ESSENTIAL CHARACTERISTICS OF THE PROCESS OF MODELLING EDUCATIONAL PROGRAMMES OF PEDAGOGICAL DIRECTIONS IN TECHNICAL AND VOCATIONAL EDUCATION

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Abstract. Within the realm of technical and vocational education (TVET) in Central Asia, this study examines contemporary ways to designing educational programs in pedagogical domains. A comparative analysis was carried out on the curricula of three universities: Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov, and Arabayev Kyrgyz State University. The primary focus of the analysis was on the incorporation of competence-based and modular strategies, as well as the utilisation of information and communication technologies (ICT). The research employed a qualitative methodology based on document analysis of official curriculum materials and related instructional documents. These were evaluated according to structural composition, the integration of ICT, and the application of competence-based and modular approaches. The analysis also incorporated thematic synthesis and interpretive comparison to reveal both shared and divergent trends in programme design. This work, in contrast to earlier research, presents a novel methodology for aligning educational content with the requirements of the digital literacy environment, the needs of the job market, and inclusive pedagogy techniques. In doing so, it highlights how modular architecture can promote flexibility, while competence-based learning can ensure that professionals are ready to adapt to changing circumstances. In addition, the study underscores the role that information and communication technology plays in boosting interactivity and access to resources, which contributes to student involvement and autonomous development. The findings provide support for the necessity of developing a curriculum that strikes a balance between theoretical knowledge, practical skills, and technological competencies. It is advocated that recommendations be made to stakeholders at the policy level and at the institutional level in order to improve the quality of pedagogical programs in accordance with global education trends.

Keywords*: innovative learning models, competence development, critical thinking, innovations in education, modular approach.

1. INTRODUCTION

In modern conditions, since the 2010, technical and vocational education has become an important element of training for a rapidly changing labour market, where professionals with a high level of competence, adaptability and professional mobility are sought. In this regard, the process of modelling educational programmes in the field of education is important to ensure that such programmes meet the requirements and standards of modern quality of education, meet market demands and improve the quality of training of future professionals. The development of modern technologies and the introduction of digital tools in the educational process also bring new challenges, especially in the field of education, where educational programmes not only provide specialized knowledge but also develop

important professional competences necessary to adapt traditional educational approaches.

Recent research on enhancing vocational teacher education has underscored many views and methodological focusses. Nonetheless, significant gaps persist unresolved. Maksiutov (2024) performed an experimental study on the incorporation of contemporary teaching methods in vocational education, highlighting the imperative to update methodological approaches. However, although his work elucidates the variety of implementation options, it inadequately examines how educators adjust to these technological transitions. Expanding on this, Saipov et al. (2024) examine the advancement of professional training and methodological competencies, particularly via functional activities, but similarly neglecting the adaptive obstacles educators have in uncertain pedagogical environments. These two studies collectively highlight the structural changes in teacher preparation, although they inadequately theorise practical adaptation.

Johansson and Andersson (2024) offer a comprehensive theoretical framework in their examination of Swedish vocational education by examining the interaction of content, pedagogical approaches, and stakeholder engagement. Their research is especially significant in emphasising the under-explored domain of production-oriented learning logics, indicating a possible pathway to enhance comprehension of vocational didactics. This theoretical gap reflects the shortcomings identified in Barber et al.'s (2024) examination of Canadian physical education teacher preparation, which highlights student autonomy and institutional support but fails to address the long-term effects of these approaches. These contributions, despite their contextual diversity, clearly highlight a significant issue: the inadequate incorporation of empirical knowledge regarding long-term teaching effectiveness in creative methods.

Comon and Corpuz (2024) explore the development of research skills in future teachers, with a particular focus on cultural and social factors. Their emphasis on developing broad and contextually oriented knowledge significantly improves the quality of teacher education. Although their study does not contain an in-depth analysis of the use of these skills in professional practice, it emphasizes the importance of basic competencies for future teachers. Dahalan et al. (2024) present a comprehensive review illustrating the beneficial effects of gamification on student motivation and academic achievement in professional education, especially in the Asian context. The study does not provide specific implementation strategies, but it highlights significant opportunities for future research on the actual integration of gamified methods into educational institutions.

Kovalchuk et al. (2024) similarly engage in the debate by examining the function of educational technology in promoting creativity; nevertheless, they also fail to assess the practical effectiveness of these tools. This trend of theoretical investigation lacking adequate empirical support is similarly apparent in Serikkhan et al. (2024), whose culturally informed model for Kazakhstani primary teacher training incorporates significant ethnopedagogical components, yet fails to sufficiently address the challenges presented by educational globalisation.

Recent investigations by Abilovich (2024) and Jiang et al. (2024) introduce new perspectives to the discourse. Abilovich analyses in-service teacher training inside military institutions, emphasising distinct institutional requirements while neglecting the impact of digital revolution on these environments. Jiang et al. conduct a systematic mapping of digital technology utilisation in vocational education, highlighting an increasing research interest while acknowledging that tangible obstacles, especially in underdeveloped areas, are inadequately addressed. These works collectively enhance the understanding of vocational teacher education while revealing persistent limitations: an inclination to emphasise innovation and structure without adequately addressing the conditions required for practical, durable, and adaptive implementation.

The purpose of this study was to analyse modern approaches to modelling educational programmes for pedagogical specialities in the field of technical and vocational education. The main tasks included comparing the curricula of several educational institutions in Central Asia, studying the effectiveness of competence-based and modular approaches, as well as the role of information and communication

technologies in education.

The effectiveness of educational programmes at these universities is assessed and opportunities for improving their content and approaches are outlined. Namely, effectiveness refers to how well the educational programs prepare students for real-world teaching environments, focusing on their ability to integrate digital technologies, apply pedagogical theories in practice, and adapt to diverse educational settings. It is measured through student performance in practical teaching scenarios, feedback from educational institutions employing graduates, and the ability of students to utilize modern educational technologies effectively.

