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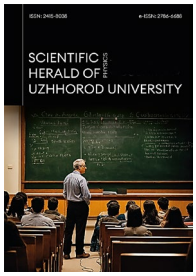

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The effects of teaching English in STEM education for ESL learners

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Abstract

Relevance. STEM education is a progressive trend in modern education. Its basic principle is personal development through scientific methods, technical applications, engineering design, mathematical modelling, foreign language learning. To improve the quality of knowledge in the modern education system it is necessary to use the latest information technologies, effective methods and techniques that will provide creative mastery of scientific knowledge in the learning process.

Purpose. The research aims to show the main techniques and methods of STEM education in teaching English as a second language. To form statistics and analytics for understanding perspective and trends of STEM-education development in educational institutions of Kazakhstan, to reveal their differences.

Methodology. The empirical research part consists of a survey of teachers at leading schools in Kazakhstan about the impact of teaching English in integrated learning, as well as an assessment of the educational programme by undergraduate students of one of the leading universities in the country. In illuminating this topic, pedagogical, comparative, dialectical, descriptive, deductive, and inductive methods as well as the method of analysis and synthesis were applied.

Results. The research resulted in the definition of the STEM-education method in teaching the English language with the application of theoretical foundations and applied skills, also the comparative analysis of programmes of leading world countries and Kazakhstani educational institutions on the implementation of education, named the main functions of robotics, defined the main tasks for development and promotion of integrated education in general. The study has provided an opportunity to highlight certain features and assess the prospects for further implementation of the latest learning technologies in the educational system of Kazakhstan.

Conclusions. The practical relevance of this study is determined by the main methodological aspects that affect the effectiveness of the use of the latest educational information technology, as well as improve the quality of ESL education.

Keywords: integrated learning approach; students; global experience; progressive trend; latest learning technologies.

Introduction

STEM (Science, Technology, Engineering, Mathematics) is popular in global education. The method combines science and engineering subjects into a single scheme, which involves a mixed system of learning, and shows students how to combine the study of science, technology, art, and mathematics in their everyday lives. These are the disciplines that are most in demand today. STEM education involves theory and practical application of the skills learned. Finland is a European leader in STEM training and graduation. There, a link is organised between pupils and students, and a teacher training programme has been developed. In such countries as the USA, Australia, and Malaysia there are state programmes to develop blended education. The main objectives are teacher training, the interest of schoolchildren, involvement of

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educational institutions in mutual work with business and industry. For example, in the Middle East or Turkey, STEM is academic in nature, and organisations are working to improve the quality of education teaching, with the priority of "quantity does not equal quality". Singapore has also made enormous strides in the development of cutting-edge technology. In early 2000, the Transforming Singapore programme was developed. Its main task was to transform the city into a world centre of design, creativity and innovation, and young people with out-of-the-box thinking are reforming the economy with creativity [1].

Educational measures are currently in place in the leading countries of the world, aiming to eliminate problems in STEM education through specialised programmes developed for primary, secondary, and higher education. England, and Scotland, have recommendations for the implementation of education reform. China, Korea, and Taiwan are developing curricula, identifying special attention for pupils on the impact of STEM education on later career choices. France, South Africa, and Japan organise extra-curricular activities (summer camps, competitions, Olympiads, extra-curricular activities). All these are aimed at attracting attention to STEM education in general [2].

ESL (English as a Second Language) learners in STEM education are rapidly increasing worldwide, and they diversify the STEM core workforce. Teaching English is a major component of the competence of future professionals. Following P. Duff, currently, quality educational training is impossible without introducing innovative technologies and approaches, namely in foreign language teaching [3]. Note that technology in the educational process needs to introduce continuous innovations that will contribute to the effectiveness of language education in schools and universities. By introducing integration in teaching, students will learn theory, and apply it to real projects.

As G. Yakman points out, one of the first who introduced the ideas of STEM education was R. Descartes [4]. He noted that all sciences are interconnected, so it is easier to study them without separating one from the other. Many educators in their publications have noted the unity of sciences, identifying the importance and effectiveness of interdisciplinary links. According to A. Toffler, creativity, design, and non-standard thinking, will be of great importance for the future workforce [5]. He believed that in the future those who cannot learn, develop, and retrain will be more illiterate than those who cannot read and write.

It is worth saying that Kazakhstan is keeping up with the latest technologies, moving in the same direction as the developed countries of the world. STEM education has become a kind of transition linking education and career. Since 2014, Kazakhstan has been actively introducing integrated education into the educational process. Robotics laboratories are opened, robotics circles are popular in schools of the country, smart schools are created, where new technologies are applied in education, and about 100 STEM laboratories start their activities [6]. V. Ibragimov and B. Murzalin described the provision of new opportunities in robotics circles, where students gain skills in thinking outside the box, and explore their creativity in creating software codes and building robotic models [7].

