assessment. Pre-service teachers identify, differentiate, and use different assessment technologies, principles, stages, and assessment tools in their own field of expertise (including formative and summative assessment and self- and peer-assessment, etc). They can critically evaluate and analyze their understanding and practices concerning assessment and develop them further.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use and apply a variety of methods and tools of assessment and feedback (formative and summative assessment); • apply pedagogical principles in defining and recognizing competence levels of learners; • understand the importance and support the development of students' self- and peer-assessment skills.
Teacher as a reflective practitioner 9 Academic credits	
<p>This module focuses on the methodological foundations of pedagogy, and it provides understanding of how pedagogical research informs teaching practices. The module helps the pre-service teachers to develop their reflection skills to become aware of themselves as teachers and to develop their own teaching as well as the ability to set new goals for pedagogical development to ensure lifelong learning. The module also addresses the ethical aspects of the teachers' work and its development.</p>	

Course title	Pedagogical Research
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a reflective practitioner 9 Academic credits
Academic credits	4
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for professional development (10) <p>This course provides pre-service teachers with a theoretical foundation on pedagogical research. Pre-service teachers possess skills to seek and critically select theoretical knowledge from various reliable sources, utilize research findings in the development their pedagogical thinking and practice, and adopt willingness to promote research-based learning and education as well as their own continuing development and professional growth.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • recognize the nature of pedagogy and its basic terminology; • identify the central areas of research in pedagogy and understand the difference between everyday thinking and scientific knowledge; • follow the changes in the field of education and consider how they influence own work as a teacher.
Course title	Research, Development, and Innovation
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a reflective practitioner 9 Academic credits
Academic credits	5
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • Competence area for professional development (8, 9) • Competence area for interaction (5) <p>To stay up-to-date and be able to continuously develop themselves and their work, pre-service teachers acquire new research-based knowledge and conduct practice-based</p>

	<p>research in an ethical manner in various networks concerning the development of education and teacher profession, innovative approaches to learning, as well as learning and guidance of students. Pre-service teachers adopt development-oriented mindset and are able to develop, update and apply innovative teaching approaches and technologies in the context of ongoing changes in society and the educational environment.</p> <p>Pre-service teachers design a small-scale research project to familiarize themselves with research-based development of their work as teachers. They identify their research topic/questions, conduct the literature review and design the methodology for the data collection and analysis, including ethical aspects of research. After the course, pre-service teachers are able to develop and update their pedagogical activities based on ethically conducted research and development and carry out or participate in research projects. They are also able to present their research and development results using various professional forms and channels.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • evaluate their own professional activities and work environment to find areas for improvement; • apply a research-based approach to their professional activities and carry out independent research work; • consider and apply ethical aspects of research procedures; • apply critical thinking in data collection and utilization for the development of initial teacher education; • participate in scientific design research and / or develop cooperation between universities and stakeholders; • document their own research activities and present the results using various forms of communication.

Teacher as a facilitator of learning (Pedagogical practice) 25 Academic credits

This module focuses on the transformation of theoretical knowledge into practical skills through two pedagogical practice periods/courses, as well as the formation of a teacher's professional identity that meets the requirements of teaching profession today and in the future. During the module, pre-service teachers also establish practice-based research skills promoting the continuous process of professional growth.

Pedagogical practice is organized in four periods/courses, one per study year, and each having their specific learning outcomes where the competences of pre-service teachers are progressively deepened from orientation and observation to designing educational processes and conducting own lessons, and developing own work environment through practice-based research activities.

All practice periods have some prerequisites and pre-service teachers must have completed a certain amount of subject and/or pedagogical studies before they can conduct their pedagogical practice, the number of credits may vary between the faculties and/or educational programmes.

Course title	Introduction to the teaching profession (1st year pedagogical practice)
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a facilitator of learning 25 Academic credits
Academic credits	2
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • competence area for pedagogy and didactics (1, 2) • competence area for interaction (3, 4, 5) • competence area for teachers' work environment (6, 7) • competence area for professional development (8, 9, 10) <p>Pre-service teachers familiarize themselves with the educational process and the context of the educational institution and its adaptation to the conditions of future professional activity.</p> <p>The prerequisite for the course is that the Pre-service teachers have completed the courses "<i>Psychology in Education and Concepts of Interaction and Communication</i>" and "<i>Age and physiological features of the development of children</i>" of the pedagogical component before entering their first pedagogical practice.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the regulatory and legislative framework of the education system of the Republic of Kazakhstan, and the documents regulating educational institutions;

	<ul style="list-style-type: none"> • distinguish the main documents for maintaining school records (work plans of the educational institution, Kundelik electronic diary, short-term, medium-term and long-term lesson planning, etc.); • comprehend the theoretical and applied aspects of pedagogy and educational psychology in the educational process at school considering social, age, psychophysical and individual characteristics of students, as well as their special educational needs.
Course title	Psychological and pedagogical assessment (2nd year pedagogical practice)
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a facilitator of learning 25 Academic credits
Academic credits	2
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • competence area for pedagogy and didactics (1, 2) • competence area for interaction (3, 4, 5) • competence area for teachers' work environment (6, 7) • competence area for professional development (8, 9, 10) <p>Pre-service teachers familiarize themselves with the features of the integral pedagogical process of an educational institution and the formation of analytical-reflexive, research, design, and other skills in the field of psychological and pedagogical support of the educational process.</p> <p>The prerequisite for the course is that the Pre-service teachers have completed the course "<i>Pedagogical Research</i>" of the pedagogical component before entering their second pedagogical practice.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • comprehend the psychological and pedagogical foundations of teaching strategies (critical thinking, functional literacy, collaborative learning, self-education, self-improvement, criteria-based learning); • apply psychological and pedagogical diagnostic methods to evaluate the needs of a group of students, and understand

	<p>how the support processes of the student welfare services function in schools;</p> <ul style="list-style-type: none"> • understand teacher's work from the socio-pedagogical aspect and reflect own professional identity as a future teacher; • establish effective dialogue to reinforce students' positive and responsible learning behaviours; • collaborate with all stakeholders of the educational process; • analyze and develop a holistic pedagogical process in its various forms (lesson, seminar, round table, debate, etc.), and conduct various forms of subject-related extracurricular activities.
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Course title	Pedagogical approaches (3rd year pedagogical practice)
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a facilitator of learning 25 Academic credits
Academic credits	6
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • competence area for pedagogy and didactics (1, 2) • competence area for interaction (3, 4, 5) • competence area for teachers' work environment (6, 7) • competence area for professional development (8, 9, 10) <p>During this course, pre-service teachers go through a comprehensive professional development where they improve in practice their professional practices and develop their pedagogical and subject-specific competences necessary for a teacher (preschool teacher, primary school teacher, subject teacher, assistant class teacher / curator).</p> <p>The prerequisite for the course is that the Pre-service teachers have completed the courses "<i>Methods and Technologies of Teaching</i>", "<i>Assessment and Development</i>", and "<i>Inclusive Educational Environment</i>" of the pedagogical component before entering their third pedagogical practice.</p>

Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • design and organize independently a constructive and inclusive educational process; • choose purposeful and suitable learning materials, innovative pedagogical approaches, and active teaching considering also the use of educational technologies and digital environments; • apply subject-specific knowledge and didactics; • apply formative and summative assessment methods and techniques, and support the development of students' reflection, self- and peer-assessment skills; • establish dialogical atmosphere with all stakeholders of the educational process to solve problems and conflict situations and to promote safe learning environment.
Course title	Research and innovation in education (4th year pedagogical practice)
Component	Pedagogical component
Cycle	Core disciplines
Module	Teacher as a facilitator of learning 25 Academic credits
Academic credits	15
Course / competence description	<p>The purpose of this course is to improve the following areas of pedagogical competence:</p> <ul style="list-style-type: none"> • competence area for pedagogy and didactics (1, 2) • competence area for interaction (3, 4, 5) • competence area for teachers' work environment (6, 7) • competence area for professional development (8, 9, 10) <p>The course focuses on establishing pre-service teachers' developmental approach towards their own professional activities and work environment. The course also emphasizes the development of pre-service teachers' collaborative, problem-solving and leadership skills. They deepen their pedagogical skills and develop research skills as well as practical skills (didactics) in accordance with their area of specialization.</p> <p>During this practice period pre-service teachers also collect and analyze data, test the hypothesis, or make experimentations according to the research plan created in the</p>

	<p>course “<i>Research, Development, and Innovation</i>”. They make conclusions and explore various forms and channels of communicating the research results in a professional manner.</p> <p>The prerequisite for the course is that the Pre-service teachers have completed the courses "<i>Teaching planning and individualization of learning</i>" and "<i>Research, development and innovation</i>" of the pedagogical component.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • design and organize independently a constructive and inclusive educational process to test hypothesis, make pedagogical experimentations and/or collect data according to their research plan; • apply innovative teaching and learning strategies, and methods and tools for designing, conducting and assessing an educational process and/or extracurricular activities based on long-term, medium-term, short-term lesson / lesson plans, and educational and out-of-class activities in the subject; • analyze the results of their experimentations and/or data collected and draw conclusions; • document their research activities and present the results in a professional manner using various forms of communication; • evaluate their professional activities in relation to the activities of the organization and through experimentations and practice-based research create ideas for improvement of their work and their work environment.

