

VII International Forum on Teacher Education

The Problem of Continuity in Teacher Education in a Complex World

Zhadra A. Zholdasbayeva* (a), Suriya I. Gilmanshina (b), Gulmira M. Abyzbekova (c)

(a), (c) *Korkyt Ata Kyzylorda University, City of Kyzylorda (Republic of Kazakhstan), 29A Aitekebie Street, zholdasbaeva.zhadira@gmail.com*

(b) *Kazan Federal University, 420008, Kazan (Russia), 18 Kremlyovskaya Street, gilmanshina@yandex.ru*

Abstract

The implemented reforms in the education system of Kazakhstan are focused on modernizing the content of education at all levels and the transition to education for sustainable development. This research analyzed the Kazakhstan's education system with regard to the implementation of the principle of succession in a complex world. It was revealed that the peculiarity of the new programs of general education is associated with the implementation of the principle of spiraling based on the cognitive theory of Jerome Bruner, while the programs of pedagogical universities do not provide systematic training of future teachers to implement the spiral approach in education. On the example of chemistry education, it is established that the study of existing approaches to identifying the essence of continuity in education allows to identify the target interconnected hierarchical system of education. It implies the correspondence of the levels of the general (succession of education), the special (succession in professionally-oriented chemical education), and the specific (succession in chemistry education). The systemic problems in ensuring the principle of succession, especially in school education in Kazakhstan, were revealed. The programs of higher and postgraduate pedagogical education do not take into account the changes in the curriculum of general education. The formation of modern national pedagogical system requires revision of training programs in teacher training universities.

Keywords: principle of continuity, education system, teacher training.

© 2021 Zhadra A. Zholdasbayeva, Suriya I. Gilmanshina, Gulmira M. Abyzbekova

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published by Kazan federal university and peer-reviewed under responsibility of IFTE-2021 (VII International Forum on Teacher Education)

* Corresponding author. E-mail: zholdasbaeva.zhadira@gmail.com

Introduction

The 2020 United Nations concept note "Education in the Era of Covid-19 and beyond" (UNESCO, 2021) states that the crisis caused by the pandemic has worsened existing problems in education, including the issue of its continuity. There is the need to ensure the flexibility of the education system, which presupposes consistency between different levels and forms of education. At the same time, the crisis stimulated innovative processes, especially related to the continuity of education.

In 2021, Kazakhstan approved the concept of lifelong learning (Government of the Republic of Kazakhstan, 2021). The pursuit of this concept assures the continuity of various levels of education; integration of formal, non-formal, and informational education; access to the profession through adaptable ways that aim at recognizing qualifications and learning outcomes, and increasing the population's labor mobility.

An action framework for the development of education and science is being implemented in Kazakhstan. In 2015, the Republic of Kazakhstan undertook the task of achieving the Sustainable Development Goals set by the United Nations in the 2030 Agenda (UN General Assembly, 2015). Achievement of the fourth goal – ensuring inclusive and equitable quality education, promoting lifelong learning opportunities for all – is one of the most important tasks. To achieve it, the main directions of educational development in the world are defined: the provision of preschool education, 12-year school education model, the development of 21st century skills of students, equal access to cheap and quality vocational and higher education (UN General Assembly, 2015). These directions are also the priorities for the Kazakhstani education system; they are outlined in the State Program of Education and Science Development of the Republic of Kazakhstan for 2020-2025 (Government of the Republic of Kazakhstan, 2019).

The main objectives of the Kazakhstan's system of education and science are to rise the global competitiveness of education and science, educate individuals on the basis of universal human values, increase the contribution of science to the socio-economic development of the country, develop human capacity, modernize the content of education at all levels, develop infrastructure and digitalization, transform management and financing systems, and modernize the research area. The implementation of these goals is related to the solution of the following tasks: ensure the high status of the teaching profession; modernize teacher education; reduce the gap in the quality of education between urban and rural schools, regions, educational institutions, students; ensure a comfortable and safe learning environment; introduce an updated system of quality assessment of students, staff, educational organizations built on the most excellent practices; ensure continuity of education, professional training according to the needs of the economy and regional peculiarities; ensure students' intellectual, moral, physical, spiritual development;

provide educational organizations with digital infrastructure and state-of-the-art material and technical base; introduce a vertical system of education management and financing.