Based on the aforementioned, STEM education and the impact of teaching English as a second language is of particular importance in this research. The research aims to provide statistics and consider a strategy for the implementation of education in the learning process, namely the teaching of English. This will provide an opportunity for quality and effective educational levels of students concerning the conditions of the modern labour market.

Materials and Methods

The research employs the functional analysis method to highlight the main aspects of mixed learning. The method of logical analysis helped to characterise the peculiarities of Kazakhstan's model of the educational process with the introduction of the latest technologies and learning its features and principles on which it is based. The method of comparative and legal analysis provided an opportunity to study the experience of leading countries in the issue of STEM, namely, to assess their effectiveness. The method of system analysis helped to identify and understand that all principles allow for the implementation of these approaches as a complete system in the general education process and to characterise each of the principles. On this basis, the theoretical aspect of this study was described in detail. The method of synthesis in the paper investigates the problem of implementing STEM education in the educational process. Due to the basic methods of analysis and synthesis, it is worth noting the reliability of the conclusions obtained in the article, and the validity of the information obtained. These methods are applied for a clear understanding of the studied topic, revealing its general characteristics and principles.

Experimental work on introducing integrated methods in education in the teaching process was carried out (to study the impact of teaching English using a blended approach in ESL education) at Nazarbayev Intellectual Schools of Physics, Mathematics and Chemistry and Biology in the Republic of Kazakhstan. The study involved 60 teachers who answered the proposed questions with "yes", "no", or "sometimes". Another study on the implementation of the STEM approach was conducted through social networks among 100 undergraduate students of L.N. Gumilyov Eurasian National University. The survey was conducted at the end of the first semester (holiday week), and the age of respondents was 22-24 years old. With the results of the experiment, it was possible to find out the impact of teaching English to ESL learners as a percentage, they showed the interest of future professionals in the methodology of integrated education.

The analysis of the role and essence of English language teaching on the example of learners in Kazakhstani educational institutions allowed the axiomatic method. The analogy method in this study showed the analysis of the experience of Kazakhstani educational institutions in teaching English using integrated technologies. The dogmatic method in the article described recommendations for the implementation and teaching of the English language in Kazakhstani higher education institutions. The deduction method made it possible to characterize the model of education in educational institutions, identifying their features, attributes, and principles of implementation. This method has considered

certain features of the educational process. The abstraction method led to abstraction, with the main aim of in-depth research of a certain aspect of it, thus allowing to focus on the main methods of implementation of English language teaching in the STEM educational process. This method bears great significance in the research, it allowed to study the object of education at the level of its internal basic properties and relations.

The research used the comparative method, through which the analysis and methodology of English language teaching were considered. The deductive method provided an opportunity to identify the analysis of the individual properties and intrinsic elements of education based on its general characteristic. The deductive method in this study reveals the consideration of the main objectives of blended learning by different scholars. The works of scholars from leading countries on the issue of STEM education implementation in the educational process are considered. The systematic method involves research and the formation of scientific aspects in the study of teaching English as a second language as well as STEM education in general. Based on this, it can be said that all methods are inherently embedded in the plan of general scientific methods, more popular in literature studies.

Results

The integrated approach is the latest trend in education, which aims to create a strong relationship between school and society, the profession, and the world. The teaching of foreign languages to pupils in the early years leads to the formation of prerequisites for future learning activities. Early learning generates an enormous amount of interest and heated debate in society. This includes the objective understanding of the early age period for foreign language teaching and the methodological support for teaching, the organisation of teaching. Parent's interest in their children learning foreign languages is growing. Knowledge of foreign languages is a crucial aspect of social and cultural progress. STEM education allows for the integration of disciplines into a unified learning scheme, and foreign language is the main link in these disciplines. The main criteria in integrated teaching are the lessons in a foreign language. It is necessary to know a foreign language to understand the mentality and culture of other countries, it expands opportunities in the choice of future profession and employment.