4.2 Structure of the subject component

Module name and main disciplines	Academic credits
FUNCTIONS NATURE: CAUSE AND EFFECT	32
University Component	22
Single variable differential calculus of functions	6
Single variable integral calculus of functions	4
Multivariable differential and integral calculus of function of series	6
Differential equations	6

Optional Component	10
Comprehensive analysis	2*5
Theory of series	
Differential geometry	
Mathematical model basis	
MATHEMATICAL CHALLENGES AND SOLUTIONS IN SOCIETY	27
University Component	17
Linear algebra and analytic geometry	6
Probability Theory and Mathematical Statistics	6
Algebra and Number Theory	5
Optional Component	10
Quantitative literacy basics	2x5
Foundations of geometry	
Plane and spatial geometric constructions	
Logics and discrete mathematics	
Econometrics	
Mathematical thinking and mathematics teaching	32
University Component	13
Elementary mathematics (algebra)	4
Elementary mathematics (geometry)	4
Mathematics teaching methods	5
Optional Component	19
Mathematically based teaching method	5
Algebra problem solving practicum	
Problem solving practicum: Geometry	4
Problem solving practicum: Trigonometry	
Mathematical statements proof methods	5
Mathematically based non-conventional methods	
Olympiad problems methods solving	5
Mathematics history	
Research and interdisciplinary connections	25
University Component	10
Digital technologies in education	5
Basics of scientific research	5
Optional Component	15
Physics	6
Programming	
Lesson Study and Action Research	5
Phenomena based mathematical disciplines teaching	
Design of learning resources in mathematics	4

Applied packages in mathematics learning	
FINAL ATTESTATION	8
Total academic credits	124

Functions nature: cause and effect 32 academic credits

The module focuses on pre-service teachers' ability to deliver new scientific results in the future and to determine the global development of mathematics. Pre-service teachers apply basic concepts, ideas, and methods of mathematical analysis, as well as to carry out analogy, comparison, collection, and processing of information in the current situation throughout life. Pre-service teachers independently acquire knowledge through the implementation of numerous intrasubject links. They also analyze the aims to form elements of research by mastering the mathematical language to prove mathematical assertions and to solve mathematical problems at different levels.

Course title	Single variable differential calculus of functions
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	6
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course builds pre-service teachers' holistic view of the mathematical analysis and comprehension of the relationship of the mathematical concepts and their practical significance. Pre-service teachers develop their skills in verbal formulation and symbolic recording of the mathematical statements and their negation. Pre-service teachers investigate a chain of topics and build their abilities to select necessary knowledge to prove mathematical statements or to</p>

	solve problems. They also develop their skills in transforming and visualizing information.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • critically evaluate information and draw analogies between different definitions of the same concept; • understand representations of static and dynamic systems and rates of change; • understand the necessity of theoretical knowledge to solve practical problems in everyday life; • read mathematical notation, and design written work using mathematical language; • use computer mathematics and dynamic algebra systems to investigate the properties of mathematical concepts and their geometric interpretation.

Course title	Single variable integral calculus of functions
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	4
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course focuses on pre-service teachers' understanding of the relationship of the mathematical facts within mathematical disciplines, as well as the relationship of mathematical concepts with concepts from other fields of sciences. They develop their skills in using mathematics to solve interdisciplinary problems, and in analyzing, synthesizing and generalizing mathematical objects and known data, thus acquiring new knowledge. They also build their abilities to formulate mathematical statements based on</p>

	the certain external features of concepts, and strictly justify them. Pre-service teachers develop their abilities to apply systems of dynamic algebra and systems of computer mathematics to solve problems of integral calculus of functions of one variable.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • identify mathematics interdisciplinary and single discipline connections; • identify the possibilities of using mathematics in solving everyday problems; • consistently express their thoughts, prove their point of view based on the substantiated facts; • logically substantiate the use of the existing mathematics to construct the mathematics school curriculum; • use computer mathematics systems and dynamic algebra systems to translate analytical reasoning into the geometric representations and vice versa;

Course title	Multivariable differential and integral calculus of functions of series
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	6
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course focuses on the building pre-service teachers' abilities to apply differential and integral calculus of many variables and series theory consistently and adequately. They search for ideas of visual and logically constructed proof of</p>

	mathematical statements. They also develop their abilities in differentiating the general plan of solutions specific to mathematical analysis of certain types of problems, and development of meta-subject content. Pre-service teachers develop their spatial thinking and abilities to represent three-dimensional graphs.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • analyze mathematical problems using appropriate analytical, computational, and experimental methods; • select the optimal proof method of the mathematical statements; • use the mathematics methods in various fields of human activity; • critically evaluate the own knowledge and skills their students have achieved; • critically assess the information from various sources concerning various branches of mathematics and compare the data.

Course title	Differential equations
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	6
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course focuses on developing pre-service teachers' understanding of the basic mathematical apparatus for studying the processes and phenomena of the world around by using concrete examples from applied fields of knowledge. Pre-service teachers develop their skills in</p>

	identifying factors that significantly affect a process or phenomenon in creating its dynamic model, described by ordinary differential equations. They also build their understanding of the relationship between the laws of science applied with the nature of the problem being studied and mathematics connected to it.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • describe the prospects of using dynamic modeling in the science and society development; • describe process or phenomenon differential model to solve an applied problem; • conduct independent scientific and practical research using the differential equations apparatus.

Course title	Differential geometry
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	5
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course develops pre-service teachers' understanding of the main sections of differential geometry. They go through classical fundamental training in the Euclidean space differential geometry and develop their skills in using the apparatus of differential geometry during the study of other mathematical disciplines. The methods of differential geometry have great potential for application in various mathematical disciplines and contribute to the development of pre-service teachers' spatial imagination.</p>

Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • solve typical problems using the skills of the mathematical analysis course; • identify the possibilities of using the differential geometry apparatus in solving routine tasks; • select and use the necessary methods of the differential geometry for scientific research; • use innovative technologies in solving problems of the theory of curves and surfaces.
Course title	Comprehensive analysis
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	4
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>The course aims to provide pre-service teachers with an understanding of the basic concepts of complex analysis, numerical and functional series, Fourier integral, Fourier and Laplace integral transforms, as well as the relationship between this discipline and other mathematical disciplines. Pre-service teachers are introduced to the current developments in analysis and their use in solving real-world problems.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • produce conformal mappings using basic complex elementary functions; • represent elementary functions by Taylor and Laurent series, find their convergence domains;

	<ul style="list-style-type: none"> • apply residue theory to calculate complex and real integrals; • describe modern trends in the development of complex analysis and its applications.
Course title	Mathematical model basis
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for research skills and interdisciplinary interactions • Competence area for practical skills <p>During the course, pre-service teachers focus on studying up-to-date mathematical models to assess social and economic problems and processes, as well as scientific forecasting of the behavior of various objects through which pre-service teachers develop their functional literacy. Pre-service teachers master theoretical and practical skills of the mathematical modeling, as well as the skills of independent learning of the mathematical modeling literature and the practical use of the information provided to solve applied tasks.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • make mathematical models of real processes using various mathematical models; • conduct independent academic research using mathematical modeling tools; • solve problems and build mathematical models using various information and communication technologies;

	<ul style="list-style-type: none"> critically assess the mathematical modelling information from various sources and compare the data.
Course title	Theory of series
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Functions nature: cause and effect 32 academic credits
Academic credits	4
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> Competence area for mathematics background Competence area for research skills and interdisciplinary interactions Competence area for practical skills <p>During the course, pre-service teachers build their understanding of the basics of series theory, and develop their skills in proving mathematical statements of series theory and in solving practical problems using the methodological principles and mathematical apparatus of the course. Pre-service teachers also develop their skills in logical and algorithmic thinking to solve optimization problems by using methods of mathematical programming and application software packages on the computer.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> make science-based decisions based on mathematical knowledge, analysis and interpretation of information; carry out problem formulation and perform mathematical experiments to verify the correctness and effectiveness of the solutions obtained; solve practical problems by identifying and evaluating interdisciplinary links of mathematics with applied mechanics, physics, etc., by constructing mathematical models;

	<ul style="list-style-type: none"> • use applied software packages for performing mathematical experiments.
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Mathematical challenges and solutions in society 27 academic credits

The module aims to provide a quality assimilation of mathematical disciplines. During the module, pre-service teachers explore new approaches to problem solving to develop their abstract and analytical thinking. They also develop the mastery of mathematical knowledge needed to study other disciplines at a modern level. Pre-service teachers develop their thinking qualities necessary for an individual to live in modern society, for general social orientation, as well as for problem formulation, and understanding and learning solution strategies. The module promotes the identification and development of pre-service teachers' creative abilities, as well as their determination of ways for further study.

Course title	Linear algebra and analytic geometry
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	6
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop an understanding of the relationship between mathematical disciplines. They also develop their mathematical thinking through a study of the fundamental concepts and methods of linear algebra and analytical geometry for a particular professional problem, imparting skills of translation of geometric objects into analytical form and their research</p>

	using analytical methods, and the use of mathematical apparatus in professional activity.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use mathematical symbolism to express quantitative and qualitative relations of objects for use in further problem solving; • introduce skills of the symbolic transformations for mathematical expressions; • describe and analyze geometric problems analytically.