New state compulsory school education standards, model curricula and training programs were developed recently in Kazakhstan. Meantime, the educational curricula of higher education, in particular in pedagogical specialties, did not take into account changes in school educational programs. The lack of continuity in the content of general education curricula of general secondary education and educational programs of higher and postgraduate education for the training of highly qualified pedagogical personnel poses problems that influence the quality of the education system as a whole, and school education in particular. The processes taking place in the conditions of modern Kazakhstan education indicate that the mechanisms for implementing the continuity of education are very weak.

In this context, the study of the problem of ensuring the continuity of education in the context of renewing the content of secondary school education on the example of chemistry education is relevant.

Purpose and objectives of the study

The purpose of the study is a theoretical analysis and identification of the principles of continuity of education in the "school-university" system in the context of updating the content of secondary school education on the example of higher chemical and pedagogical education in the Republic of Kazakhstan.

Literature review

In the conditions of the dynamically changing modern world, the Kazakhstan education system is being modernized, which makes it possible to timely and appropriately address the "challenges of the time" and focus on the integration of Kazakhstan's educational policy into the world space.

In accordance with the Education Act of the Republic of Kazakhstan (Government of the Republic of Kazakhstan, 2021), the education system based on the principle of continuity and succession of educational curricula includes seven levels of education: preschool education and training; elementary education; basic secondary education; secondary education (general secondary education, technical and vocational education); after-secondary education; higher education; postgraduate education.

One of the main priorities of the state policy of Kazakhstan is the formation of a national model of education. For all levels of education, a key role was assigned to the development of state general education standards, which ensured an equal opportunity for students to acquire knowledge, develop skills and abilities regardless of the types and kinds of schools, their location.

In 2018, Kazakhstan adopted new state compulsory education standards at all levels of education (Ministry of education and science of the Republic of Kazakhstan, 2018).

The implementation of the state general educational standard of education of the Republic of Kazakhstan is aimed at the transition of education from a cognitive model to a competency model of teaching and upbringing, as well as changing the quality of education, which considers all components of the education system: standards and programs, management systems, validation of scientific and pedagogical personnel, quality of educational services, learning conditions, self-education and upbringing of the student, learning outcomes.

The content of education is determined by curricula, which follow state general education standards of education (Ministry of education and science of the Republic of Kazakhstan, 2018). Curricula, depending on the content and direction (purpose), are subdivided into general education (standard, working); professional (typical, working) and additional.

The study of problems of continuity is an important area of research in the field of education; scientific works of many famous scientists Bazyleva (2018), Okulova (2006) and others are devoted to this problem. Continuity from a practical point of view is ensured by the use of a system of methodological tools, the content of textbooks, teaching aids and programs, the sequential presentation of educational materials from simple to complex, the organization of independent work of students. Ensuring continuity in learning presupposes a continuous conversion of quantitative changes (information) to qualitative ones (mental development), which ensures a natural and gradual shift in the development zones of students, which is expressed in the gradual complication of educational tasks and a purposeful change in the measure of each level of education. At the same time, the change in these zones is also a change in the stages of personality development and serves as a precondition for its more effective inclusion in the teaching and learning process of the next level.

Continuity in education is manifested in the following aspects 1) providing systemic knowledge; 2) further development of forms and key methods as well as the content of training; 3) advanced education and training, contributing to the formation and improvement of the personality.

Shuinshina, Alpeisov, Akhmetova, Tuyakov, & Adamova (2019a, 2019b) determined the principles of continuity, taking into account the updated content of the school curricula on the example of the natural science subject "Chemistry". The study revealed the continuity of the curriculum of the subject "Chemistry" at the levels of school education in the framework of the updated content of education.

It is shown that in each subsequent class, consistent development and deepening of knowledge and skills is ensured throughout the course of teaching the subjects "Natural Science" and "Chemistry" from grades 2 to 11.