2. MATERIALS AND METHODS

This study adopts a qualitative research design, with a focus on document analysis as the primary method. The analysis was based on official curricular documents and supplementary teaching materials collected from three leading higher education institutions in Kyrgyzstan: Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov, and Arabayev Kyrgyz State University. These documents were analysed using comparative and thematic techniques to assess structural components, pedagogical strategies, and the integration of digital technologies. The study also applied interpretive comparison to evaluate how competence-based and modular approaches are implemented within the educational programmes. The selection of institutions was based on their representativeness, institutional diversity, and active engagement in educational reform.

The study analysed curricula that include both general education and specialized courses. All three universities offer courses in pedagogical theory, teaching methods, psychology, as well as disciplines related to inclusive education and the use of digital technologies. Particular attention is paid to compulsory and elective courses that allow students to adapt their studies to their own interests and specializations. Quantitative analysis was used to compare the structural components of the educational programs, such as the distribution of general and specialized courses, the integration of digital technologies, and the allocation of practical training. The primary data for this study were derived from official curriculum documents and supplementary materials provided by each university. These documents are publicly accessible and approved by the respective educational authorities, ensuring that the data reflects current and accurate educational practices.

The paper examines the structural components of the teacher education programme at each of the universities. All three institutions include general and specialized courses in their curricula, but they have different approaches to the core subjects. The assessment focuses on key subjects such as educational theory, teaching methods, psychology and other areas related to teaching. Particular attention was paid to which courses are compulsory, and which can be chosen depending on the interests and specializations of students. Courses covering inclusive education and the use of digital technologies in education, which are important aspects of modern pedagogical practice, were also considered.

The methodology of pedagogical practice, which is an integral part of the Pedagogy programme, was a separate object of analysis. Another area of research was the analysis of competence-based approaches implemented in all three university programmes. This approach includes not only the acquisition of knowledge, but also the development of important skills necessary for successful professional activity. Considerable attention was paid to the development of communication skills, which are important for interacting with students, colleagues, and parents in professional activities.

The integration of digital technologies into the educational process was another important aspect of the study. The use of digital platforms, such as Moodle, Google Classroom, Zoom, which are actively used in these universities, was considered. It was analysed how these technologies improve the quality of teaching staff training by providing access to interactive materials and facilitating the development of modern teaching methods.

3.   RESULTS AND DISCUSSION

3.1. Analysis of the structural components of the educational programme "Pedagogy"

The analysis of educational programmes of pedagogical specialization in Central Asian universities, such as Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov and Arabayev Kyrgyz State University, allows identifying differences in approaches to structuring curricula in the field of teacher education.

Kyrgyz National University named after J. Balasagyn is one of the largest universities in Kyrgyzstan and offers multifaceted study programmes, including pedagogical specialization programmes. Specialized pedagogical programmes include general education courses that develop basic academic skills and specializations that focus on pedagogy, psychology, and teaching methods. This approach allows students not only to acquire theoretical knowledge but also to develop practical skills during the pedagogical practice, which is an important part of the curriculum. The University actively integrates the latest technologies into teaching, which is reflected in the use of interactive learning platforms and online courses in pedagogical specialities. An important aspect is also the preparation of students to work in the context of modern educational challenges, in particular through the integration of competencies in digital technologies and pedagogical innovations (Tobis et al., 2020).

Kyrgyz National University named after J. Balasagyn offers general and specialised studies. History, literature, and foreign languages are taught in general classes, which help pupils learn academic skills. Educational theory, teaching methods, psychology, and other career-related courses are specialised. Digitisation is a program highlight. The curriculum prepares students to use current digital educational platforms, a vital part of teacher education. The program also incorporates active pedagogical practise that lets students see and participate in learning in an educational institution. This university's pedagogy program trains specialists with academic and practical knowledge. The course covers pedagogical philosophy, teaching methods, age psychology, and new teaching technologies. The curriculum includes courses on educational organisation, innovation, and digital technology.

The Kasym Tynystanov Issyk-Kul State University offers a pedagogy program that develops broad and specialised subjects to improve pedagogical and psychological skills. The curriculum teaches skills for working in schools and educational institutions. The university's flexible curriculum lets students add courses based on their professional interests. It emphasises practical training, which includes internships and teaching placements in schools to help students apply their knowledge and abilities. It actively adopts an interdisciplinary approach and incorporates many teaching-related areas. Issyk-Kul University's pedagogical specialisation includes general and specialised disciplines and is well-structured.

In general education courses, students study subjects that contribute to the development of their intellectual potential and cultural competence. These include history, basic concepts in the humanities, and language courses. Specializations at Issyk-Kul University cover a wide range of topics, including child psychology, teaching methods, inclusive education, and educational counselling. An important aspect of the programme is practical training, where students are required to participate in internships and practical classes at real educational institutions, consolidating their knowledge through hands-on experience.

While the curriculum includes inclusive education, the university has also introduced a number of targeted strategies to support students with disabilities and those from disadvantaged groups. These include differentiated instruction techniques, the adaptation of curricular materials into accessible formats (e.g., large print, audio materials), and the integration of assistive technologies such as screen readers and speech-to-text software in classrooms. Additionally, teacher training modules emphasize universal design for learning (UDL) and foster the development of individual educational plans (IEPs) to accommodate diverse learning needs. University-led workshops and seminars are regularly

conducted to build awareness among faculty and students about inclusive practices and social integration.