Course title	Theory of probability and mathematical statistics
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	6
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their understanding of the structure of theoretical and probabilistic models of random events, quantities, and processes. They impart skills in solving probabilistic and statistical problems, processing statistical information, and obtaining statistically justified conclusions using standard methods and models. Pre-service teachers develop their skills in building and analyzing mathematical models that reflect the properties, characteristics, and dependencies that exist in real random phenomena and processes.</p>
Learning outcomes	Pre-service teachers who demonstrate competence can:

	<ul style="list-style-type: none"> • build probability-theoretic models of casual events, random variables and processes; • implement practical methods and technologies for constructing distributions of discrete and continuous random variables and the laws of operating with them; • get statistical distributions of samples and find an empirical distribution function and its plotting; • use statistical methods to test statistical hypotheses to analyze empirical data systems and process experimental results; • assess the degree of influence of various factors on the experiment results.
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Course title	Quantitative literacy basics
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their abilities to reflect on a mathematical solution to a real-world problem, as well as to recognize and identify opportunities to use mathematical apparatus (mathematical concepts, facts, procedures and tools). They also develop their abilities to reason about the rationality of using mathematical apparatus to create a mathematical model reflecting the features of the described situation, and to interpret and evaluate the resulting solution. Pre-service teachers develop their abilities to explain and argue a mathematical solution in the context of a real-world problem.</p>

Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • analyze information on the mathematical charts and graphs; • transform the situation into a form amenable to mathematical processing; • evaluate and interpret the findings in the light of the specifics of the proposed situation.
Course title	Logics and discrete mathematics
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers examine the fundamental material on sections of mathematical logic and discrete mathematics, including many mathematical methods and knowledge, which are necessary for a modern teacher of mathematics in the development of algorithms for solving problems of different levels of complexity, and which can be used in their future professional activities and self-development.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • use research methods used both in discrete mathematics and mathematical logic and in other scientific disciplines; • distinguish between fact, which can always be verified or proven, and conjecture and personal opinion;

	<ul style="list-style-type: none"> • develop new ideas and knowledge in the context of already existing ideas and knowledge.
Course title	Foundations of geometry
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers build their understanding of the axiomatic theory of mathematical science, and axiomatic theory of geometry construction. They also develop their skills in using methods of axiomatic justification of Euclidean geometry. Pre-service teachers form a general geometric and worldview culture as a basis for mastering the language of modern mathematics.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the current state of mathematics and its integration with other branches of science; • use basic constructions and techniques of modern geometry related to axiomatic construction of different geometries; • analyze and make a mathematical model of problems from real life and find appropriate ways to solve them.
Course title	Plane and spatial geometric constructions
Component	Subject Component, Optional Component

Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers study the theory of constructions on the plane and in space and learn to master the methods of solving geometric problems in construction. They also learn to master the technique of geometric constructions and develop their constructive and logical thinking, as well as their skills as a researcher.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • set goals and define research objectives, select the best ways and methods of their achievement; • understand the features of models that allow, in any various information, to solve a variety of econometric problems; • solve tasks with economic content using various software products; • apply methods of econometric analysis, prepare and present analytical reviews.

Course title	Algebra and numbers theory
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers build their understanding of the fundamental concepts and methods of higher algebra and number theory. They also develop their abstract and analytical thinking, as well as a general mathematical culture. Pre-service teachers develop their skills in using abstract mathematical apparatus necessary for analyzing and modeling processes and phenomena. They also learn to master methods of processing and analyzing results using algebra and number theory.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the theories and methods of higher algebra and number theory; • reason about the influence of mathematical knowledge on the structure of the world using abstract and analytical thinking skills; • solve everyday problems using algebraic structures and number theory.

Course title	Econometrics
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical challenges and solutions in society 27 academic credits
Academic credits	5

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers build their understanding of economic processes by using modeling and quantitative analysis, and finding quantitative confirmation or refutation of the formulated hypothesis. They also develop their skills in building predictions based on available data, and presenting scenarios, taking into account different execution probabilities. Pre-service teachers also develop their skills in using methods of econometric research, allowing them to describe, analyze, and forecast real economic processes occurring at macro- and micro levels.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the characteristics of models, which allow, in the presence of different information, to solve a variety of economic problems; • determine the factors that are the most essential and should be included in the models of socio-economic phenomena; • determine the conditions and boundaries of the application of the obtained models for the solution of economic problems; • analyze developed models and determine their adequacy to real economic phenomena; • solve problems with economic content using various software products..

Mathematical thinking and mathematics teaching 32 academic credits

During the module, pre-service teachers develop their mathematical thinking by exploring the history of mathematics and solving standard and non-standard mathematical problems. Pre-service teachers explore the role and impact of mathematics, and the evolution of mathematical development on the development of society and science in general. They examine the current issues in contemporary methods of teaching mathematical problem solving and identify their interests in the field. They also identify the role and place of learning materials, including mathematical tasks (historical tasks,

Olympiad tasks, etc.) in the teaching of mathematics, and impart skills for their development and use in future professional activities.

Course title	Elementary mathematics (algebra)
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	4
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>The course is the basis for the study of both mathematical disciplines in the further education programme and related disciplines. The content covers the main sections of the school algebra course, which develop students' knowledge and skills in solving algebraic problems in different ways, the ability to judge and select the necessary information to solve the problem, the mathematical thinking, and the ability to state their thoughts.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • have skills in solving school algebra problems in different ways; • use skills to apply basic techniques and algorithms for solving school mathematical problems; • apply basic techniques and algorithms of elementary mathematics when solving applied tasks.

Course title	Elementary mathematics (geometry)
Component	Subject Component, University Component
Cycle	Major disciplines

Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	4
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>The course is propaedeutic for pre-service teachers of mathematics and aims to align theoretical knowledge and practical skills in solving geometric problems in the school mathematics course. The course develops skills in drawing up algorithms for solving mathematical problems, proving mathematical assertions; it develops logical, spatial thinking.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • have knowledge of the ideas and methods of the school mathematics course, the system of basic mathematical structures; • use basic methods of mathematical reasoning for proving statements and solving mathematical problems; • apply symbolic values in formulating conditions, assertions in proving and solving geometric problems.

Course title	Mathematics teaching methods
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	6

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers improve their assimilation of mathematics content, methods, techniques of teaching sections of secondary school mathematics. They develop their skills in using constructive learning theory with behavioral and cognitive approaches. They also explore methodological development for conducting mathematics lessons at school and organizing learning activities of students.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • explain different approaches to learning and teaching; • analyze, compare, and evaluate school mathematics textbooks; • analyze and interpret instructional material for mathematics lessons; • apply constructive methods of mathematics instruction to clarify specific issues in a school mathematics course • apply student-appropriate methods of mathematics instruction that will motivate and interest students to study the subject.

Course title	Mathematically based teaching method
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills

	<ul style="list-style-type: none"> • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers evaluate the basic ways and algorithms of teaching students to solve mathematical problems. They develop their methodological skills and their abilities to competently explain algorithms step by step for solving mathematical problems. Pre-service teachers also develop their abilities to form students' understanding of the importance of their skills in solving mathematical problems for their further life.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • determine the level of mathematical knowledge of students; • apply methods of teaching mathematical problem solving; • analyze and select instructional materials and tasks of different levels of complexity, taking into account differentiation of instruction; • analyze the necessary methods of teaching students to select and apply appropriate methods in solving mathematical problems; • evaluate and develop their level of proficiency in methods and techniques of learning to solve mathematical problems.

Course title	Algebra problem solving practicum
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop a holistic understanding of the content of the high school algebra course and analyze its sections in the context of its connection with other subjects. They develop their abilities and skills in learning to solve algebra problems by using standard and non-standard methods, and transformation of algebraic and transcendental expressions. Pre-service teachers develop their abilities to develop algebraic problems for different levels of secondary school.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the goals and objectives and continuity of the algebra course in different grades of secondary school; • teach algebra in high school using active teaching methods; • teach students to choose the best methods for solving algebra problems; • develop tasks on algebra of different levels of complexity, taking into account the differentiation of students' knowledge.

Course title	Problem solving practicum: Trigonometry
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	4

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their mathematics skills to teach students the transformation of trigonometric expressions solving trigonometric equations and inequalities of different levels of complexity. Pre-service teachers develop their abilities to extract educational information based on a comparative analysis of function graphs. They develop their mathematical thinking, logical and algorithmic culture, and understanding the essence of trigonometric functions. They also develop their skills in proofing mathematical statements in trigonometry, and in evaluation and development of materials for teaching trigonometry at school.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • teach how to analyze graphs of trigonometric functions; • guide and support students in solving trigonometry problems; • select or independently develop didactic materials for solving trigonometry problems.
Course title	Problem solving practicum: Geometry
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers form students' ideas about geometric methods and the possibilities of their application, as well as the importance of studying geometry for their future professional activities and the application of their knowledge in everyday life. Pre-service teachers consolidate and deepen students' knowledge and skills in solving geometric problems of the school course. During the course, pre-service teachers form students' logical thinking and their ability to use mathematical symbols in proofs and in solving various geometric problems.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • apply methods for teaching students to use mathematical symbols competently when solving geometric problems; • use methods of teaching students to construct an algorithm for solving geometric problems; • analyze and interpret methods for teaching students to use the mathematical tools necessary to prove theorems.
Course title	Mathematical statements proof methods
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	4

Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for mathematics background • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers build their skills in deepening students' knowledge and developing their skills of inductive and deductive proof of mathematical statements, as well as to develop their logical thinking and research skills. Pre-service teachers improve their skills in developing students' understanding of the principles of mathematical reasoning and proof.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the ways and methods of developing students' skills in inductive and deductive proof of mathematical assertions; • teach students to understand algorithms for mathematical reasoning and to use them in solving mathematical problems; • analyze and evaluate their skills in teaching proof of mathematical statements.

Course title	Mathematically based non-conventional methods
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions

	<p>During the course, pre-service teachers learn to raise students' interest and positive attitudes toward mathematics by using methods and techniques to support the learner. Pre-service teachers explore ways to develop mathematical content and flexible curricula, and how to implement different problem-solving methods, which contribute to students' personal development and individual improvement, but are not found in school textbooks.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • analyze and compare methods of solving mathematical problems; • create a creative and flexible mathematics curriculum; • organize the preparation of students for participation in competitions and Olympiads; • use methods and techniques to motivate the study of mathematics for the personal development of the student; • understand how to support students who are gifted or weak in mathematics, in and out of school.

Course title	Olympiad problems methods solving
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their skills in applying basic concepts, ideas, and methods of fundamental mathematical disciplines to solve Olympiad problems, and to determine by the type of a problem the</p>

	probable methods of its solution. Pre-service teachers develop their skills in solving and composing Olympiad problems, improving the creative approach to their solution, and to sharpening the flexibility of thinking.
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • classify Olympiad mathematical problems by the type or the approach to their solution; • possess the skills of solving Olympiad problems; • develop Olympiad problems in mathematics.