There are very few studies devoted to the problem of ensuring the continuity of the content of higher pedagogical education in accordance with the updated content of secondary schools. This is primarily due to the academic freedom of Kazakhstan universities in solving the problem of ensuring the continuity of educational programs in educational institutions that train teaching staff for higher education institutions.

Universities independently develop educational programs for higher education in accordance with the requirements of the State Educational Standard, reflecting the learning outcomes, on the basis of which curricula are developed (working curricula, individual curriculum for students) and working curriculum for disciplines (syllabuses). The content of the educational program of higher education consists of disciplines of three cycles – general education disciplines (GED), basic disciplines (BD) and major disciplines (MD). The GED cycle includes the disciplines of a mandatory component (MK), a university component (UC) and an optional component (OC). The BD and MD cycles include the UC and OC disciplines. UC and OC are determined by the university independently and take into account the needs of the labor market, the expectations of employers and individual interests of the student.

The volume of the GED cycle is no more than 23% of the total volume of the educational program of higher education or 56 academic credits. Of these, 51 academic credits are allocated to the disciplines of a compulsory component: Modern history of Kazakhstan, Philosophy, Kazakh (Russian) language, foreign language, Information and communication technologies (in English), Physical culture, Module of socio-political knowledge (political science, sociology, cultural studies, and psychology).

Of the 240 credits to be mastered during the entire undergraduate study according to the standard, 51 credits are compulsory according to the state standard, and 177 credits are cycles of basic and major disciplines developed by each university independently.

The Center for the Bologna Process and Academic Mobility in the Republic of Kazakhstan performs the functions of the Operator of the information system "Register of educational programs of higher and postgraduate education". The EP register performs an accounting and information function and allows to inform interested parties (employees of organizations of higher and (or) postgraduate education (OHPE), employees of secondary education systems, parents of schoolchildren, applicants and others) about educational programs implemented in OHPE. The inclusion of an educational program in the EP Register confirms the compliance with the qualification requirements for educational activities of the OHPE.

The presence of an educational program in the EP Register is one of the criteria for obtaining a state educational order. Thus, the quality of educational programs has a direct impact on the training of personnel in OHPE.

The Higher School of Kazakhstan developed educational programs taking into account the potential of the teaching staff and the teaching and laboratory base, the needs of the labor market. Output learning outcomes have been developed in accordance with the Dublin Descriptors. In the State Educational Institution of Higher Education, the academic independence of universities has been expanded to 65%, for master's degrees – 70%, for doctoral studies – 90%.

In matters of quality assurance of educational services of higher educational institutions, in recent years, priority has been given to accreditation (institutional and specialized). It is carried out on a voluntary basis, the university independently chooses the accreditation body included in the register of the Ministry of Education and Science of the Republic of Kazakhstan. In 2012 Kazakhstan was included in the European register of quality assurance in education. The National Register includes ten accreditation agencies, including two Kazakhstan ones.

Analyzing the expertise of accreditation agencies, the following was identified:

- the names of individual modules do not reflect the updated content of secondary education;
- the expected learning outcomes do not coincide with the content of the module or discipline;
- the expected learning outcomes lack knowledge of the concept of the updated content of secondary education, the new assessment system, regulatory documents and the procedure for maintaining school records;
- the expected learning outcomes to a greater extent reflect academic knowledge as well as personal and professional competencies than the practical skills and abilities of future teachers, that is, they do not correspond to the descriptors of the professional standard “Teacher”;
- the expected learning outcomes are reflected in quantitative indicators;
- the expected learning outcomes are recorded for all specialties without taking into account their specifics;

- there is no unified approach to the formation of modules of educational programs, taking into account the renewal of the content of secondary education.

For the high-quality training of future subject teachers for general education schools of the Republic of Kazakhstan on the basis of the updated content of the curriculum, it is necessary to revise the curricula in the natural scientific disciplines of higher pedagogical education.