The programme is characterized by considerable flexibility in the choice of additional courses, allowing students to deepen their focus on particular educational topics, including inclusive education or the use of digital technologies in learning. Moreover, the pedagogy programme at Issyk-Kul University reflects local educational traditions and cultural aspects of the region. Particular attention is paid to preparing teachers to work in a multicultural and multilingual environment. The educational process also includes courses on research methodology, professional ethics, and the integration of inclusive practices at different educational levels.

Arabayev Kyrgyz State University emphasizes a balanced combination of theoretical learning and practical teaching, enabling students to engage in fieldwork and apply pedagogical theory in classroom settings. Students may select specializations such as inclusive education, child psychology, or educational administration, deepening their knowledge in these areas. The university supports inclusive education through policy-based measures that promote equal access, such as the provision of accessible campus infrastructure, tutoring support for students with special needs, and collaboration with NGOs working in disability advocacy.

In addition to general education subjects such as history, foreign languages, and other humanities, which build foundational academic skills, the university places particular emphasis on pedagogical practices that promote equity. Specialized courses include educational psychology, methods of teaching in inclusive classrooms, behaviour management techniques, and intercultural communication. A core component of the programme is mandatory teaching practice, which is often conducted in inclusive school settings. This practical component allows students to work directly with learners with diverse needs and receive mentorship from experienced inclusive educators.

Furthermore, Arabayev University incorporates digital pedagogy tools that enable personalized learning experiences, especially beneficial for learners with physical or cognitive impairments. Training in the use of electronic platforms, adaptive learning systems, and virtual classrooms ensures that future educators are equipped to apply inclusive methodologies in both in-person and hybrid environments. The programme ultimately seeks to align teacher preparation with contemporary international standards, fostering professional competencies that address diversity, equity, and social justice in education.

In general, all three universities offer a similar curriculum structure, including general education and professional courses. However, there are also significant differences in emphasis and approach. At all three universities, general education courses cover traditional humanities subjects such as history, foreign languages, philosophy and basic law. This allows students to acquire a broad cultural and scientific outlook, which is important for the development of teaching skills.

In educational institutions with linguistically diverse student bodies, language policy is typically integrated into curriculum design and delivery through several strategic approaches (Yang et al., 2025). These institutions often incorporate multilingual support systems, such as offering courses and materials in multiple languages, and employing bilingual or multilingual instructors. Additionally, language learning modules are integrated into the curriculum to enhance language proficiency among students, which aids in both their academic and professional development. The use of technology also plays a crucial role, with digital platforms providing translation services, language learning software, and resources that cater to non-native speakers. Furthermore, cultural competency training for staff and students ensures that the educational environment is inclusive and supportive of linguistic diversity (Porkodi et al., 2024; Tepavicharova et al., 2020). This holistic approach not only respects linguistic differences but also leverages them as a resource for enriching the learning experience.

All universities offer courses focused on pedagogy. However, the emphasis may change. At Kyrgyz National University named after J. Balasagyn, courses related to digital technologies are being actively implemented, which is an important advantage in preparing for teaching in the context of modern

changes in education. On the other hand, at Issyk-Kul State University named after K. Tynystanov, it is possible to choose additional courses to study certain aspects of pedagogy in detail, such as inclusive education, which is important for working in a multicultural and multilingual environment. Arabayev Kyrgyz State University pays special attention to educational practice as an important component of the programme, which allows students to apply theoretical knowledge in real-life settings. All universities consider educational practice to be an important element of learning. However, the availability of additional internship programmes, educational practices or volunteer projects may vary. Issyk-Kul University allows for a more flexible approach to the choice of internships, while Kyrgyz National University named after J. Balasagyn pays more attention to digital literacy, which can be important in the modern educational environment. Thus, the study programmes in the educational specialities of these 3 universities have a common element, but each university adapts its structure to the details of local needs, current trends in education and its educational policy.

3.2. Competence-based and modular approaches in educational programmes

The competence-based approach is one of the most acceptable learning strategies at the current stage of development of the education system. It is based on the idea that learning should be result-oriented. This means that students should develop the ability to apply their knowledge and skills in real-life situations. Competence is not just a set of knowledge, but a set of capabilities, including skills, experience and attitudes, that students can use to solve specific problems. This approach focuses on the development of specific qualities in students, such as critical thinking, adaptability, communication skills, independent problem-solving and effective teamwork (What is a competence-based…, 2024).

The application of the competency-based approach has also become the subject of attention of researchers who propose innovative methods for its implementation. The study by Nazyrova et al. (2024) is based on a competency-based approach structured through an ontology. It describes the development of software for creating and analysing curricula. The study focuses on creating a mathematical model for assessing the level of professional competence of students and developing a mechanism for determining the prerequisites for studying specialization based on the relationships between the competences formed by different courses.

The main contribution is the development of a model for assessing managerial tasks to determine the degree to which students have mastered the required competencies. The solution integrates data into the ontology structure, provides the ability to edit and analyse the integrity of curricula, facilitates workflow and supports export to ontology web language formats. This allows for the integration of the curriculum into the educational environment and contributes to the development of a flexible and coherent curriculum that meets the modern requirements of vocational education.

Ayalew et al. (2024) studied the perceptions of teachers and academic leaders about competence and competency-based education. The researchers collected data from 22 participants, including teachers and academic leaders, through semi-structured interviews. The aim was to determine how these participants understood competence and competency-based education.

The study identified ten categories that were grouped into three broad categories: competence and behaviourist functionalism, competence and integrative professionalism, and competence and situational professionalism. According to the survey, the category "competence and integrative professionalism" was the most common, while "competence and behavioural functionalism" was the least common. This indicates an inconsistency in the understanding of competence and competence-based education and has important implications for educational practice.