Course title	Mathematics history
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Mathematical thinking and mathematics teaching 32 academic credits
Academic credits	5
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their knowledge of mathematics, and the evolution of mathematics as a science. They also develop their skills in identifying the advantages of problem-solving methods used earlier and currently, as well as in systematizing knowledge obtained in various mathematical courses. Pre-service teachers increase their understanding of the general mathematical culture and expand their horizons through familiarization with the historical facts of mathematics, as well as the life and work of outstanding mathematicians.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the role of mathematics in the development of society, science, and the education system;

	<ul style="list-style-type: none"> • analyze and systematize historical facts and mathematical problems that influenced the development of mathematics; • recognize historical problems and explain different methods of solving them; • reason about the development and nature of mathematical knowledge.
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Research and Interdisciplinary Connections 25 academic credits

During the module, pre-service teachers develop their understanding of the interdisciplinary links of mathematics with other subjects, as well as the development of the research interests of the future specialist. Pre-service teachers build an understanding of the evolution stages of research in mathematics education and develop their skills in organizing and conducting pedagogical research, and in organizing student learning based on the results of the research. They integrate their knowledge of mathematics-related disciplines in the planning and implementation of the educational process.

Course title	Digital technologies in education
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their professional competence as a teacher through the formation of a holistic view of the role of digital technology in the modern educational environment. They develop their abilities to organize pedagogical activities on the basis of the possibilities of digital technology.</p>

Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the need for in-depth study of the computer technology as a factor in improving professional competence; • develop digital educational resources (presentations, video lectures, etc.) using digital technologies; • organize online and offline training using digital tools; • develop surveys, questionnaires, tests, and provide feedback using cloud technologies.
Course title	Basics of scientific research
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their understanding of the general scientific methodology of psychological and pedagogical research, and the preparation for the organization of research in the field of education. They master the knowledge of the evolution stages of research in education, as well as the basic approaches of research, and the methods of organizing and conducting scientific research.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • understand the meaning and nature of educational research; • distinguish between basic, applied, and action research;

	<ul style="list-style-type: none"> • understand the difference between qualitative and quantitative research methods; • choose the necessary methods to conduct educational research; • analyze and reflect on the results of research conducted in mathematics education..
Course title	Physics
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	6
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers conduct a practical study of the laws of nature, the properties and structure of matter, and the laws of its motion. They explore the basic knowledge of the fundamental physical laws through practical experiments, while paying particular attention to the essence of the laws themselves and the phenomena they describe.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • understand the meaning of basic physical concepts and laws; • analyze the laws underlying modern physical research methods; • understand the contribution of the great scientists to the formation of the modern natural-science picture of the world;

	<ul style="list-style-type: none"> • apply knowledge of the physical laws and theories to explain the matter structure, forces and interactions in nature, the origin of fields.
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Course title	Programming
Component	Subject Component, University Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	6
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their understanding of the fundamental Python programming concepts. They also develop their algorithmic thinking skills as well as coding skills by using commonly used data structures, writing custom functions, and reading and writing results to files.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • program using the syntax and rules of the appropriate high-level programming language; • set a simple problem and develop an algorithm to solve it using the Python programming language; • use various tools to design and write Python programs; • code using frequently used data structures, write custom functions.

Course title	Lesson Study and Action Research
Component	Subject Component, Optional Component
Cycle	Major disciplines

Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers develop their research interests as future teachers. They master the theoretical foundations of pedagogical approaches Lesson Study and Action Research as well as plan the processes of teaching mathematics based on their own scientific research. They also provide professional support to colleagues in a pedagogical community setting and develop their abilities for self-improvement.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • identify the problems of mathematics teaching and organization of the educational process in the classroom; • formulate the goal and objectives, object and subject, and hypothesis of the study; • conduct research of a lesson using Lesson Study; • conduct research of own practice in action, using Action Research; • critically evaluate methods to develop, change, and improve their teaching and learning practices.

Course title	Phenomena based mathematical disciplines teaching
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits

Academic credits	5
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers explore the role of interdisciplinary integration in school as a means of developing intellectual creative abilities of students. Pre-service teachers analyze the methods and methodological techniques in a pedagogical process allowing them to form the integrative way of thinking of their students. Pre-service teachers also develop their skills in developing practice-oriented assignments in mathematics for secondary school.</p>
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • teach students to analyze the information they receive, to make their own hypotheses, and to make decisions; • support a group of students in the study of a given phenomenon; • select/design interesting and motivating real-life phenomena for students to study; • support the application of subject knowledge from several disciplines when analyzing a given phenomenon.

Course title	Design of learning resources in mathematics
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	4
Course/ Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills

	<ul style="list-style-type: none"> • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers investigate the concepts and types of digital educational resources, didactic, and the principles of developing multimedia digital content, as well as the analysis of existing digital educational resources in mathematics for secondary schools in the Republic of Kazakhstan. Pre-service teachers develop their skills in working with digital tools and developing digital educational resources in mathematics for secondary schools.</p>
Learning outcomes	<p>Pre-service teachers who demonstrate competence can:</p> <ul style="list-style-type: none"> • generate electronic content using the capabilities of text, tabular and graphic editors, defining a single display style for the entire resource; • optimize the structure of the digital learning resource for goals and objectives; • develop digital learning materials for providing information, as well as monitoring and evaluating school students' academic achievements; • evaluate the quality of the digital learning resource.

Course title	Applied packages in mathematics learning
Component	Subject Component, Optional Component
Cycle	Major disciplines
Module	Research and Interdisciplinary Connections 25 academic credits
Academic credits	4
Course/Competence description	<p>The purpose of this course is to improve the following areas of subject competence:</p> <ul style="list-style-type: none"> • Competence area for practical skills • Competence area for research skills and interdisciplinary interactions <p>During the course, pre-service teachers investigate the basics of dynamic geometry and computer algebra systems as well</p>

	as explore the possibilities of learning mathematics using them. They also conduct an analysis of the benefits and possible harms of using computer-based environments in secondary school mathematics teaching.
Learning outcomes	<p>Pre-service teachers demonstrating competence can:</p> <ul style="list-style-type: none"> • analyze and compare different application software packages; • understand the ways and methods of using application packages in teaching mathematics; • develop digital resources (texts, tests, interactive tasks, dynamic models, etc.) using application software packages.

FINAL ATTESTATION 8 academic credits

FINAL STA

Final attestation of the graduate is mandatory and is carried out after mastering the educational programme in full. The aim of the attestation is to evaluate the level of maturity of general cultural and professional competences of the graduate, as well as their readiness to perform basic professional activities.

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Final attestation work (*Oral Exam, Written Exam, Diploma work, Research project, Development project, Organisational project, Strategic project, Art project*)

Final qualifi

4.3. Structure of the compulsory component

The Compulsory Component (Cycle of General Education Studies) consists of 56 academic credits (51 academic credits mandatory studies and 5 academic credits optional studies) and includes the following modules and courses.

Name of modules and courses	Academic credits
COMPULSORY COMPONENT (CYCLE OF GENERAL EDUCATION STUDIES)	56
MANDATORY STUDIES	51
Module of historical and philosophical competencies	10
<i>History of Kazakhstan</i> Kazakhstan in Ancient and Medieval Times. Prehistoric society. Settlements, economy, and household (2.5 million - 12 thousand B.C. - 4th century). Ethnogenesis of Kazakh nation. Medieval	5

<p>Kazakhstan (IV-XV cc.). Kazakh Khanate. Geopolitical position of the Kazakh state. Kazakh Khanate: formation, rise, decline. Social history (mid- XV - beginning XVIII cc.). Kazakhstan in a colonial period (30-40s of XVIII - 60s XIX cc). Kazakhstan in the beginning of XX century. Formation of a poly-ethnic structure of the population. Kazakhstan in the Soviet period (February-October, 1917 - August, 1991) Kazakhstan - Independent State. The Modern period in the country's history (December 1991 - up to the present).</p>	
<p><i>Philosophy</i> Origins of a culture of thinking. The subject and method of philosophy. Foundations of philosophical understanding of the world. Consciousness, spirit and language. Ontology and metaphysics. Ethics. Philosophy of values. Philosophy of freedom. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. Philosophy of modern Kazakhstan.</p>	5
<p>Module of socio-political knowledge (sociology, political studies, cultural studies, psychology)</p>	8
<p><i>Sociology</i> Sociological studies in understanding the social world. Sociological research. Social structure and stratification of society. Socialization and identity. Family and modernity. Deviation, crime, social control. Religion, culture, society. Sociology of ethnicity and the nation. Education and social inequality. Mass media, technology and society. Economics, globalization, labor. Health and medicine. Population, urbanization, and social movements. Social change.</p>	2
<p><i>Political studies</i> Main stages in the development of political science. Politics as part of social life. Political power. Political elites, leadership. Political system of society. State and civil society. Political regimes. Electoral systems, elections. Political parties, party systems and socio-political movements. Political culture, behavior. Political consciousness, ideology; development, modernization; conflicts and crises. World politics, modern international relations.</p>	2
<p><i>Cultural studies</i> Morphology of culture. Language of culture. Semiotics of culture. Anatomy of culture. Nomadic culture. Cultural heritage of proto-Turks. Medieval culture. Central Asia. Cultural heritage of Turks. Basis of the Kazakh culture. Kazakh culture in the</p>	2