The language aims at the programme of study, provides an opportunity to discuss the topic presented, and strengthens the motivation to use the language in the context of the material being studied. However, the main methodology in the teaching of English remains the traditional classical education programme. But, due to the introduction of the latest technologies in the educational process, the old school curriculum is less and less satisfying to the interests and requirements of the modern learner. Disciplines that are not connected scatter the learner's attention and do not consolidate the acquired information into a coherent whole. Technology in STEM education creates sustainable links between the studied disciplines, solving this problem; it allows applying one's skills in practice in various fields and industries. Overall, it can be said that it is a multifunctional-oriented approach that allows the student to cope with tasks of any complexity while applying knowledge from different disciplines. Therefore, this is why this method of teaching is the most effective and necessary in today's education. Traditional pedagogical methods in the teaching of integrated disciplines cause pressure on STEM ESL learners. ESL students face problems with complex scientific language in curricula, plans and in STEM professions. To better understand the language, ESL students need to learn to understand STEM-specific English vocabulary and apply it to the topics they are studying. For students learning English as a second language, this aspect is particularly challenging, quite often English words have different meanings when viewed in a context other than STEM. This also shows how scientific language shapes students' experience of science learning.

The basic principles of English language teaching are illustrated in Figure 1 for an understanding of integrated teaching.

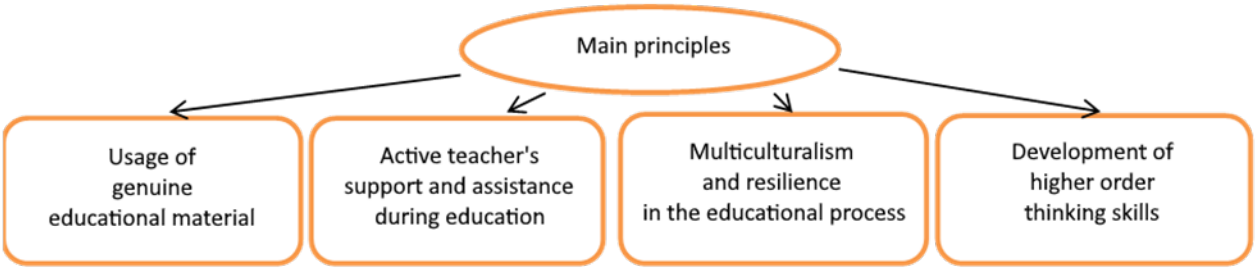

Figure 1. Principles of English language teaching

Thus, by adhering to the above principles, the process of learning in English will be purposeful, as only through language can specific communication tasks be solved. The integration of ESL and STEM subject learning in English through additional instructional language has an impact on improving English language learning in STEM. In language teaching, it is possible to integrate different disciplines. For example, hold a joint English and geography lesson in which they discuss seas, rivers, oceans, and astrology with characteristics of constellations and galaxies. Pupils can provide pictures and interesting facts about bodies of water and constellations while using specific vocabulary. In the process of learning, as ESL learners expand their scientific understanding, they increasingly turn to several modalities, e.g., pictures and symbols. In this way, learners learn how to apply different modalities to communicate their ideas, and they better understand when to display information in the form of graphs, tables, and diagrams. The beginning of development of STEM education in Kazakhstan begins with the Robotics Olympiad among pupils of secondary schools in 2014. Schoolchildren are becoming increasingly

interested in robotics and are actively involved in various extracurricular activities. Following statistics from the robotics website RoboLand, the number of teams from Kazakhstani schools arrives every year [8].

A consistent sequence of STEM processes has been created from kindergarten to higher education institutions, all the way to the workplace. Since 2016, all educational institutions have been connected to the Internet. And starting from the academic year 2019-2020, the subjects of natural and mathematical sciences are studied in English in high schools. All this contributes to the introduction of Kazakhstan's intellectual education system into the global scientific community. Particular attention in education is paid to the repetition of the studied material throughout the whole period of study. This promotes critical and creative thinking, communication, and teamwork. From this, it should be noted that Kazakhstan is developing on an equal footing with other countries. Although, it is also worth noting that the training of teachers to implement STEM education remains a significant problem. Teachers need regular professional development and accumulation of experience in teaching integrated technologies in educational institutions.

On this basis, the following challenges for the development and promotion of this education in the country can be seen (Table 1).

Table 1. Challenges for developing and promoting STEM education

The accumulation of links between different actors, their overall reinforcement and organisation:	• building relationships between educational institutions and business entities, for opportunities to intern and work on real projects; • the connection from school to university; • creating platforms for new developments, models to be made available for application, organising active communication, and sharing experiences.
General access to STEM education, organising career guidance:	• creation of centres, and clubs that aim to promote interest in the natural and exact sciences; • the summer camps, forums where education perspectives will be illustrated; • support with resources for their sites; • free libraries, and museums, where educational programmes will be presented.
Further education, qualification, retraining, and internships for teachers:	• development of plans and programmes for the internship of teachers practising STEM education; • development of methodological materials.