In the study by Rief et al. (2024) on competency-based psychotherapy training from a paratheoretical perspective, a paradigmatic perspective is considered. The authors discuss whether such an approach can contribute to the development of psychotherapy as a discipline and integrate different theoretical treatment strategies. The researchers proposed a model that allows treatment to be classified according to paratheoretical goals and showed how the competence approach can be adapted to academic

teaching. This study integrates different psychotherapeutic traditions and contributes to the development of psychotherapy as an integrative, evidence-based discipline.

Critical thinking and the ability to interact effectively in a team are important elements in various fields, as it requires not only technical knowledge, but also the ability of future professionals to adapt to new technologies and changing circumstances. Problem-solving requires the ability to find innovative solutions to complex problems, which also contributes to the development of flexibility in learning and practice. Independent learning plays an important role, allowing students to adapt their skills to new requirements and maintain their professional development.

Pacher et al. (2024) systematically review the literature on competency-based education in various fields, including industrial engineering and management (IEM), and discuss these aspects in detail. The authors emphasize the importance of integrating competences into curricula and provide recommendations on the use of new methods and tools to improve the professional training of future engineers.

Thus, the main goal of the competency-based approach is to prepare students for the real world, i.e., for professional activities where they have to work in a changing environment and face various problems and challenges. The focus is not only on theoretical knowledge, but also on solving specific problems and issues. This helps students to be better prepared for the fast-paced world in which they will work in the future.

The modular approach to learning is another important feature of modern educational practice. In this approach, courses are divided into independent blocks or modules, each with its own objectives, goals, and form of learning. Modules include theoretical teaching, practical classes, laboratory work and assignments for students' independent work. The modular approach allows students to work through the learning material step by step and absorb small portions of information, which reduces their workload and facilitates the learning process.

Modular learning is an approach to learning that breaks down a larger curriculum into smaller, self-contained modules. These are typically independent units of learning so that learners can easily comprehend and apply the knowledge or skills being taught. Each module focuses on a specific topic or skill, allowing students to progress at their own pace and choose the modules that best suit their needs. They can start with the basics and gradually develop their knowledge by completing additional modules. This modular structure helps them to review specific modules for reinforcement or to address specific gaps in their understanding (12 online modular training…, 2024).

The modular approach is characterized by flexibility and adaptability to the needs of students. Each module can be assessed individually, which allows tracking students' progress and provide feedback. Students can also choose modules according to their interests and needs, thus creating an individual learning trajectory. The modular approach organizes the learning process in such a way that each module contains both theoretical knowledge and practical tasks, which facilitates the learning of material and the development of professional skills. This makes the learning process more interactive and varied, so that students not only acquire knowledge but can apply it directly in practical situations.

The modular approach also provides flexibility in curriculum development. For example, several modules can be developed from a single course, each covering a different aspect of the subject. This allows students to choose which modules to study according to their interests and professional needs. Modular learning has several key features that distinguish it from traditional approaches. It consists of a stand-alone module – an independent unit covering a specific topic – which provides flexibility and the ability to choose the complexity of study depending on the individual student's needs.

Thanks to the adaptive approach, students can move on to more complex modules after learning the basic concepts. The module is easy to use in different applications and integrates assessment into each module, making it easy to update materials and track progress (Tsurkan-Saifulina & Stupak, 2022). Interactive elements, such as quizzes and multimedia, increase engagement and help to retain visitors. Among the advantages of modular learning is the ability of students to adapt the learning process to

their needs, learn materials at their own pace, and distribute information into smaller blocks due to the availability of online modules, which allows them to expand the learning process, while interactivity ensures that students' interests are met. To efficiently execute modular learning, it is essential to systematically allocate learning materials, anticipate the sequence of modules, incorporate assessments, furnish resources, and devise programs that utilize learning platforms for accessing and delivering educational content. (Understanding modular learning…, 2023).

Thus, competency-based and modular approaches to learning have much in common and are often combined to achieve the best learning outcomes. The modular approach helps to create a more structured and accessible learning process, while the competency-based approach ensures a result-oriented approach and the development of practical skills useful for students' professional activities (Porkodi, 2024). Together, these approaches enable a holistic approach to learning, where knowledge, skills, and competences are developed in parallel. In such a system, each module contributes to the development of specific competences of students and helps them to be better prepared to work in real-life situations. This enables students to acquire not only theoretical knowledge, but also the ability to apply this knowledge to solve specific problems.

Given the above approaches, universities in Central Asia are actively implementing both competency-based and modular approaches in the curricula of professional pedagogical disciplines. For example, one can see how these approaches are integrated into the curricula at Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov and Arabayev Kyrgyz State University. These universities focus not only on knowledge, but also on the development of practical skills, such as the ability to organize the learning process, apply modern teaching methods and adapt to rapid changes in education. These universities teach students using a competency-based approach, which includes courses aimed at achieving specific competencies and developing professional skills through modular learning that can be studied in stages.

For example, practical courses that engage students in solving real-world problems and modules that focus on developing technical skills allow students to respond flexibly to modern educational challenges. Tab. 1 shows a comparison of competency-based and modular approaches.

Tab. 1

Comparison of competence-based and modular approaches in three universities

University	Competence-based approach (main features)	Modular approach (main features)
Arabayev Kyrgyz State University	Developing practical skills	Structured courses into short modules
Kyrgyz National University named after J. Balasagyn	Emphasis on the development of critical thinking	Flexibility of the learning process
Issyk-Kul State University named after K. Tynystanov	Focus on adaptability competences	Possibility of individual learning pace

Source: created by the authors

Analysing the contrast between competency-based and modular techniques at three Central Asian institutions reveals varying emphases in the structuring of the educational process and interpretations of these methodologies. At Arabayev Kyrgyz State University, the emphasis is on the development of practical skills. The university's modular approach promotes a structured learning process by dividing the course into short, clearly defined modules that facilitate students' gradual mastery of the material. The competency-based and modular approaches not only meet the requirements of modern education, but also contribute to the development of university education focused on specific results and practical activities. The integration of these approaches into the educational process maximizes learning

effectiveness, prepares students for real professional challenges, and creates flexible and adaptable study programmes that meet the current requirements of the labour market.