Teacher education in Kazakhstan is undergoing considerable changes associated with the problem of continuity in the system "school-university". This process was triggered by the renewal of the content of general education provided by the new state standard of school education, new curricula, and programs designed for intellectual schools. Pedagogical activity in modern schools of Kazakhstan assumes the readiness of the teacher to develop students' critical thinking, creativity, and functional literacy; build a harmonious digital educational environment; conduct research work; apply information and communication technologies in teaching; organize innovative activities in the classroom. At the same time, teacher training should meet the qualification requirements of the global educational space and meet the goals and objectives defined in the Strategy "Kazakhstan – 2050" (2012).

Since gaining independence, one of the main priorities of the state policy in Kazakhstan has been the formation of a national model of education development. For all levels of education the key role was given to the development of state compulsory standards of education (SCSE) which ensured equal opportunity to acquire knowledge, skills and abilities by students regardless of the types and types of schools, their location, etc.

In Kazakhstan, for secondary school education, the first state compulsory standards of education (SCSE) were developed in 1998, the social and economic situation in the country repeatedly demanded its improvement. The development of model curricula and teaching-methodical complexes (TMC) made it possible to prevent the appearance of low-quality educational courses and reduce the educational load. At the same time, these standards were based on the subject approach and "knowledge-centric" orientation of academic subjects.

The 2012 SCSE was a transitional standard from the 11-year school to the 12-year model of secondary education. For the first time, it focused on the development of students' functional literacy.

The updated educational content standards adopted in 2016 differ significantly from previous standards in that they set the expected outcomes at the "exit" from school in the form of a wide range of skills.

The learning achievements of students are assessed by means of knowledge assessment criteria, while taking into account the special educational needs and individual capabilities of students.

With the adoption of the new standards, a gradual transition of all grades to the updated content of education began in 2016. In the 2016-2017 school years, only first graders began using the Common Core textbook; in 2017-2018, grades 2, 5, and 7 began using the Common Core textbook. In 2018-2019, they were joined by grades 3, 6, 8. Testing of a new program for grades 4, 9, 10 will also begin.

For the level of higher and postgraduate education, it should be noted that in accordance with the principles of Bologna declaration, a gradual transition from specialist to bachelor degree (except for medical specialties) began in 2000. Master's and PhD programs were first introduced in 2004. Until 2012 the Master's degree programs were taught mainly in humanities disciplines. With the implementation of the industrialization program, the state order was reoriented to technical specialties. The number of students enrolled in master's and PhD programs has increased significantly in recent years.

During the years of independence, the modernization of higher education in Kazakhstan was conducted in the following directions:

- Integration into the European Higher Education Area (signing of the Lisbon Convention in 1997, Kazakhstan's accession to the Bologna Declaration in 2010, development of academic mobility of students and higher-education teaching personnel);
- Opening a world-class university (Nazarbayev University) and joint international universities (International Kazakh-Turkish University named after Khoja Ahmed Yassawi, the Kazakh-British Technical University, a branch of the Lomonosov Moscow State University).

The SCSE of higher and postgraduate education was developed in the context of expanding academic freedom of universities. The ratio of compulsory and optional disciplines was reconsidered in the direction of gradual reduction of the compulsory component.

The Higher School of Kazakhstan developed educational programs taking into account the capacity of the teaching staff and laboratory facilities, the needs of the labor market. Output learning outcomes were developed in accordance with the Dublin Descriptors. In SCSE of higher education, the academic independence of HEIs is expanded to 65%, master's degree – 70%, doctoral studies – 90%.

In 2012, the National Qualifications Framework (NQF) was adopted. It created the basis for the recognition of qualifications in the labor market and the implementation of the lifelong learning strategy.

In 2013, the Plan of phased development of the national qualifications system was developed. In subsequent years the NQF was amended accordingly. On the basis of 13 professional standards 131 educational programs were developed. The standard for the cycles of socio-humanitarian and natural-science disciplines was unified. This develops academic mobility and technology of the educational process.

The development of model curricula, educational programs, working curricula for specialties, individual curricula for students and curricula for the disciplines must necessarily comply with the requirements of SCSE of higher education.

Methodology

In order to identify compliance with the principle of continuity, the analysis of modular educational programs of pedagogical specialties of universities was carried out. The modular educational programs of 15 universities with a description of the expected learning outcomes were analyzed. The analysis was based on the updated content of educational programs of secondary school education.