It is worth noting that in school education, learning in English for Kazakh students means understanding basic terms in the language of science and fully cooperating with the world's scientific society. Soon, there will be a shortage of programmers, IT specialists, engineers, technology production specialists. Professions unknown now will be popular, but one way or another they will all be closely intertwined with technology and manufacturing together with the natural sciences. Namely bio- and nanotechnology specialists. It is necessary to introduce nanotechnology into the educational process to prepare future students today. That is why projects for the implementation of STEM education in secondary schools are implemented in Kazakhstan, and training in this direction is carried out.

Let's take Nazarbayev Intellectual Schools as an example, whose main function is to develop and incorporate physics and mathematics and chemistry and biology innovations into the curriculum. The schools develop the abilities of gifted children. They aim to raise the quality of education in Kazakhstan in a specialised way and to enable the development of competitive personalities. The trilingual education system combines the best of Kazakhstani tradition, international experience, and the practice of the country's intellectual potential. Schools actively develop team teaching – one subject is taught by two teachers at the same time (one Kazakh teacher, the other a foreign teacher, who teaches the class in English). They teach to apply the language in practice in difficult situations. The academic curriculum is STEM-oriented, and subjects are combined with others. Pupils take an active part in international Olympiads, Physics and Mathematics, Chemistry and Biology competitions, and Robotics tournaments, where they win prizes and awards at the international level. Pupils go abroad to various thematic conferences and language courses. Graduates end up speaking three languages, develop throughout their lives, and graduate from the best universities in the country, as well as from international universities. They become competitive in the world labour market, which contributes to the development of Kazakhstan's international relations.

To study the impact of integrated education on learners, a pilot study was conducted in schools. Sixty teachers took part in a questionnaire which investigated whether the STEM method has a positive impact on the teaching of English to ESL learners (Figure 2).

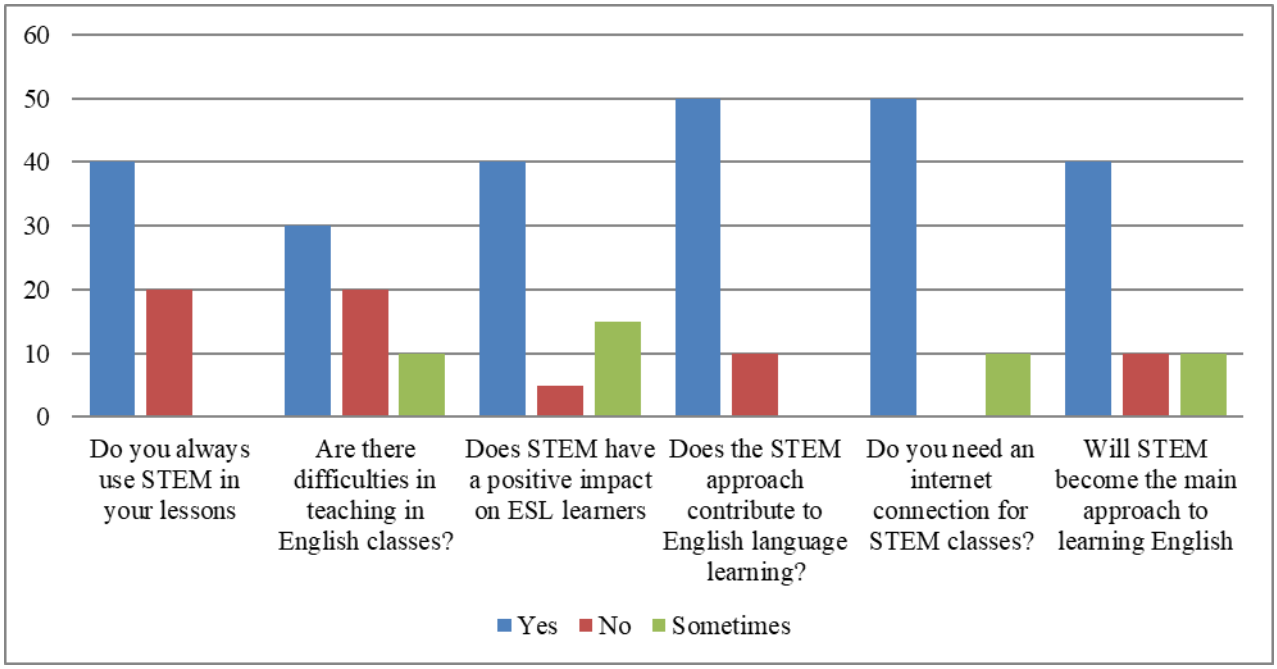

Figure 2. The impact of STEM education on ESL learners

Figure 2 shows that not all teachers are using STEM technologies in their teaching, many still have difficulties, but in general, the integrated approach helps in learning English. STEM education is also being introduced to the youngest pupils, for example, at "Miras" Kindergarten they teach the IBPYP (International Baccalaureate Primary Years Programme) programme to become researchers from an early age, without departing from the requirements of the country's educational standards. The children have already explored the human environment around the world and designed models of ancient and modern housing using various construction materials, as well as cardboard and paper. All projects are interdisciplinary and STEM-oriented. Festivals are organised every year, with technical creative skills, and all sorts of scientific discoveries and inventions, which develops competitiveness from childhood.