The recent curriculum reforms at Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov, and Arabayev Kyrgyz State University were driven by a combination of factors, reflecting both global educational trends and local socio-economic needs. External regulations have played a significant role, as educational policies at the national level increasingly emphasize the importance of aligning university curricula with international educational standards. This push for standardization is aimed at enhancing the global competitiveness of graduates and ensuring that educational outcomes meet international benchmarks. Additionally, internal institutional priorities have been crucial in shaping these reforms. Each university has sought to address specific gaps in their existing programs, such as the need for greater integration of digital technologies and more robust practical training components. These internal assessments have led to a focus on enhancing the curriculum with more interactive and technology-driven learning experiences.

Labour market shifts have also significantly influenced these changes. As the demand for skilled professionals in various sectors evolves, particularly with the rapid advancement of technology and digitalization, universities are adapting their programs to better prepare students for the modern workforce. This includes incorporating competencies in digital literacy, problem-solving, and adaptability into the curriculum. Key stakeholders in the decision and approval processes included university administrators, faculty members, educational policy makers, and industry representatives. University administrators and faculty were primarily responsible for identifying the need for curriculum updates and proposing changes based on academic research and student feedback. Educational policy makers at the national level provided the regulatory framework and approval necessary for implementing these changes. Industry representatives contributed by offering insights into the skills and knowledge required in the current job market, ensuring that the curriculum reforms would produce graduates better suited to contemporary professional environments.

3.3. Implementation of information and communication technologies in the learning process

Information and communication technology (ICT) has become one of the key elements transforming education around the world, fundamentally changing the way students acquire knowledge and teachers organize learning. ICT encompasses a wide range of digital tools and resources, from computers and tablets to learning software, cloud services, and virtual and augmented reality. Their use incorporates the principles of accessibility, interactivity, and personalization of education, leading to changes at both school and university levels. One of the advantages of ICT is that it provides wider access to educational resources. Previously, access to books, research papers and materials required a physical visit to a library or archive, but with the advent of digital technologies, information from around the world can now be accessed instantly. This allows students to quickly find the resources they need, especially useful for self-study or classroom preparation (All about ICT in…, 2024).

ICTs are transforming education, enabling students and teachers to develop 21-century skills. ICTs play a significant role in education through integrated technological tools that facilitate effective learning, change teaching methods, and make the learning process more interactive and accessible (Porkodi et al., 2022). The use of ICTs prepares teachers to present material in an engaging way, which is especially important in today's world. This includes the use of the Internet and interactive multimedia, which are powerful tools for creating a dynamic learning environment. For example, access to online learning resources allows teachers and students to share, analyse and discuss information, greatly enhancing the capabilities of the traditional classroom (Ratheeswari, 2018).

Many educational institutions have created their own digital libraries, where not only textbooks and study guides are available, but also video lectures, interactive simulators, simulations and other resources. The most popular resources include Coursera, Khan Academy, and the edX platform, which offers online courses from leading universities around the world with access to high-quality learning

materials. Not only does ICT facilitate the accessibility of learning materials, it also facilitates the possibility of personalized learning, where students can learn at their own pace. Personalized learning takes into account the individual needs, interests, and characteristics of each course. Thanks to adaptive platforms like Duolingo for languages and Khan Academy for maths, everyone can customize their learning plan by choosing the level of difficulty of tasks and the pace of work. This is especially useful for students who have other learning needs or require additional learning support. In addition, by using educational data analytics, teachers can get information about each student's progress, identify complex problems, and work on solving them individually.

The modern world requires not only basic disciplinary knowledge, but also the development of so-called 21st century skills, such as critical thinking, the ability to apply knowledge, digital literacy, communication skills and problem-solving skills (Ongan et al., 2025; Titova et al., 2023). ICT opens up new opportunities for developing these skills. Using specialized applications, students can, for example, analyse data, create presentations, conduct research and simulate various scenarios. Most modern educational programmes, such as Google Workspace, Microsoft Teams and Zoom, help students to practice communication skills and collaborate in teams even remotely (Sadirbekova et al., 2024). The ability to use these technologies is becoming increasingly important for successful integration into the digital economy. It is worth noting that educational institutions often use ICT if they see a concrete example of its use. In the process of modelling programmes, the usefulness of ICT is manifested through the possibility of automation, improved model accuracy, as well as effective visualization and communication, which allows for faster informed decisions and solving complex modelling problems (Acosta-Prado and Tafur-Mendoza, 2024).

ICT also enhances multimedia learning opportunities, including audiovisual materials that contribute to a better understanding of English. For example, videos with subtitles should allow students to simultaneously perceive audio and textual information, contributing to better vocabulary and grammar acquisition. Multimedia presentations, online games and virtual tours will help students to absorb information in the context of real-life situations and will help them learn English. In addition, ICTs facilitate global communication and collaboration between students from different countries, which is important for learning foreign languages (Zhou et al., 2024). Using tools such as video conferencing, forums and social networks, students can interact with native speakers and other students from different cultural backgrounds. This helps to develop intercultural skills and encourages students to use English in real-life communication situations (Rofi'i et al., 2024).