The methodological basis of the research is the theoretical provisions on the integrity of the pedagogical process, the main ideas and concepts of the educational standard, the scientific and pedagogical foundations of the formation of professional education standards, aspects of the continuity of secondary and higher education, the principles of the formation of educational programs. The study relied on the following research methods: theoretical analysis, systematization and generalization of psychological and pedagogical literature, normative documents regulating the pedagogical activity of teachers in Kazakhstan, educational programs of teacher training universities. The content of the educational program "Chemistry", modular educational programs for the training of teachers of chemistry of 15 universities of the Republic of Kazakhstan has been studied.

Results

The first concepts of chemistry education are taught within the subject Natural Science studied in grades 1-4 of elementary school and continue to be taught in grades 5-6 of basic secondary school. The subject Natural Science is a propaedeutic course aimed at laying the foundations of teaching the subjects Biology, Geography, Physics, and Chemistry in the basic school, developing the ability to apply the acquired knowledge to explain, describe, predict the phenomena and processes of nature encountered in everyday life (at home, at school, in the natural world).

In secondary schools of Kazakhstan, the subjects of natural and mathematical cycle Chemistry, Physics, Biology, Geometry, Algebra and Geography are taught in parallel with the updated content of education from 7th grade. Teaching the subject Chemistry in the updated content is based on the fact that students not only understand the meaning of chemical processes, basic laws and regularities but can also safely apply them in real life as well as develop practical skills.

The content of the curriculum of the school subject Chemistry consists of 5 sections: Particles of Matter, Laws of Chemical Reactions, Energy in Chemistry, Chemistry and the Environment, Chemistry and Life.

The features of the updated content of chemistry education in secondary schools are:

- the spiral principle of discipline;
- hierarchy of learning objectives based on the laws of cognition and classified according to the most important types of subject operations (measurement of results, consideration of all types of learning activities from reproductive to creative);
- careful goal-setting by a discipline level and throughout the course of study which allows for the clearest possible consideration of the connections within the discipline;
- correspondence of the content of sections and topics of modern disciplines, the emphasis on the formation of socialization skills.

The main feature of the updated content of chemistry education in secondary schools is the spiral principle of the subject.

The educational program, built on the spiral principle, is based on the cognitive theory considered in the work of Jerome Bruner "The Educational process" (Takaya, 2008). According to the author, even the most complex materials can be very well understood by young children if they are properly structured and presented.

The main features of a spiral educational program based on Bruner's work:

- the student repeats the same topic several times during subject instruction;
- the depth and complexity of the topic increases with each repetition;

- the new knowledge is closely related to the previous knowledge and is considered in terms of previously learned information.

Proponents of a spiral curriculum urge attention to the following priorities: each time a learner repeats a topic, the information is supplemented and validated; the educational program "spiral" allows a logical progression from simple ideas to more complex ones; it is recommended to encourage students to apply their previous knowledge to achieve the final learning goals.

In general, the purpose of studying the subject "Chemistry" in high school is to provide students with a system of knowledge about substances and their cycle, the laws and theories that explain the dependence of the properties of substances, their composition and structure, enabling students to understand the meaning of chemical processes, basic laws and patterns, safely apply them in real life, critically evaluate information, and make decisions.

The main objectives of chemistry education in secondary school include:

- formation of the system of knowledge about substances and their transformations into each other (facts, concepts, laws and theories);
- formation of experience of realization of popular methods of activity in the form of intellectual and practical abilities and skills;
- formation of experience of creative, searching activity requiring independent modernization of the previously learned knowledge and skills in the solution of problems arising in the course of training, formation of a new way of action on the basis of known ones;
- formation of valuable and constructive attitude to the object or means of human activity, reflecting the attitude to the environment, manifested in the formation of actual and subject competences, which are the cumulative contribution of the subject "Chemistry", affecting the solution of life problems of each member of society.