Al-Farabi Kazakh National University follows the development plan and has introduced the latest technologies into the educational process and diversified curricula to harmonise education with leading foreign universities by 2020. The State Compulsory Standards as well as the programmes of the world's leading universities such as Edinburgh, Harvard, Oxford, Cambridge, Strasbourg University, London and Munich Universities, Sorbonne, Massachusetts Institute of Technology, and others were analysed to develop new education curricula. As a result, new curricula for core disciplines at Al-Farabi Kazakh National University in science and technology and socio-humanities are developed, complemented by competency and a modular approach to the development of learning content. The plans are aimed at the main demands of employers and have a core set of disciplines consisting of a core set of professions. Following the Transformation Programme, the university's undergraduate specialisations are reduced, but the master's and doctoral specialisations are increased. The plan to increase the training of qualified specialists and the pedagogical capacity of the departments with the redistribution of professions between them has been implemented. It should be noted that the number of master's and doctoral students is still increasing, and the university is ranked first among higher education institutions in terms of the number of master and doctoral students.

The training of graduates who will practice STEM education, conduct analysis, and manage the learning process is also aimed at educators at L.N. Gumilyov Eurasian National University. Let's consider visually the main elements of the educational programme of the university (Table 2).

Table 2. Elements of a university's STEM education programme

Subject	Course direction
Natural science and STEM	Creating a system to introduce the subject skills of vocational training in nanotechnology together with cybernetics, computer science, physics, and mathematics
STEM education as a universal tool for teaching	Teaching using critical and creative thinking, integrated problem understanding, design fundamentals, engineering approach, understanding and application of the scientific method
STEM introduction	Application of aims, methods and objectives to the organisation and delivery of IT classes
STEM education policy	Creating a link between school-society-work, developing literacy and the ability to compete in society
STEM education in IT	Expansion of professional competencies

Foreign language (professional)	Creating communicative competence in the foreign language master's programme, teaching academic writing, preparing scientific reviews, critical analysis, and compiling bibliographies and essays on the topics of the research in progress
Micro robot programming	Review ways of introducing robotics in different areas of activity. Building learner experience in designing and programming robots
Maintaining and supporting STEM projects	Formation of Master's project practices, technological and engineering problem-solving designs
Education digitalisation	Use of digital Kazakhstan, 3D printing and graphics technology, digital information processing techniques in professional fields, and multimedia
Could technologies	A breakdown of cloud technology, its implementation in higher and secondary education, and training in virtualisation and consolidation technologies

As a result of studying at university, the future professional will:

- analyse the methodological problems of an interdisciplinary nature investigated in science at the present stage of its development and use the results in professional activities;
- be experienced in the application of modern pedagogical technologies and have good communication skills;
- monitor the state of STEM learning;
- understand the causes of integration consequences;
- use robotics, work with software, and design micro-robots;
- introduce cloud technology into the learning process;
- communicate with other participants in the learning process.

To investigate the satisfaction with STEM learning among undergraduate students, a university-based online survey was conducted. A total of 100 graduate students of the Faculty of Science participated in the survey. The results are presented in Figure 3.