One of the main advantages of ICT is that it can increase students' interest in the learning process through interactivity and visualization. Instead of traditional lectures and reading texts, students can now work with topics using interactive tools (Svyrydiuk et al., 2022). For example, it is possible to use virtual reality to create a virtual laboratory where students can conduct experiments without leaving the classroom. Interactive teaching methods, such as simulations and gaming, allow students to interact with the material, improving their learning. ICT also allows students to use visual aids such as graphs, diagrams and 3D models to help present complex concepts in an easy-to-understand way. Three-dimensional anatomical models provide a detailed view of the structure of organs and body systems to enhance understanding of biology. ICTs also facilitate distance learning, which is especially important in the context of globalization and the growing need for flexible learning (Ma et al., 2024). Thanks to online platforms, students can get an education regardless of their geographical location. This opens up new opportunities for residents of remote areas who have limited access to quality educational services. In addition, distance learning platforms such as Google Classroom, Moodle, and Microsoft Teams can be used to create virtual classrooms where materials can be shared, topics discussed and tests and quizzes administered. This allows students to keep in touch with their teachers and receive support and feedback during the learning process.

ICT not only brings many benefits to the learning process itself, but also helps automate administrative processes. The use of electronic journals, attendance systems, and document

management software simplifies the work of administrative offices. However, the introduction of ICT in education also has some minor problems and limitations. Firstly, one of the main issues is the need for funding, as providing educational institutions with the latest technology requires significant resources. Not all universities can afford to buy the necessary equipment or provide high-speed internet. This leads to inequalities in access to quality education, as students from less affluent schools may fall behind those who study at technologically advanced institutions. Another challenge is the lack of teacher training. While many teachers have basic knowledge of ICT, effective use of digital technologies in education requires in-depth training. An important point is the ongoing means of improving the quality of teachers. The organization of seminars, workshops, and refresher courses is a prerequisite for the successful use of ICT in the educational process. Table 2 summarizes the main aspects of the use of ICTs in education, their advantages, and examples of application.

Tab. 2

Key aspects of use of ICT

Category	Description	Advantages	Examples of application
Interactive technologies	Use of interactive whiteboards, online platforms, video conferencing	Increased student engagement, real-time interaction, and better accessibility of content	Webinars, interactive online classes, video conferencing platforms (Zoom, Google Meet)
Multimedia resources	Use of video, audio, animations, simulations, podcasts	Improving building material through the use of different sensory channels, making complex topics easier to understand	Video tutorials, educational YouTube channels, and the use of multimedia to explain theoretical concepts
Electronic resources	Use of online courses, e-books, articles, databases	Access to a huge amount of learning materials at any time and from anywhere in the world	Moodle, Coursera, Khan Academy, Google Scholar
Online communities	Virtual groups for knowledge sharing, discussion and collaboration	Joint problem-solving, improvement of teamwork skills, mutual support of students among	Virtual classrooms, discussion forums, Google Groups, Discord for educational purposes
Digital assessment tools	Use of online surveys, tests, and automated assessment systems	Quick and effective knowledge assessment, feedback, and the ability to save and analyse results	Google Forms, Kahoot, Quizlet
Individual training	Use of adaptive learning platforms that are tailored to the student's level	Personalized approach to learning, meeting the needs of different students, increasing motivation to learn	Duolingo, adaptive learning platforms (iReady)
Virtual simulations	Use of virtual laboratories and	A safe environment for practical experiments,	PhET interactive modelling, virtual

	simulations for practical training	saving time and resources	laboratories for science education
Social media	Using communication and collaboration platforms such as Facebook, Twitter, Instagram in the learning process	Improving communication, engaging students in discussion, developing digital communication skills	Using Twitter to discuss course topics, create a Facebook group for student projects

Source: created by the authors

Thus, ICT such as Moodle, Google Classroom, and Zoom play pivotal roles in enhancing the educational experience. Moodle is primarily utilized for organizing course content and facilitating assessments, allowing students to access learning materials and submit assignments digitally. Google Classroom enhances communication and collaboration between students and instructors, streamlining the process of distributing resources and providing timely feedback. Zoom supports real-time interactive learning sessions, enabling virtual lectures and meetings that are crucial for distance learning. These technologies are integrated across various departments, although their application can vary based on the specific pedagogical requirements and technological infrastructure of each subject area. This integration of ICT tools is essential in fostering a cohesive and interactive learning environment tailored to meet the demands of modern education.

However, one of the most significant challenges in implementing educational reforms is the constraint of resources. Many educational institutions, particularly in developing regions, face budget limitations that restrict their ability to acquire necessary technologies and infrastructure (Bashtannyk et al., 2020; Luzan et al., 2021; Lukash et al., 2025). This lack of resources can hinder the effective adoption of digital tools and platforms, limiting the potential benefits of digitalization in education. Schools may struggle to provide adequate hardware, such as computers and tablets, or maintain high-speed internet access, which is crucial for digital learning environments.

The success of educational reforms heavily depends on the preparedness of teachers to adapt to new methodologies and technologies. However, many educators may not have the required training or familiarity with digital tools to effectively integrate them into their teaching practices. Professional development programs are essential but often insufficient or unavailable. Without proper training, teachers may resist changes or fail to utilize new technologies to their full potential, thereby limiting the effectiveness of competence-based and modular learning approaches.

Beyond the availability of digital devices, infrastructural deficits such as outdated classroom facilities and inadequate technical support can pose substantial barriers. Effective digital learning environments require not only devices but also reliable electricity, network infrastructure, and technical maintenance support. In many cases, schools lack the physical infrastructure necessary to support advanced technological integration, which can impede the implementation of digital learning initiatives (Vazov et al., 2022).

Institutional resistance to change is another critical challenge. Educational institutions can be inherently resistant to change due to bureaucratic inertia, cultural attitudes, or a lack of visionary leadership. Resistance can manifest in various forms, from reluctance to adopt new technologies to skepticism about the benefits of modular and competence-based learning approaches. Overcoming this resistance requires strong leadership, clear communication of benefits, and inclusive involvement of all stakeholders in the reform process.