XVIII - end of XIX century, XX century. Kazakh culture in the context of modern world processes, and in the context of globalization. Cultural policy of Kazakhstan. State program "Cultural heritage".	
<p><i>Psychology</i></p> <p>Personality in the context of national consciousness. Me and my motivation. Emotions, emotional intelligence. Human will, psychology of self-regulation. Individual-typological features. Values, interests, norms. Psychology of the meaning of life, professional self-determination, health. Communication between individuals and groups. The perceptive side of communication. The interactive side of communication. The communicative side of communication. Social and psychological conflict. Patterns of behavior in conflict. Effective communication techniques</p>	2
Instrumental and communication module	25
<p><i>Russian /Kazakh language</i></p> <p>Proficiency in accurate use of vocabulary, scientific terms, syntactic constructions in oral and written communication; conversation skills. Business communication, letter-writing, report-writing, review, essay-writing skills; meaningful reading of texts, ability to express own idea. Fluent speaking in various conversations, mastering the ability to carry on a conversation, discussion. Functional styles of speech as a historically developed system of speech means, a variety of literature language.</p>	10
<p><i>Foreign language</i></p> <p>Social and domestic sphere of communication. Me and my family. Social and cultural sphere of communication. World map. Customs and Traditions. Educational and professional sphere of communication: Future profession. A modern home. Family in modern society. Cultural and historical background. Education. Profession. Human and nature, environmental problems. News, media, advertising.</p>	10
<p><i>Information and communication technologies</i></p> <p>ICT role in society development. Standards in ICT. Introduction to computer systems. Software. Operating systems. Human-computer interaction. Database systems. Data analysis. Data management. Networks and telecommunications. Cybersecurity. Internet technologies. Cloud and mobile technologies. Multimedia technologies. Smart technology. E-technologies. E-business. E-learning. E-government. ICT in industries. Prospects of ICT development.</p>	5

Health Promotion module	8
<i>Physical education</i> Principles of physical education. Scientific basis of physical education. Modern recreational systems, basics of body physical state monitoring. Main methods of practicing sports and physical education independently. Professional physical training. General physical training. Speed. Running. Relay races. Execution of exercises for: endurance, flexibility, agility, coordination, balance, gymnastic and acrobatic exercises. Strength. General training exercises. Special physical training.	8
Optional component	5
<i>Basics of Economics and Law</i> Social production. The essence, forms and structure of capital. Costs and income of production in a market economy. Business. Financial system. Resource saving. Cyclical economic development. Kazakhstan in the system of global economic relations. Market emergence. Role of the government in business development. The main provisions of the Constitution and current legislation of the Republic of Kazakhstan. System of public administration institutions and the sphere of their authority. Aims, methods of state regulation of economy. Role of public sector in economy. Financial law and finance. Mechanism of interaction between substantive and procedural law.	5
<i>Basics of an anti-corruption culture</i> Anti-corruption culture: a concept, structure, tasks and functions. Anti-corruption awareness and anti-corruption culture: content, role and functions. Formation of anti-corruption culture in foreign countries. Anticorruption culture: mechanisms and institutions for development. Role of a family in fostering an anti-corruption culture. National bases of an anti-corruption culture. Social control as a mechanism of counteracting corruption. Political parties and the mass media as tools for building an anti-corruption culture. Anti-corruption education and upbringing. Anti-corruption legislation and legal liability for corruption. The constitutional basis of anti-corruption. Legal liability for crimes of corruption. Building an anti-corruption culture in civil service and business.	5
<i>Entrepreneurial skills</i> Types of entrepreneurship. Business. Financial system. Time management and project management. Stress management. Negotiation skills. Public speaking skills. Business management skills. Teamwork and leadership skills. Customer service skills.	5

Financial skills. Analytical and problem solving skills. Critical thinking skills. Strategic thinking and planning skills. Technical skills. Time management and organisational skills. Branding, marketing and networking skills. Business management skills.	
<i>Ecology and life safety</i> Basic laws of functioning of living organisms, ecosystems of different organisational levels, biosphere as a whole, their sustainability. Interaction of biosphere components and ecological consequences of human economic activity, in particular under conditions of nature management intensification. Modern understanding of the concepts, strategies and practical goals of sustainable development in different countries and in the Republic of Kazakhstan. Life safety, its main provisions. Risks, emergencies. Risk analysis, risk management. Human security systems. Modern destabilizing factors. Social, religious, political, economic threats, threats in everyday life. System of security institutions and legal regulation of their activities.	5
<i>Research methods</i> Research approaches. Inductive and deductive reasonings. Qualitative, quantitative, mixed methods research. Primary and Secondary research. Action research. Research designs – descriptive, correlational, experimental, quasi-experimental, cross-sectional, longitudinal, case study, ethnographic, exploratory, explanatory. Variables and hypotheses. Reliability and validity of research. Reproducibility and replicability. Random and systematic error. Triangulation. Sampling. Inclusion and exclusion criteria in sampling. Sampling methods. Collecting data – surveys, interviews, experiments, observational studies, systematic review. Data cleansing. Transcribing interviews. Analysing data – statistical analysis, content analysis, discourse analysis, thematic analysis, textual analysis. Research ethics. Peer review.	5
Total academic credits	56
4.4 Progression of the studies	

Modules and courses	BA degree, 4 academic years							
	1. year		2. year		3. year		4. year	
	1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem
PEDAGOGICAL COMPONENT								
SUPPORTING LEARNERS AS INDIVIDUALS – 17 academic credits								
Psychology in Education and Concepts of Interaction and Communication 3 academic credits			3					
Educational Science and Key Theories of Learning 3 academic credits			3					
Inclusive Educational Environment 3 academic credits					3			
Age and Physiological Features of the Development of Children 4 academic credits		4						
Teaching Planning and Individualization of Learning 4 academic credits						4		
TEACHING AND ASSESSMENT FOR LEARNING – 9 academic credits								
Teaching Methods and Technologies 5 academic credits				5				
Assessment and Development 4 academic credits					4			

TEACHER AS A REFLECTIVE PRACTITIONER – 9 academic credits								
Pedagogical Research 4 academic credits			4					
Research, Development and Innovation 5 academic credits							5	
TEACHER AS A FACILITATOR OF LEARNING (PEDAGOGICAL PRACTICE) – 25 academic credits								
Introduction to the teaching profession (1st year pedagogical practice) 2 academic credits		2						
Psychological and pedagogical assessment (2nd year pedagogical practice) 2 academic credits				2				
Pedagogical approaches (3rd year pedagogical practice) 6 academic credits						6		
Research and innovation in education (4th year pedagogical practice) 15 academic credits								15
COMPULSORY COMPONENT								
HISTORICAL AND PHILOSOPHICAL COMPETENCIES – 10 academic credits								
History of Kazakhstan 5 academic credits	5							
Philosophy 5 academic credits			5					

SOCIO-POLITICAL KNOWLEDGE – 8 academic credits								
Sociology 2 academic credits				2				
Political studies 2 academic credits				2				
Cultural studies 2 academic credits			2					
Psychology 2 academic credits			2					
INSTRUMENTAL AND COMMUNICATION – 25 academic credits								
Russian /Kazakh language 10 academic credits	5	5						
Foreign language 10 academic credits	5	5						
Information and communication technologies 5 academic credits	5							
HEALTH PROMOTION – 8 academic credits								
Physical education 8 academic credits	2	2	2	2				
Optional Component – 5 academic credits								
Basics of Economics and Law 5 academic credits							5	
Basics of an anti-corruption culture 5 academic credits								
Entrepreneurial skills 5 academic credits								
Ecology and life safety 5 academic credits								
Research methods 5 academic credits								
SUBJECT COMPONENT								

Single variable differential calculus 6 academic credits		6						
Single variable integral calculus 4 academic credits			4					
Multivariable differential and integral calculus Series 6 academic credits				6				
Differential equations 6 academic credits					6			
Differential geometry 5 academic credits						5		
Comprehensive analysis 4 academic credits							4	
Mathematical model basis 5 academic credits						5		
Theory of series 4 academic credits							4	
Linear algebra and analytic geometry 6 academic credits	6							
Theory of probability and mathematical statistics 6 academic credits					6			
Quantitative literacy basics 5 academic credits						5		
Logics and discrete mathematics 5 academic credits				5				

Foundations of geometry 5 academic credits				5				
Plane and spatial geometric constructions 5 academic credits				5				
Algebra and numbers theory 5 academic credits			5					
Econometrics 5 academic credits				5				
Elementary mathematics (algebra) 4 academic credits	4							
Elementary mathematics (geometry) 4 academic credits		4						
Mathematics teaching methods 6 academic credits				6				
Mathematically based teaching method 5 academic credits					5			
Algebra problem solving practicum 5 academic credits					5			
Problem solving practicum: Geometry 5 academic credits						5		
Problem solving practicum: Trigonometry 4 academic credits							4	
Mathematical statements proof methods 4 academic credits								

Mathematically based non-conventional methods 5 academic credits						5		
Olympiad problems methods solving 5 academic credits							5	
Mathematics history 5 academic credits							5	
Digital technologies in education 5 academic credits							5	
Basics of scientific research 5 academic credits							5	
Physics 6 academic credits					6			
Programming 6 academic credits					6			
Lesson Study and Action Research 5 academic credits						5		
Phenomena based mathematical disciplines teaching 5 academic credits						5		
Design of learning resources in mathematics 4 academic credits							4	
Applied packages in mathematics learning 4 academic credits							4	
FINAL ATTESTATION – 8 academic credits								
Final attestation								8

Academic credits in total	27	33	30	30	30	30	37	23
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4.5 Requirements for the successful completion of curriculum

For successful completion of the educational program, pre-service teachers shall have:

- minimum credits for core and major subjects;
- achievement of all learning outcomes;
- successful completion of compulsory and optional courses;
- successful fulfillment and defense of Final attestation work (*Oral Exam, Written Exam, Diploma work, Research project, Development project, Organisational project, Strategic project, Art project*);
- the minimum average achievement score.

5. Description of students' work

Students' work includes contact teaching, individual, pair and group work, assignments, exams, etc. 1 ECTS = 30 hours of student work.

Students' individual and/or pair and group work is divided into two parts: individual and/or pair and group work supervised by a teacher and the work that is performed entirely independently.

Students' individual and/or pair and group work is carried out on a specific list of topics allocated for independent/group study, provided with educational and methodical literature and recommendations for each course. Students' individual and/or pair and group work supervised by a teacher is carried out according to the schedule, which determines the university or the teacher themselves.

The entire scope of work performed entirely independently is supported by assignments that require the student to work independently on a daily basis.