Thus, the updated educational program includes a transition to modern educational philosophy and methodology, transformation of teaching methods, improvement of models in the educational system, effective approaches to teaching and learning as well as the transition to a developing constructive model of learning that provides cognitive activity, self-esteem, patriotism, national spiritual values, multiculturalism, health, and environmental education.

The study of educational programs of higher and postgraduate education has shown a lack of consideration of changes in the educational programs of secondary education. Due to the lack of succession in the content of educational programs of general secondary education and educational programs of higher and postgraduate education to train highly qualified teachers, there are problems affecting the quality of the entire system of education. These problems require further research to develop recommendations for improving modular educational programs of pedagogical universities.

As a result of the study, it was found that the succession is a process of growth of students, which proceeds through their comprehension of existing and new knowledge. Succession should be understood as a consistent deployment of the university system of educational process in a dialectical connection with the system of activities of secondary school in order to form a student as an object of university training and education. Analyzing various approaches to the definition of succession, we conclude that succession is more often considered as a connection and as a principle. From the pedagogical point of view, teaching succession is the main didactic principle, which includes all sides of the educational process.

One of the important factors that can affect the problem of continuity of general secondary higher education is the profile education in high school. At the high school level, the general secondary education of students is completed, providing their general development, formation of functional literacy, social adaptation of the personality, professional and civil self-determination of young people. Profile education as one of the forms of pre-professional training process in the conditions of a general school is the most favorable environment for the formation of professional self-determination.

The problem of successful professional self-determination of students can be solved on the basis of established interaction between secondary and higher education and, above all, by ensuring succession in the formation of students' personality, in the content, methods, and means of education.

As a result of the analysis carried out in the study, it was found that the practical implementation of the continuity of teaching chemistry presupposes:

- the use of logically related series of textbooks and other educational and reference literature (textbooks whose authors adhere to a unified system of concepts, notations, mathematical transformations);
- the use of constant chemical terms, notations, concepts, and systems of units;
- organization of succession in the use of theoretical provisions and their practical implementation, computer experiments;

- strengthening of interdisciplinary connections of chemistry, physics, mathematics, computer science, biology;
- clear coordination of educational material, timing of its teaching.

The greatest interest is the possibility of ensuring the succession of formation of socially significant motives for learning of high school students because these motives not only meet the social order of society at a crucial stage of its development but also characterize important personal qualities of students.

The educational and research activities of students are one of the factors in the formation of a sustainable cognitive interest in chemistry for modern secondary school students. In accordance with the principle of succession in the process of learning chemistry in secondary school, partially exploratory and exploratory experimental tasks seem to be the most effective. Research technologies stimulate students to independent research work and form a stable cognitive interest in chemistry, since teaching as research implies that the feature of the student's research activity is the subjective discovery of new knowledge on the basis of actualization of previously acquired knowledge and skills.

Working on projects and research papers as a form of extracurricular activity introduces students to new concepts, the study of which is carried out much later in the lesson. This knowledge is used by students in the future in the classroom. Conducting such research tasks stimulates curiosity in all students, and their systematic use in the educational process contributes to the formation of a deep cognitive interest in chemistry, develops their scientific worldview, forms research skills and skills in both middle-level students and high school students.

Succession in high school education in profile groups gives students the opportunity to prepare for higher education. The unpreparedness of high school graduates for higher education is often related to their inability to use the knowledge they acquired in high school. Therefore, the teaching process should be aimed not only at forming solid subject knowledge but also at making students aware of the process of knowledge development, its logic and structure, the formation of metacognition as the basis of a scientific worldview. With this purpose, in the senior school, the skills of independent work with the educational literature, creation of presentations, video films, booklets, and work with additional sources of information are formed.

In recent years, the experience of "Nazarbayev Intellectual Schools" (NIS), the curricula of which were developed jointly with the International Cambridge Examination Council, have been widely transmitted in general education schools in Kazakhstan.

NIS carries out the educational process at three levels of general and secondary education: primary education; basic secondary education, general secondary education. This structure takes into account the stages of students' maturation, age-specific development of their cognitive abilities, as well as positive experience in the organization of the educational process in the world educational practice.