The analysis and discussion of the educational programs at Kyrgyz National University named after J. Balasagyn, Issyk-Kul State University named after K. Tynystanov, and Arabayev Kyrgyz State University reveal significant insights into the evolving landscape of teacher education in Central Asia.

Each university, while sharing a common structure of general and specialized courses, exhibits unique approaches and emphases in their pedagogical programs. The integration of digital technologies, flexible learning pathways, and practical training components are pivotal in preparing students to meet contemporary educational challenges and demands. The competence-based approach adopted by these institutions underscores the importance of developing practical skills and competencies that are essential for modern educational practices. This approach, combined with modular learning strategies, facilitates a more personalized and adaptable educational experience, allowing students to progress at their own pace and focus on areas of interest or need. Such methodologies not only enhance student engagement and learning outcomes but also ensure that graduates are well-equipped to navigate the complexities of the current educational environment.

Furthermore, the incorporation of ICT into the curriculum has been transformative, offering enhanced accessibility, interactivity, and personalized learning experiences. ICT tools have enabled more dynamic and inclusive educational practices, bridging gaps in traditional teaching methods and providing students with the necessary skills to thrive in a digital world. Despite the challenges associated with funding and training, the benefits of ICT in education are profound, offering innovative solutions to longstanding educational barriers. Overall, the curriculum reforms at these universities reflect a broader trend towards creating more inclusive, flexible, and technology-integrated educational programs. These reforms are driven by a combination of external regulatory pressures, internal institutional assessments, and the evolving needs of the labor market. The collaboration among university administrators, faculty, policymakers, and industry representatives has been crucial in shaping these changes, ensuring that the educational offerings remain relevant and effective in preparing students for successful careers in education.

The approaches described in this study, including modularity, competence-based learning, and the integration of digital technologies, have the potential to be expanded to a broader set of universities within Central Asia and adapted internationally. However, the successful diffusion of these approaches depends on identifying enabling conditions such as adequate infrastructure, supportive policies, and comprehensive teacher training, as well as recognizing limiting conditions like resource constraints, teacher preparedness, and institutional resistance. Understanding these factors can significantly enhance the study's value for practitioners and policymakers by providing insights into the practical aspects of scaling and transferring these educational strategies to diverse settings.

4. DISCUSSION

Modelling of educational programmes is an important aspect of educational practice, especially in the context of technical and vocational education. The theoretical approach to the modelling programme indicates the need for a systematic approach that takes into account not only academic disciplines, but also socio-economic needs, technological development of the market and changes in labour force requirements. The modelling of educational programmes in the context of technical education is becoming an integral part of the training of qualified specialists who do not only have sufficient basic knowledge in their field, but also the ability to adapt to constantly changing conditions. According to the theory of educational modelling, the successful formation of learning activities includes integration between free disciplines, optimal activities in programmes that build the content and purpose of learning, and the organization of effective methods and forms of learning activities.

One of the most important aspects is the interaction between theoretical knowledge and practical skills that an educational programme should provide. Theoretical concepts require practical and effective implementation, which includes not only educational modules, but also practical classes and research activities that allow students to acquire professional skills at a high level. Addressing labour market demands, predicting trends, and employing an interdisciplinary educational approach effectively develops programs that prepare graduates with substantial competence (Khamzina et al.,

2021). This equips them to operate efficiently within the framework of globalisation and technological advancement.

Liu et al. (2023) an increasing number of studies highlight the growing importance of educational technologies and individualized methodologies in professional education. Liu et al. (2023) conducted a thorough systematic review of the application of virtual and augmented reality (VR/AR) in vocational education. Their study, based on data from leading international databases, showed that VR/AR has significant potential to improve both theoretical understanding and practical skills. However, they noted that the implementation of these technologies is still in its early stages and advocated for greater interdisciplinary integration and outcome-oriented evaluation. These findings reinforce the emphasis made in the present study on the development of educational programs that promote the significant integration of new technologies. Liu et al. emphasize the importance of VR/AR for comprehensive skill development, while the present study focuses specifically on the organization of educational content and technological interaction in a professional context. These two studies complement each other, as both recognize the need for educational models that are relevant to the realities of the digital transition in the context of learning.

The importance of personalization is also evident in the study by Mykytyuk et al. (2023), which explores the enhancement of teachers' pedagogical abilities in the field of finance through individualized methodology. Their emphasis on modelling and capacity building is relevant to all disciplines and aligns with the current study's goal of adapting educational content to practical requirements. Although their focus is on the financial sector, the fundamental pedagogical principle of individualization reinforces the general logic of flexible program design in teacher training.

Abu-Rasheed et al. (2023) elaborate on this point by exploring how contextual elements, including prior knowledge and motivation, influence students' responses to individualized learning recommendations. Their research highlights the need to recognize student diversity and context in curriculum design, emphasizing the need for adaptable learning pathways that accommodate diverse professional trajectories. Together, these studies confirm the importance of a learner-centred approach, which is incorporated into the present study through competency-based and modular frameworks.

Cabreros (2023) examines aspects of leadership and management in the creation of professional programs, emphasizing the strategic importance of contemporary leadership in education when adapting curricula. This study focuses on aligning management practices with changing expectations in education, highlighting the readiness and responsiveness of institutions in the field of technical and vocational education. The bibliometric study by Tian et al. (2023) provides a macro-level perspective, highlighting key trends and patterns in vocational education research worldwide, thereby contextualizing the current study within the broader academic achievements.