The ratio of time between classroom contact work, students' individual and/or pair and group work supervised by a teacher, and the work that is performed entirely independently for all types of educational activities is determined by the educational institution independently. At the same time, the amount of classroom work and students' individual and/or pair and group work supervised by a teacher is 1440 hours per year, the scope of work that is performed entirely independently - 360 hours per year.

6. Evaluation methods/Assessment

6.1 Assessment

The Assessment of learning outcomes is based on the competence objectives of the modules and the resulting evaluation criteria of the courses. Assessment criteria are used as a basis for various tasks. Learning tasks include independent tasks, group tasks, plans, reports, group discussions, group tests, development tasks, laboratory tasks, various tasks for reflection and evaluation, or activating tasks. The assessment generates information for the pre-service teacher about his or her achievement of the competence goals of the pedagogical education modules.

Assessment is at the heart of all competence-based education. Competence-based assessment should measure not only what a pre-service teacher knows, but also take into account skills and whether pre-service teachers can apply what they know to real life problems or situations. Pre-service teachers should be given assignments and non-standard problems in situations that students are likely to encounter in the workplace. Assessment plays a very important role in competence-based training. Based on the recognition of prior competence and personal situation, competence can be demonstrated on a per-course basis. The demonstration of competence can cover the entire training module. Specific guidelines regarding the practice of recognizing and accrediting prior training or training received elsewhere.

Studies are evaluated on a scale basis. Learning achievements (knowledge, abilities, skills and competencies) of pre-service teachers are evaluated in points on a 100-point scale, corresponding to the internationally accepted letter system with a numeric equivalent (positive grades, in descending order, from "A" to "D", and "unsatisfactory" - "FX", "F")

Alphabetic system of evaluation of pre-service teachers' learning achievements, corresponding to the digital equivalent of the four-point system.

Assessment by letter system	Digital equivalent of points	% content	Assessment according to the traditional system
A	4.0	95-100	Excellent
A-	3.67	90-94	

B+	3.33	85-89	Good
B	3.0	80-84	
B-	2.67	75-79	
C+	2.33	70-74	
C	2.0	65-69	Satisfactory
C-	1.67	60-64	
D+	1.33	55-59	
D	1.0	50-54	
FX	0.5	25-49	Unsatisfactory
F	0	0-49	

The purpose of assessment is to provide guidance and encouragement to pre-service teachers, develop their self-assessment abilities, provide information about pre-service teachers' competences, and ensure that the competences and intended learning outcomes defined in the educational programme are achieved. Self-assessment skills and peer assessment are considered as the main skills of the world of work, and assessment is a central tool to support the development of these skills during study.

6.2 External evaluation

1) Design of new educational programmes Internal quality assurance system

The new curriculum needs to be designed through engagement with all stakeholders, including students, faculty and employers. The aim throughout the process is to retain and further develop the strengths and high quality of the existing programme while addressing some of the challenges of the current programme, such as the workload demand on students and the need for a course on education management. A survey of all students and alumni, together with focus group discussions and interviews with alumni and employers, also inform the design of the programme. All faculty are involved in discussions of programme aims and learning outcomes, and programme teams worked collaboratively to design the courses for their area of specialization.

Based on the faculty (school) of the university, a council on academic quality is formed, which makes decisions on the content and conditions of implementation of curricula, on the policy of evaluation and other academic

issues of the faculty (school), organizing a survey of students on the quality of curricula and (or) disciplines/modules.

2) Procedures for external evaluation of the educational programmes. Continuous Improvement

All faculty are actively engaged in continuous improvement of their courses as an integral part of the culture of university and their own professionalism as experts in education. In addition to formal student feedback mechanisms such as course evaluations and Student Committee meetings, faculty and students are to communicate closely regarding specific courses and the programme as a whole. The process of continuous reflection and improvement informs the Annual Programme Monitoring process, in which individual faculty reflect on courses they have taught, this feeds into specialization-level reflection and suggestions for improvements, and this in turn goes to programme and School level reflection and plans for further improvement.

Universities have regular, formal mechanisms for obtaining feedback from employers and the professional community. These interactions also inform the continuous improvement of the programme.

For the improvement of the quality assurance of the educational programmes, the universities need to:

- develop an internal quality system that has a delicate balance between quality assurance and quality enhancement. While quality assurance is more of a preventive measure, quality enhancement has higher-order aims and implies transformational change (Jones, 2003).
- raise institutional awareness and develop deep understanding of the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (2015) and implement ESG 2015 standards.
- regularly revisit the existing institutional quality processes for ongoing improvement.

3) Accreditation

There are institutional and specialised accreditation in Kazakhstan, they remain voluntary for higher educational institutions. However, accreditation is one of the conditions for obtaining state grants for student education.

7. Faculty requirements

7.1 Faculty Requirements

Availability of teachers in accordance with the disciplines of the educational programme, the correspondence of teachers' education to the profile of the taught disciplines and/or their academic or research degree of "Doctor of Philosophy (PhD)" or "Doctor in Profile", and/or the academic title of "Associate Professor (Associate Professor)", or "Professor" (if any) and/or teachers with the degree of "Master" to the profile of disciplines and (or) senior teachers with at least three years of experience as a teacher or experience practical work on the profile for at least five years.

The advanced/academic degree of the teaching staff corresponds to the academic degree of the doctor/candidate of sciences or the advanced/academic PhD degree of the doctor or master. Basic education or postgraduate education or doctorate/candidate of science degree, advanced/academic PhD degree must correspond to the subjects taught.

7.2 Additionally Required Faculty

Part-time teachers in the main place of work engaged in practical professional activities in the profile of the subjects taught, with at least 3 years of work experience in the field of training. Additionally, leading scientists, specialists from other higher education institutions and research organizations, teachers, and supervisors of schools in corresponding categories such as: expert teacher, research teacher, master teacher, can be involved in the work.

7.3 Required professional development of faculty

Based on the Law of the Republic of Kazakhstan "On Education" (2007; with amendments dated 27.12.2019) and other regulatory legal acts regulating the activities of higher education organizations in the Republic of Kazakhstan, a teacher who carries out professional activity in a higher education organization has the right for professional development at least once every five years for a duration of no more than four months.

The development of professional competences is also one of the priorities adopted in the Republic of Kazakhstan "Concepts of lifelong learning (continuing education)" (2021).

7.4 Required additional administrative staff

Vice-rector for academic affairs is responsible for planning and monitoring the implementation of educational services.

Responsibility for arranging and coordinating the implementation of the specific steps of the procedure and the quality of the outputs rests with the heads of divisions.

8. Resources

8.1. Library Resources

The library collection is an integral part of the information resources and includes educational, teaching, scientific and other literature.

Availability of a library fund of educational and scientific literature: in the format of printed and electronic publications for the last ten years, providing 100% of the disciplines of the curricula, including those published in the languages of instruction. Updating of the library fund should be carried out in accordance with the regulations of the Republic of Kazakhstan.

8.2. IT Resources

University provides pre-service teachers with educational and teaching literature and (or) electronic resources necessary for successful implementation of curricula, provides the functioning of the information system of education management (high-tech information and educational environment, including the website, information and educational portal, automated system of credit technology training, a set of information and educational resources).

8.3 Infrastructure

University provides equipment with educational, methodological, scientific and other literature, classrooms with multimedia complexes, computer rooms, access to broadband Internet, sports, material and technical, educational and laboratory facilities and equipment necessary for the implementation of curriculum.

9. Additional information

9.1 Additional materials

Inclusion is one of the most important cross-cutting principles of the curriculum (see more in Annex 1.). Inclusion in education means that all students, regardless of their possible impairments or disability, should have the opportunity to participate in the regular school systems and study with their

peers. The teacher education emphasizes on pre-service teachers' perceptions of themselves as experts in implementing curriculum for diverse learners based on the principles of pedagogy of difference or universal design for all. It is important to renew inclusive pedagogies such as co-teaching and differentiating. It is important that not only the specialized teachers (special education teachers) but all teachers can work in an inclusive educational environment. Thus, competences of all pre-service teachers need to be developed in areas such as:

Knowledge of the concepts and principles of inclusive education:

- Evaluation of one's own activity in terms of the values of inclusion.
- Understanding of the implementation of the principle of inclusiveness in education implemented by a flexible model of the educational process: adaptive programmes, changing the ways of assessing educational achievements.
- Understanding of children's different abilities and application of different trajectories to support versatile learners.

Practical applications in teaching:

- Designing of an adapted/individual programme for a child with special education needs in specific subject.
- Using of multimodal universal teaching methods, simple structured speech, use alternative communication.

9.2 E-learning

The rapid development of digital technologies requires the study of not only specific software tools, but the development of pre-service teachers' competences on using virtual learning environments and tools in teaching and choosing pedagogical methods suitable for learning processes in digital learning environments (psychological and didactic justification). For this the universities need:

- to create provisions for the professional development of pre-service teachers with the effective use of digital technology;
- to develop competences of pre-service teachers on understanding how individual educational needs of their students can be considered when using digital tools or in virtual learning environments;
- to develop digital competences of pre-service teachers on using digital learning environments and tools in assessment, such as gamification, digital tests and quizzes, and other formats of digital evaluation;

- to promote pre-service teachers’ capabilities in assessing their digital competences and the use of digital tools in pedagogical processes in relation to the requirements of the employers (schools) daily operations;
- to put into practice the integration of education, science, and industry, and involve professional communities in teaching school students the basics of applying and using digital technology, and perform an independent assessment of the practical skills acquired;
- to include digitalization into the educational process for in-service teachers to increase efficiency and practical application of digitalization in education;
- to promote the implementation of global standards in digitalization in initial teacher education (i.e. International Society for Technology in Education (ISTE) and the establishment of an expert community of educators in digitalization.