Discussion

The principle of continuity in the education system is due to the objectively existing stages of learning and concerns the content of training, its forms and methods, strategies and tactics of interaction of subjects in the learning process. Continuity allows combining and structuring individual learning situations in a holistic learning process of gradual learning of natural links and relations between objects and phenomena of the world.

The essence of succession in learning is based on the retained basic knowledge received at the previous level of education and its gradual increase and refinement at the expense of removal of the marked contradictions at the subsequent levels of education. In this case, learners gradually form primary physical concepts which grow in the process of learning into systems of concepts between which a logical continuous connection is established.

If previously, general secondary education was seen as the foundation of higher education, in connection with the concept of education "lifelong learning", it is now seen as part of a through-line of the entire system of continuing education. From this point of view, the essence and functions of higher education have also changed, lined up in a general through-line that runs through a person's entire life.

The lack of continuity in the content of general secondary education curricula and educational programs of higher and postgraduate teacher education creates problems that affect the quality of the education system as a whole, and school education in particular.

Ensuring succession between the curricula of secondary and higher education is an important task when it comes to the transition from the former to the latter. It is advisable to ensure continuity in the selection of educational content at different stages, taking into account the prospects of scientific and technological development, on the one hand, and the needs of students, on the other.

It is not easy to ensure succession of content between different levels and stages of education in real life, for example, in the United States two years of the four-year cycle of undergraduate education are spent to fill gaps in the general educational development of students.

In the Soviet period, the secondary school curriculum included the necessary amount of knowledge for studying at a higher educational institution. This provided school leavers with a wide range of choices and equal opportunities to access higher education. The experience of post-Soviet education shows that graduates of most general education schools have not sufficiently mastered general skills in their subject (chemistry, in particular); it is difficult for them to continue studying their subject at a higher education institution. The system of centralized state testing undoubtedly has its advantages, but it assumes that secondary school students and applicants to higher education institutions are focused only on test-taking. Such an orientation prevents the development of skills of generalization, analysis, mastering the skills of experimental work and performing creative assignments.

On the basis of the analysis, the following was noted (the conclusions relate to the science area):

- the titles of individual modules do not reflect the updated content of secondary education;
- the expected learning outcomes do not correlate with the content of the module or discipline;
- the expected learning outcomes lack knowledge of the concept of updated content of secondary education, the new evaluation system, regulatory documents and school documentation procedures;
- the expected learning outcomes to a greater extent reflect the academic knowledge than the practical skills of future teachers, as well as their personal and professional competencies, i.e. do not correspond to the descriptors of the professional standard for teachers;
- there are cases when the expected learning outcomes are expressed in numerical indicators;
- the same expected learning outcomes are prescribed for all specialties without taking into account their specifics;
- there is no unified approach in the formation of modules of educational programs, taking into account the renewal of the content of secondary education.

Thus, the study of the content of the educational program "Chemistry" and the analysis of modular educational programs for the training of teachers of Chemistry in 15 universities of the Republic of Kazakhstan showed that the educational programs of universities are not oriented to the updated content of school Chemistry.

Moreover, the educational programs of universities are designed without regard to updating the content of education in secondary schools and cannot ensure the readiness of future teachers, graduates of universities to work on updated curricula in the educational organizations of the country.

In this regard, we recommend providing seminars on the updated content of education and criterion-based assessment for developers of educational programs with the involvement of experts; expanding the content of the discipline on criterion-based assessment to include the concept of updated educational content (new standards, curricula of secondary education).

In general, during the years of Kazakhstan's independence, the country has been gradually improving the entire education system on the basis of international and domestic experience. Legislative frameworks, state compulsory standards of all levels of education, modular educational programs, and curricula are being updated. At the same time, the observance of the principles of succession between the educational programs at different levels of education is enshrined by law.

However, this study has revealed significant discrepancies between the educational programs of schools and universities, requiring a revision of the modular educational programs of universities on the basis of the updated content of school programs.