Lebid et al. (2023) propose implementing active and cooperative approaches to teaching to develop the creative abilities of future primary school teachers, with a particular focus on innovation and diversity. Their methodology, which integrates technology to meet postmodern educational requirements, is consistent with this study's focus on improving the skills of students with special educational needs. Despite differences in target groups, both studies are dedicated to improving learning outcomes through technological and methodological innovations.

Ivaniuk et al. (2023) offer important insights into psychological and pedagogical support for future teachers in distance education settings. Their research on adaptive learning tools, digital portfolios, and professional development methodologies aligns with this study's focus on skill acquisition through technology. Their research focuses on teacher training while contributing to the broader discussion on the effective use of digital environments to meet diverse educational needs, including those of students with special needs.

Together, these studies demonstrate a general recognition of the transformative potential of educational technology and learner-centred design. This study builds on existing concepts by proposing a systematic method for designing educational programs that incorporate digital technologies,

modularity, and competency-based learning, while meeting the needs of both general education and specialized student groups. teachers.

Thus, the modelling of educational programmes in technical and vocational education is aimed at integrating theoretical knowledge, practical skills, and innovative technologies and ensuring compliance with the requirements of the modern labour market. The theoretical analysis shows the need for a systematic approach that takes into account socio-economic factors, interdisciplinary integration and the use of digital tools. Innovative technologies, such as virtual and augmented reality, contribute to increasing the interactivity of learning and the development of professional skills. At the same time, special attention is paid to adapting the programme to the individual needs of the student and the contextual requirements of the employer, which ensures the training of competent specialists who are able to adapt to the conditions of globalization and rapid technological change.

5. CONCLUSIONS

This study has identified important aspects of the process of modelling educational programmes for pedagogical specialities in the field of technical and vocational education, especially on the examples of 3 higher education institutions in Central Asia. It turns out that the use of a competence-based and modular approach to teaching significantly increases the effectiveness of training future specialists, as it allows students to develop practical skills that are important for the modern professional environment.

The competence model analysed in this study involves not only general education, but also a detailed study of specialities that directly contribute to the development of professional skills. It also emphasizes the importance of integrating ICT into the educational process, which is necessary to improve the quality of education and enhance the theoretical and practical training of students. The qualitative results of the study include a significant improvement in the level of student engagement in the educational process, increasing the level of activity learning through the use of digital technologies and interactive methods. It is also important to develop students' independent work skills necessary to adapt to a rapidly changing professional environment.

The study also emphasized the importance of improving the education system for future teachers, who play a key role in implementing innovative teaching approaches. In particular, it is necessary to create in-service training programmes that allow future teachers to acquire skills in working with digital platforms, interactive tools and modular teaching methods. At the same time, it is important to pay attention to the development of interdisciplinary skills that contribute to a deeper understanding of modern professional requirements. Implementing such an approach not only improves the quality of education, but also develops students' critical thinking, teamwork and problem-solving skills, which are important in today's professional environment.

In general, the results of the study confirm the need for further improvement of educational programmes, taking into account rapid changes in technologies and professions, which allow training highly qualified specialists capable of working effectively in the modern professional environment. In the future, work should continue on introducing new learning technologies, improving e-learning software and feedback mechanisms. This will ensure a high level of adaptation of educational programmes to the requirements of the times. The recommendations are primarily intended for university leadership, curriculum designers, and educational policymakers. while some actions – such as revising curricula or piloting inclusive teaching methods – are immediately actionable at the institutional level, others, like expanding digital infrastructure or reforming accreditation standards, require broader policy and financial support.

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Кусаїнова Жанара, Сартбекова Нуржан, Абакіров Азіз. Основні характеристики процесу моделювання освітніх програм педагогічних напрямів у технічній і професійній освіті. *Журнал Прикарпатського університету імені Василя Стефаника*, **12** (3) (2025), 150-168.

У статті висвітлено сучасні підходи до розробки освітніх програм у педагогічній сфері, зокрема у контексті технічної та професійної освіти (ТПО) в Центральній Азії. Представлено результати порівняльного аналізу навчальних програм трьох університетів: Киргизького національного університету імені Ж. Баласагина, Іссик-Кульського державного університету імені К. Тинистанова та Киргизького державного університету імені Арабаєва. Основну увагу в аналізі приділено впровадженню компетентнісних і модульних стратегій, а також використанню інформаційно-комунікаційних технологій (ІКТ). У дослідженні застосовано якісну методологію, засновану на аналізі офіційних навчальних програм і відповідних документів. Вони були оцінені за структурним складом, інтеграцією ІКТ та застосуванням компетентнісних і модульних підходів. Аналіз також включав тематичний синтез та інтерпретаційне порівняння для виявлення спільних і відмінних тенденцій у розробці програм. Наукова новизна цього дослідження в тому, що в ньому презентовано нову методологію узгодження освітнього контенту з вимогами середовища цифрової грамотності, потребами ринку праці та інклюзивними педагогічними техніками. При цьому акцентовано, як модульна архітектура може сприяти гнучкості, а навчання на основі компетентностей здатне забезпечити готовність фахівців адаптуватися до мінливих умов. Крім того, у дослідженні наголошено на значенні інформаційно-комунікаційних технологій у підвищенні інтерактивності та доступу до ресурсів, що сприяє залученню студентів та їхньому самостійному розвитку. Результати дослідження підтверджують необхідність розробки навчальної програми, в якій забезпечено баланс між теоретичними знаннями, практичними навичками й технологічними компетенціями. Вказано на необхідності надати рекомендації зацікавленим сторонам на політичному та інституційному рівнях задля поліпшення якості педагогічних програм відповідно до глобальних тенденцій у галузі освіти.

Ключові слова: інноваційні моделі навчання, розвиток компетентностей, критичне мислення, інновації в освіті, модульний підхід.