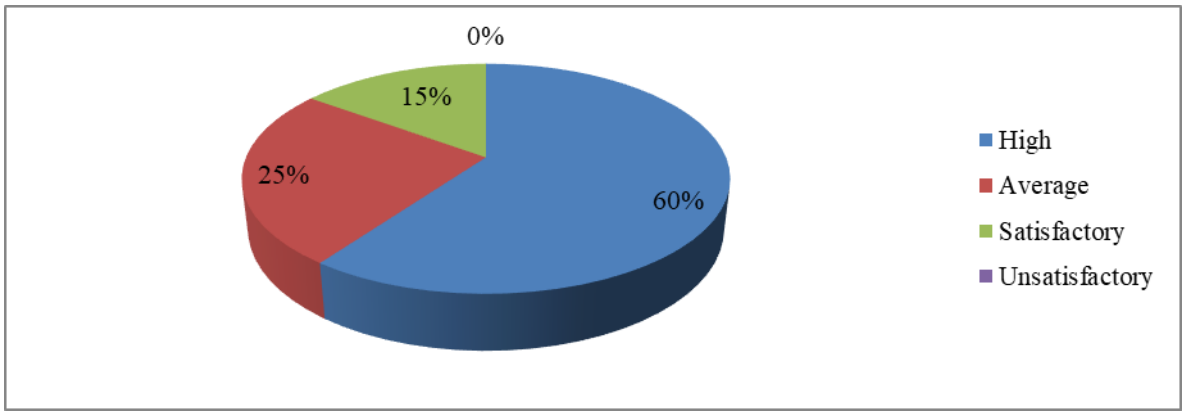

Figure 3. Indicator to assess the quality of satisfaction with the STEM education programme of Master's degree students in the science faculty

The results show that there are no unsatisfactory answers, students are interested in innovative programmes. Although the future science professionals who spoke satisfactorily about STEM education believe that the standard curriculum will be more accessible and easier to learn, the rest of the students are medium to high in their evaluation of integrated learning. Educational robotics has become a trend in STEM education worldwide. Robotics develops programming and design skills and integrates the entire education system. In Kazakhstan, it has also been actively developed since 2016. There are laboratories for robotics education, and pedagogical staff is being trained [9].

It is necessary to note that Haileybury schools are leading the way in an integrated education in Kazakhstan today. They are shaping new science curricula in the educational process, giving work to practitioners and enticing pupils to realise their work. Following V. Singeretsky, one of the leaders of such a school, STEM disciplines fill the leading place, using laboratories, 3D-printing, and robotic designers in the educational process [6]. The educational outcomes of Haileybury graduates depend on a strong teaching staff. They include Cambridge and York University graduates, professors, and doctoral students. The school aims to motivate high school students to work on academic projects and research and encourages gifted children in every way possible. For example, the best students at Haileybury Astana have been sent to NASA (National Aeronautics and Space Administration) for internships. The Haileybury curriculum is interdisciplinary, allowing for better learning. There was also an exchange with students from the Massachusetts Institute of Technology, which has had a positive impact on innovation and productivity in the educational process.

However, the main advantages and disadvantages of STEM education should also be noted when it comes to learning about STEM education (Table 3).

Table 3. Advantages and disadvantages of STEM education

Advantages	Education form: the pupils solve the questions on their own and tasks by collecting personal experience as well as becoming self-sufficient in their activities
	Critical thinking development
	Usage of practical experience
	Acquiring information from the source
	Experience and skill exchange with other countries
	Development of gifted kids
Disadvantages	Insufficient communication skills
	Incomplete creative skill development
	Educator requalification needed
	Traditional higher educational institution entrance exams

Concluding the empirical part of the research, it can be noted that the STEM method has a positive impact on the learning process, namely learning English, contributing to better language acquisition for ESL learners. This approach will broaden students' professional skills and open new opportunities in their choice of future professions. Thus, the examples of curricula of Kazakhstani educational institutions show that STEM education is oriented to the application of experiments in practice, modelling, independent creative activity, and implementation of ideas into projects. All this makes it easier for students to learn theory and practice and provides an opportunity to choose future professions. Quality teaching for ESL students using STEM materials is still an issue in any country and can influence society, so teachers' knowledge of the pedagogical content of disciplines ensures the evolution and development of integrated knowledge, and English needs a clear focus for ESL learners.

Discussion

The main aim of the STEM education approach was to form and implement an innovative educational platform, namely the integration of a foreign language, which increases the quality of speech, reading and writing studies. The foreign language is already a problem-solving subject for the learner, which develops motivation in further study of the whole learning process. The education system in Kazakhstan is moving smoothly towards integrated teaching in English. Researchers in this field believe that when teaching English in science classes, it is important to consider the age-specificities of the teacher. To motivate teachers, it is necessary to pay a surcharge on the teaching load [9]. It is worth agreeing with such recommendations, however, to add that a teacher should have basic language training, and methods of integrated English language teaching should be developed to improve programmes.

The issues of implementing new technologies in the educational process, as well as the problems of innovative STEM education of students, have been studied by scientists from around the world (USA, Italy, France, Germany, China, Singapore). A. Konyssova et al. [10] and R.R. Baiduc et al. [11] are most prominent. Using multimodal pedagogy in the context of the dominant traditional pedagogy of higher education, ESL students are enabled to introduce a broader palette of semiotic resources. H. Kahwaji points to the need to recognise and adapt pedagogical strategies to address 'multiliteracy' in the ways that ESL adults learn [12]. It is worth agreeing with such views of scholars, this study has shown that learners are more active and confident in learning to write in English through multimodal pedagogy.