Conclusion

The analysis of Kazakhstan's educational system with regard to the implementation of the principle of succession in a complex world revealed that the peculiarity of the new programs of general education is associated with the implementation of the spiral principle, based on the cognitive theory of Jerome Bruner, while the programs of pedagogical universities do not provide systematic training of future teachers to implement the spiral approach in education. On the example of chemical education it was found that the study of existing approaches to identifying the essence of succession in education allows to identify the target interconnected hierarchical system of education. It implies the correspondence of the levels of the general (succession in education), the special (succession in professionally-oriented chemical education), and the specific (succession in chemistry teaching). The systemic problems in ensuring the principle of succession, reflecting on the quality of education in general, especially school education in Kazakhstan, were revealed. Namely, the programs of higher and postgraduate pedagogical education do not take into account the changes in the curriculum of general education; the formation of modern national pedagogical system of teaching staff requires revision of training programs in universities for future teachers.

Funding

This paper has been supported by the Kazan Federal University Strategic Academic Leadership Program.

Competing interests

The authors have declared that no competing interests exist.

Acknowledgements

The authors have no support to report.

References

- Azimov, Y., Gilmanshin, I., & Gilmanshina, S. (2016). Modern technologies of waste utilization from industrial tire production. *IOP Conference Series: Materials Science and Engineering*, 134, 1-15.
- Bazyleva, N. V. (2018). Succession of general secondary and higher education at the school-university stage. *2nd International scientific and practical conference*, 22-24.
- Gilmanshin, I. R., & Gilmanshina, S. I. (2017). Competence formation of engineering directions students in the field of energy saving as a way to create new generation technologies. *IOP Conference Series: Materials Science and Engineering*, 240, 1-15.
- Government of the Republic of Kazakhstan. (2019). *On approval of the state Program for the Development of Education and science of the Republic of Kazakhstan for 2020-2025*. Retrieved from <https://adilet.zan.kz/rus/docs/P1900000988>.
- Government of the Republic of Kazakhstan. (2021). *On the approval of the Concept of Lifelong Learning (continuing education)*. Retrieved from <https://adilet.zan.kz/rus/docs/P2100000471>
- Government of the Republic of Kazakhstan. (2021). *The Law of the Republic of Kazakhstan «On Education» with amendments and additions*. Retrieved from https://online.zakon.kz/Document/?doc_id=30118747
- Kazakhstan - 2050. (2012). *Message of the President of the Republic of Kazakhstan-Leader of the Nation N. A. Nazarbayev to the people of Kazakhstan*. Retrieved from <https://adilet.zan.kz/rus/docs/K1200002050>

- Ministry of education and science of the Republic of Kazakhstan. (2018). *On the approval of the state mandatory standards of education at all levels of education*. Retrieved from <https://adilet.zan.kz/rus/docs/V1800017669>
- Okulova, L. P. (2006). *Coherence of Educational Programs as a Prerequisite for Succession of Educational Standards in the "School-Higher Education" System*. Izhevsk: Institute of Advanced Training and Retraining of Educational Workers.
- Roberts, P. (2006). *Nurturing Creativity in Young People: A report to Government to inform future policy*. London: DCMS.
- Shuinshina, S. M., Alpeisov, E. A., Akhmetova, B. S., Tuyakov, E. A., & Adamova, M. E. (2019a). Continuity of Educational Programs by Levels of Education. *International Journal of Experimental Education*, 2, 23-28.
- Shuinshina, S. M., Alpeisov, E. A., Akhmetova, B. S., Tuyakov, E. A., & Adamova, M. E. (2019b). Some Issues of Modernization of the Education System of Kazakhstan. *Modern problems of science and education*, 2, 1-5. DOI: <https://science-education.ru/ru/article/view?id=28692>
- Takaya, K. (2008). Jerome Bruner's theory of education: From early Bruner to later Bruner. *Interchange*, 39(1), 1-19.
- UN General Assembly. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. Retrieved from <https://www.refworld.org/docid/57b6e3e44.html>
- UNESCO. (2020). *United Nations General Assembly calls for sustainable funding for education in the era of COVID-19 and beyond*. Retrieved from <https://en.unesco.org/news/united-nations-general-assembly-calls-sustainable-funding-education-era-covid-19-and-beyond>