10. Approval

- Ensure a review of the developed curricula, its coordination and approval by the Republican Educational and Methodological Council of Higher and Postgraduate Education.
- Scale up all developed curricula in pedagogical universities

APPENDIX 1: Main principles of the curriculum

Competence-based approach

Competence-based approach is a learning-oriented way to organize and implement teaching. It is an alternative to more traditional educational approaches mainly focusing on what learners are expected to learn about in terms of traditionally defined subject content. In designing the curriculum following the principles of competence-based approach, the focus is on what we want our students to learn. Thus, it is essential to define the competences that the students are supposed to learn during their degree programs. The articulation of competences should include both discipline specific skills as well as the generic competences or soft skills that the teacher students should develop during the curricula. Soft skills include, for example, leadership, communication and collaboration skills, reflection skills, social and emotional intelligence etc. The development of these soft skills should be included in all the curricula, the competences and learning outcomes as well as the implementation of the curricula.

After defining the degree level competences, the learning outcomes of study units and study modules should be compiled by comparing them to the objectives of the entire degree. Learning outcomes represent the desired state, which is expressed as knowledge, skills and attitudes. The written learning outcomes of all the interconnected study units should also make visible the accumulated competence. Planning competence-based learning thus starts at degree programme level and is then realized at study unit level through the learning outcomes, the execution of the study unit and its assessment.

The reason for using competence-based approach to designing curricula is that it makes it possible to design courses and study programs in a more student-centred way. Student-centred approach means that the key knowledge and skills that the students need to achieve during their studies determine the content of the course or study programme. The aim of the competence-based approach to designing curricula is that the students acquire the knowledge, skills and attitudes/values that are essential. Further, the competence-based approach supports students to identify the knowledge and skills specific to their discipline or field of education as well as the generic competences that accumulate during their studies and are common to all degrees.

To sum up the key elements in designing competence-based curricula, it is essential to focus on describing explicitly a) what competences (including subject-specific and general competencies) should a student have after graduation/after study unit/after an individual course, b) how do different study

modules, courses and study modes support the development of the competencies, c) how is it ensured that the degree program and the learning objectives of the courses form a coherent entity supporting the development of the competencies, and d) how is it possible for students to make their competence visible (assessment related decision)

The implementation of all curricula should introduce methodologies that promote student-centeredness and active learning, such as gamification, PBL, etc. In a student-centred learning approach, students are active participants, placed at the core of the learning process. The learner is not seen as a passive receiver of knowledge but, rather, an active participant. The teacher's role becomes that of a guide who assists the learner in the difficult process of constructing his/her knowledge. Student-centred approach to teaching broadly means the shift of focus from the teacher to the student and their learning processes (Tran et al., 2010). The emphasis in student-centred approach to teaching is on what the student does and the ways to improve students' active engagement and deep approach to learning (Biggs and Tang, 2011; Prosser and Trigwell, 2014). In student-centred approach the student is seen as an active constructor of knowledge. Thus, the focus of the student-centred teaching practices is to develop autonomy and active learning that eventually enable lifelong learning.

Student-centred approach & Active Learning Methodologies

Student-centredness differs from traditional teaching approach, also known as teacher-centredness, in that the focus is on designing the teaching-learning process in a way that it promotes students' active participation and deep approach. Teaching that requires active engagement from students is likely to increase quality learning (Biggs and Tang, 2011). However, student-centered learning does not sideline or diminish the role of teachers. Instead, it seeks to use teachers' expertise in different ways to increase student engagement.

Student-centeredness requires a change in the mindset of the teachers and has many implications for the teaching practices. For example, teaching and learning activities should be designed in a way that they support and promote active learning. Active learning methods place greater responsibility on the learner rather than passive approaches such as lectures. Active learning activities promote higher order thinking skills such as application of knowledge and analysis and engage students in deep learning processes rather than surface learning. Furthermore, they enable students to transfer and apply knowledge better. There is a variety of active learning methods, such as case studies, problem-solving, group projects, debates, peer teaching, games etc. to mention a few. However, it should be kept in mind that the methods should always be chosen purposefully to support the attainment of the intended learning outcomes. Thus, when choosing the active learning methods, it should always be considered

from the perspective of which methods support the attainment of the intended learning outcomes in a best possible way.

Constructive alignment

The principle of constructive alignment has long been promoted as a powerful way to enhance the quality of teaching and learning (Biggs and Tang, 2011). Constructive alignment is an integrative design for teaching and curriculum design in which the alignment between intended learning outcomes/competences, teaching-learning activities and assessment tasks is emphasised to optimize the conditions for quality learning. The fundamental principle is that curriculum should be designed in such a way that the learning activities and assessment tasks are aligned with the intended learning outcomes (ILOs), and what the students should be able to do or demonstrate after completing the degree, module or a course. High quality learning may be supported by integrating these components together.

Constructive alignment reflects the more general paradigm shift from teacher-centred teaching to student-centred teaching described above. The central step in designing teaching is to define the intended learning outcomes or the competences that the students are supposed to learn during the learning process and how they will demonstrate that learning has taken place (Biggs and Tang, 2011). The role of the instructor is to engage the student in relevant activities that support the attainment of the intended learning outcomes (Biggs, 1996). By choosing appropriate teaching and assessment methods and tasks and aligning them with the intended learning outcomes/competences it is possible to effectively guide students' study practices and enhance deep, meaning-oriented learning (Biggs and Tang, 2011; Boud and Falchikov, 2006). Constructively aligned teaching is essentially a criterion-referenced system where the central elements, that is, intended learning outcomes, teaching-learning activities and assessment, are aligned and there is consistency throughout these elements.

Constructive alignment should be applied at all levels of the educational system, including institutional, departmental and classroom levels as teaching and learning take place in the whole system. In a good system, all aspects of teaching and assessment are tuned to support high level learning, so that all students are encouraged to use higher-order learning processes.

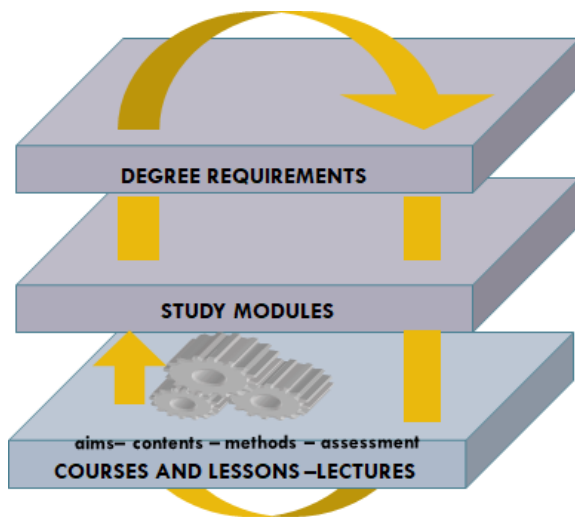


Figure 1. Illustration of constructive alignment

Research-based Initial Teacher Education

The recognition of the importance of research-based teacher education is growing worldwide (Flores, 2018). The research-teaching integration in the teacher educators' work has been suggested to be an effective solution to develop the profession in many aspects. They should be able to make explicit links between the educational theory, research and teaching practices. There is an increasing recognition that research is an important component of teacher education practices and is beneficial for preparing reflective practitioners (Flores, 2018). Research-based teacher education can take place in different forms. In its simplest form, it can mean that the teaching content is based on research, or that the teaching methods and pedagogical designs are based on research. It can also mean that teachers use inquiry-oriented methods in their teaching to enhance their students' own knowledge construction and research skills. Moreover, research-based teacher education can mean that the teacher educators themselves conduct research of their own work or more generally about topics related to teacher educators' work. The different forms of research-based teacher education identified in a recent research are presented in Table 1.

Teaching content is based on research	Teacher educators use their own or others' research as their teaching content to transfer academic knowledge to student teachers and develop the student teachers' independent thinking (Visser-Wijnveen et al. 2010).
Teaching methods and course design are based on research	Teacher educators benefit from their research work in teacher education and

	develop their teaching methods accordingly (Cochran-Smith 2005; Krokfors et al. 2011).
Applying inquiry-oriented methods in teaching	Teacher educators organise the course based on inquiry-oriented activities to guide student teachers to learn in an analytical and inquiring way to develop their pedagogical thinking (Krokfors et al. 2011).
Acting as researchers in teacher education	Teacher educators work as researchers and conduct research on what and how they teach, and on topics in teacher education (Cochran-Smith 2005).
Encouraging student teachers' involvement in research work	Teacher educators involve student teachers in research process to provide them with the experience of conducting research (Visser-Wijnveen et al. 2010).
A supportive relationship between research and teaching	Teacher educators consider the research-teaching nexus is complementary and fairly evident. Teaching and research support each other in a general and broad sense.

Table 1. Forms of research-based teacher education (Cao, Postareff, Lindblom-Ylänne & Toom, 2021)

Teacher education can adopt the research-based approach in diverse ways, and it is important to consider what kind of forms fit the cultural context and practices. The ultimate goal of research-based teacher education is to support student teachers to become pedagogically-thinking, reflective and inquiry-oriented teachers with an inquiring attitude towards teaching. Teachers' pedagogical thinking means the ability to analyse and conceptualise educational occasions and phenomena, to evaluate them as part of larger instructional processes and to make rational and theory-based decisions and justify their decisions and actions as teachers. Their readiness to consume as possibly also conduct research enhances their ability to meet the challenges of the future (Toom et al., 2010).

Research-based teacher education not only enhances the teacher educators' own professional development, but also enhances teacher students' reflective and deep learning. By engaging in research-based activities, the students can acquire a set of highly valued competences, such as critical thinking, problem solving and reflective skills (Lunenbergh, 2010). Thus, it is important, that teacher educators support the student teachers' to become reflective practitioners with an inquiring

attitude (see Toom et al., 2010), which they can learn not only from what their teachers say about how to teach, but most importantly, from how their teachers engage their students in collaborative and interactive teaching-learning activities (Berry, 2004).