A skilled workforce is on the rise all over the world. STEM professions are the top priority of modern life because of their capabilities following researchers from Qatar F. Kayan-Fadlelmula et al. [13]. In their opinion, the future generation of the Gulf countries does not show proper interest in the integrated approach, so in their work, they provided the results of a systematic analysis of blended education in the Gulf countries in connection with the introduction of new technologies. Researchers concluded that it is necessary to move to new standards of education through communication. It is worth agreeing with this judgement and adding that there is no material basis to work on a smooth transition from the traditional education programme to STEM. Chinese scholars have explored a new approach in the STEM education industry digital games. Following them, learning games in education will become a new type of learning in conventional education, as they effectively improve student learning [14]. Having studied their opinion, it should be noted that if the game process in learning would be strengthened, it is quite possible to develop such games in the STEM-education approach.

The demand for qualified specialists, who possess not only knowledge of theory but also practical skills in working with technological objects, is known to have changed tremendously already at the beginning of the 21st century. Thus, the research of many scientists, who conducted studies on this topic, revealed several factors and contradictions, namely the reduced motivation in learning STEM subjects and, consequently, the choice of the profession, the low level of education in the field of physics and mathematics. As a result, such shortcomings lead to a decrease in the quality and quantity of STEM professionals. It is worth agreeing with such results of researchers and adding that in the future the lack of STEM professionals will be a threat to the competitiveness of a developed country.

Vietnamese and Thai researchers jointly presented a project where they revealed the essence of basic pedagogical approaches in the branch of technology, science, mathematics, and educational engineering in Vietnam. The researchers believe that integrating the

approach will turn education into an innovative and inclusive education and that it will provide stable development. It is worth agreeing with this position of scholars, as the main function of STEM is to integrate all disciplines into a single learning scheme, which is already significantly different from the traditional curriculum [15]. In March 2019, a training programme for educators was organised in Da Nang and Hai Phong (Vietnam), where they were given the opportunity to develop their topics and STEM lesson plans in groups. It is worth noting that such activities are important and productive not only for gaining new knowledge but especially for sharing experiences.

However, there are other views on STEM education. Following S.M. Lesin and L.E. Osipenko, integrated learning technologies are detrimental to the educational process [16]. They believe that the introduction of the latest technology in schools is a senseless waste of the country's budget, and the use of technology traumatizes memory and causes addiction. One should not agree with this judgement, because STEM education provides the opportunity for the all-around development of the learner, which causes a desire for progress and development. For example, following A.A. Grustlivaya and E.S. Tregubova, STEM education is the main aspect of building economic power, and STEM professions are the professions of the future [17]. Such a judgement is correct, and it is reasonable to add that the future society also needs professionals trained in the latest technologies.

A researcher from India, G. Bansal believes that school and university graduates who do not speak English well are always at a disadvantage in society [18]. It is worth agreeing with his opinion about teaching science in English, but it should be noted that for such implementation it is important to provide the teaching staff with multilingual scientific education. Researchers in mathematics education A. Bray and B. Tangney believe that digital technologies have resources to discover new ways of learning and develop knowledge in mathematics and new methods of solving problems [19]. However, the researchers observed that this forces a change in the pedagogical approach, i.e., the teacher must have the appropriate qualifications. It is right to agree with this view. This study has repeatedly precisely stressed the importance of a teacher's professional competence.

It should be noted that the problem of STEM education in scientific terms has been little researched by Kazakh scientists. As correctly noted by L.K. Turabaeva, this is determined by the lack of specialists capable of mastering computers, information technology and technologies in all sectors of the economy [20]. Today, the issue of training specialists in relevant sectors remains unresolved. The ability to correctly apply information technology will help to learn educational and methodological programmes and to apply educational materials effectively. One can agree with this judgement but still add that controlling pupils' correct understanding of information, participation in discussions of information and the ability to solve problems is equally important.

Learning in English has become a popular trend in education in Kazakhstan, namely in higher education institutions. K. Akmaral, a researcher from Kazakhstan, pointed out the main reasons for students' choice to study in English and considered the main language problems of students when studying in English [21]. She shows that STEM students and social science students remain at different language levels. They have only writing and speaking in common. But it is worth noting that social science students and those who are STEM students are presented with fewer opportunities to improve their language quality upon graduation. The researcher correctly noted that students still have difficulties in learning because English is not their first language. To improve the quality of the language, it is necessary to gain experience by communicating in an English environment.