To make research-based teacher education occur in practice, it should be made visible in the teacher education curricula. Secondly, the teacher education programmes should develop their students' inquiry-oriented and research-oriented approach to their work and enhance their research skills. Becoming an inquiry-oriented reflective practitioner requires time and space to deeply reflect on theory, practice, and the link between them. Therefore, the curriculum of teacher education should provide possibilities for reflection and practicing new skills.

Interdisciplinary learning

Content and Language Integrated Learning (CLIL)

CLIL (Content and Language Integrated Learning) is a dual-focused educational approach in which an additional language is used for learning and teaching of both content and language (Coyle, Hood & Marsh, 2010:1). The umbrella term of CLIL also includes a range of other language programs, such as bilingual education, English- medium of education or immersion programs (Coyle, 2007; Mehisto, Marsh, and Frigols, 2008). But CLIL differs from those language programs by its equal focus on both content and language (Coyle, 2008; Dalton-Puffer, 2008; De Zarobe, 2008; Marsh, 2012). Thus, this approach is neither language learning nor subject learning but a combination of both; hence, attention is given both to the language and the content. Contrary to the common belief, the CLIL instruction takes place with and through a foreign language and it is not the approach when non-language subjects are taught in the foreign language (Eurydice, 2006).

The reasons for introducing CLIL include provision of a more holistic educational experience for the student as well as content-and language-learning outcomes realized in class. Furthermore, benefits of CLIL are also linked with insights from interdisciplinary research within neurosciences and education (Coyle, Hood & Marsh, 2010). Due to these advantages CLIL is increasingly attracting stakeholders' attention across continents.

In terms of the curriculum implementation, the CLIL approach is inclusive and flexible; it includes a range of models that can be adapted according to the age, ability and needs of the students (Coyle, 2007). Thus, implementing CLIL varies based on the context. In primary stage, language learning can be embedded across

the curriculum and link with one or more subjects of the curriculum. For example, through specific themes or projects (e.g. lifestyle, sports, and holidays).

Secondary CLIL can make specific links between a language and a subject (e.g. history through Kazakh, science through English) or it can take a broader approach integrating language with parts of curriculum. More recently, CLIL is less aligned to a single subject and is evolving through links with a variety of subjects or themes. The content for lessons can include particular aspects of the curriculum for individual subjects. In practical terms, lesson planning involves joint effort across a number of subjects focusing on the cross-curriculum feature for the secondary curriculum. But there is a need for research to explore whether such an approach is compatible with the local context.

The existing curriculum models integrating CLIL vary in length from a single unit which comprise a sequence of 2-3 lessons to a more sustained approach through modules lasting half a term or more. Some successful cases include schools with bilingual sections where subjects are taught through the medium of another language for extensive periods (Coyle et al., 2010).

STEM (Science, Technology, Engineering, Mathematics) education

Interdisciplinarity in natural sciences and mathematics, so called STEM - education can be defined as “an effort to combine some or all of the four disciplines of science, technology, engineering, and mathematics into one class, unit, or lesson that is based on connections between the subjects and real-world problems” (Moore et al. (2014). Implementation and integration of engineering in K-12 STEM education. In S. Purzer, J. Strobel, & M. Cardella (Eds.), *Engineering in Pre-College Settings: Synthesizing Research, Policy, and Practices* (pp. 35–60). West Lafayette: Purdue University Press.). STEM - pedagogy in teacher education aims to prepare students to design, teach and develop research-based active learning STEM -lesson plans to educate competent citizens, who can access and make sense of science relevant to their lives and global perspectives (Feinstein, N. W., Allen, S., & Jenkins, E. (2013). *Outside the pipeline: Reimagining science education for nonscientists*. *Science*, 340(6130), 314-317.).

Active learning includes student centered active methods, such that project based education, and benefitting from diverse out of classroom learning environments and communities of learners and ICT. On the hand, Science education should also focus on competences with an emphasis on learning through science and shifting from STEM to STEAM (A = All) by linking science with other subjects and disciplines (Hazelkorn, Ellen & Ryan, Charly & Beernaert, Yves & Constantinou, Costas & Deca, Ligia & Grangeat, Michel & Karikorpi, Mervi & Lazoudis, Angelos & Pintó, Roser & Welzel-Breuer, Manuela (2015). *Science Education*

for Responsible Citizenship. 10.2777/12626). In the ITE curricula in Kazakhstan, the A should include at least developing the English linguistic skills of teacher students (KAZ ITE D-3 Framework Report).

Digitalisation in Education and Teachers' Digital competence development

New information and communication technologies (ICTs) provide teachers and learners with an innovative learning environment to stimulate and enhance the teaching and learning process. In this context, novel educational concepts such as online learning, or blended and hybrid learning are being developed (López-Pérez, Pérez-López & Rodríguez-Ariza, 2011). Hybrid or blended learning can be defined as the integration of face-to-face classroom instruction learning with web-based tools and materials (e.g. Garrison & Kanuka, 2004), as contrast to fully online learning. Blended or hybrid learning is becoming increasingly significant to complement traditional forms of learning. Often these two terms are defined similarly, but can also be differentiated. Blended learning can be defined as a mix of various event-based activities, including conventional face-to-face classrooms instruction, e-learning, and self-paced learning, while in hybrid learning a part of the learning activities and assignments are transferred from the face-to-face environment to the distance learning environment (see Valiathan, 2002, in Koohang, Britz & Seymor, 2006).

Blended forms of learning has the potential to enhance both the effectiveness and efficiency of meaningful learning experiences, and some researchers have suggested that blended learning has the potential to be even more effective and efficient when compared to a traditional classroom model (see Garrison & Kanuka, 2004). Other benefits of blended forms of learning include convenience, student satisfaction, flexibility and higher retention (Koohang, Britz & Seymor, 2006).

Especially in situations where student numbers are high, online, blended or hybrid forms of learning have the potential to provide greater opportunities for improved learning (Osguthorpe & Graham, 2003). In teacher education, student teachers can also learn from their teachers the use of various digital tools and platforms. Thus, not only teacher educators should have the skills to adopt digital tools in their teaching, but also student teachers should develop their digital skills during teacher education. Times faced with uncertainty and sudden changes, such as pandemics, require flexible and advanced use of digital tools and instructional practices functional in online contexts.

Inclusion in education and recognition of different learners

Inclusion in education is a principle which means that all students, regardless of their possible impairments or disability, should have the opportunity to participate in the regular school systems and study with their peers. Inclusion is based on several international United Nations declarations, such as the Salamanca Statement (1994) and The Universal Declaration of Human Rights (1948). Inclusive pedagogy is a pedagogical approach that is impacted by the sociocultural context of learning (Florian & Black-Hawkins, 2011) and it aims to respond to the diverse learning needs of students in as varied ways as possible.

The concepts of 'inclusion' and 'diversity' are reviewed in the teaching and education practices with the activities and arrangements that promote inclusion as the centre. The key words in education are educational equality, accessibility, individuality, lifelong learning and co-operation. The teacher training emphasizes on teachers' perceptions of themselves as experts in implementing curriculum for diverse learners based on the principles of pedagogy of difference or universal design for all. It is important to renew inclusive pedagogies such as co-teaching and differentiating. The teacher's task is to teach and guide students to become lifelong learners while taking each student's individual learning style into account. Four core values related to teaching and learning have been identified as the basis for the work of all teachers in inclusive education (European Agency). These core values are associated with areas of teacher competence. The areas of competence are made up of three elements: attitudes, knowledge and skills. All teachers must commit to the idea of equality for all students. (Saloviita, 2018.)

Teachers' professional development and change management

Considering the dynamic and constantly changing nature of teachers' work, teachers at all levels must be continuous learners throughout their professional careers. Teachers' professional development needs to address simultaneously the teachers' beliefs and conceptions and the improvement in their practices (Timperley & Phillips, 2003), as well as integration of theoretical and practical knowledge (Tynjälä, Häkkinen & Hämäläinen, 2004). Often an experience of a successful implementation in teaching changes teachers' attitudes and beliefs, and therefore, positive experiences are central for teachers' professional development (Guskey, 1989).

Development and growing as a teacher can be understood in different ways: 1) growing understanding of one's content area, in order to become more familiar with what to teach; 2) getting more practical experience as a teacher, in order to become more familiar with how to teach; 3) building up a repertoire of teaching strategies, in order to become more skilful as a teacher; 4) finding out which teaching strategies work best for the teacher, in order to become more effective as a teacher, and 5) continually increasing understanding of what works for

students, in order to become more effective in facilitating student learning (Åkerlind, 2007).

It is important to notice, that professional development of teachers is often a slow process. Furthermore, the development is not a linear continuum, but instead, the development may be interrupted by various reasons (Beijaard, Meijer & Verloop, 2004). Some teachers may experience change and development as threatening and change processes often include feelings of anxiety or uncertainty (Postareff et al., 2008). Such negative emotions towards the change may narrow the teacher's attention (Fredrickson, 2001). Therefore, it is important to ensure that teachers receive enough support from diverse sources (e.g. peers, supervisors, work environment) and encouraging feedback. It is also important for teachers to understand, that failures are part of the teachers' professional development, and mistakes should be seen as learning opportunities. When teachers have the possibility to share experiences and engage in collaboration with their peers, it has been shown to have positive influences of their learning and development (Voogt, et al., 2011). When teachers feel well and are engaged in their work, they are more likely to engage in pedagogical practices that promote their development (Fredrickson, 2001) The development of teaching is, at best, a continuous process, and thus, teachers should be encouraged to reflect on their own teaching on a continuous basis to increase their pedagogical awareness (Parpala & Postareff, 2021).

Teachers should also be provided with agency, which refers to the teacher's possibilities to influence, make decisions and take actions. The aim of exercising agency is to create new work practices and transforming the course of activities (Hökkä et al., 2012). When teachers have a possibility engage in development and changes, and when they experience that their opinions truly matter, they are likely to become highly engaged in their work (e.g. Day, Elliot & Kington, 2005; Pyhältö et al. 2012).

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