It is worth mentioning the study on gender equality in STEM education by H.K. Ro et al., who highlighted the main ideas of such equality in education in Kazakhstan [22]. The research shows how formal education in universities and informal learning take place through mass media, with propaganda and the reproduction of gender roles largely ignoring women in education. Scholars believe that the problems faced by women are because there are more men than women in Kazakhstan in STEM occupations. This research will be of interest not only to those studying the topic of education but also to the understanding and certainty of education in the country.

Based on this, it is important to note that all reviewed studies are professionally performed effectively and presented with appropriate quality indicators. The reviewed analysis of researchers' activities in integrated education of the leading countries of the world allows for making certain changes in the current legislation of Kazakhstan. This provides an opportunity to improve the quality of education in the country, and to train competitive specialists in the future, based on the basic requirements of the labour market.

Conclusions

The study was conducted to identify English language teaching using the latest technology. As part of the studied topic, STEM education in the leading countries of the world was examined and the main aspects of the programme of scientific and practical education were highlighted in the example of educational institutions in Kazakhstan. The empirical part of the study showed that education has a positive impact on students, teachers are increasingly implementing STEM methods in education, and students are increasingly satisfied with this teaching methodology. Following the research results, it can be determined that the formation of STEM reform is influenced by three main aspects: global economic issues, the need for a workforce, and the demand for integrated professionals.

Thus, it is necessary to introduce basic integrated approaches in modern education into the mainstream of traditional education. In summary, STEM education is the main trend in modern education and one of the main innovations of the current century. Soon, innovative education will become part of the educational plans and programmes of universities, schools, and kindergartens. Such approaches in education will integrate "education-training-education-training". Universities will be able to engage world-class teachers online. The introduction of new-generation pedagogical technologies into the educational process will enable the effective creation of language and subject-specific, interdisciplinary learning in

the framework of STEM education, teachers will be able to go beyond the traditional curricula. Educational methodology changes the position and habitual directions of the teacher and the student, which will increase the students' cultural level of personality, and the quality of learning English, as well as provide an opportunity to develop professional skills and abilities, providing new ways to choose a future profession.

As a result, STEM education provides knowledge and understanding of the professions of the future and gives access to new technology and enormous financial opportunities. New professions are created through it, which means new jobs, giving students an understanding of a stable, carefree future. Attempts are being made around the world to develop and improve teaching and learning models for ESL learners. There is a need to equip all integrated learning initiatives, especially those for ESL learners, to combine more innovative pedagogical practices as well as to address learners' need for knowledge in both STEM subjects and English. Based on the above, it can be concluded that further research will focus on exploring the development and implementation of curricula of in-demand subjects in modern teaching, with the application of integrated technologies in all areas of education.

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Conflict of Interest

None.

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Ефекти викладання англійської мови в STEM-освіті для студентів, які вивчають англійську мову як іноземну

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Анотація

Актуальність. STEM-освіта є прогресивним напрямком сучасної освіти. Її основним принципом є розвиток особистості за допомогою наукових методів, технічних застосувань, інженерного проектування, математичного моделювання, вивчення іноземних мов. Для підвищення якості знань у сучасній системі освіти необхідно використовувати новітні інформаційні технології, ефективні методи і прийоми, які забезпечать творче оволодіння науковими знаннями в процесі навчання.

Мета. Дослідження має на меті показати основні прийоми та методи STEM-освіти у викладанні англійської мови як другої іноземної. Сформувати статистику та аналітику для розуміння перспектив і тенденцій розвитку STEM-освіти в навчальних закладах Казахстану, виявити їх відмінності.

Методологія дослідження. Емпірична частина дослідження складається з опитування вчителів провідних шкіл Казахстану про вплив викладання англійської мови в інтегрованому навчанні, а також оцінки освітньої програми студентами старших курсів одного з провідних університетів країни. При висвітленні цієї теми були застосовані педагогічний, порівняльний, діалектичний, описовий, дедуктивний та індуктивний методи, а також метод аналізу та синтезу.

Результати. У результаті дослідження було дано визначення методу STEM-освіти у викладанні англійської мови із застосуванням теоретичних основ і прикладних навичок, а також проведено порівняльний аналіз програм провідних країн світу і казахстанських навчальних закладів щодо впровадження освіти, названі основні функції робототехніки, визначені основні завдання для розвитку і просування інтегрованої освіти в цілому. Проведене дослідження дало можливість виділити певні особливості та оцінити перспективи подальшого впровадження новітніх технологій навчання в освітню систему Казахстану.

Висновки. Практична значущість даного дослідження визначається основними методологічними аспектами, які впливають на ефективність використання новітніх освітніх інформаційних технологій, а також на підвищення якості ESL-освіти.

Ключові слова: інтегрований підхід до навчання; студенти; світовий досвід; прогресивна тенденція; новітні технології навчання.