“Information Technology” subject programme

(Science and Mathematics strand in the framework of the curriculum reforms in secondary education initiative)

Secondary School (Grade 8)

This subject programme has been drafted by Nazarbayev Intellectual Schools AEO in cooperation with the National Academy of education named after Y.Altynsarin, higher educational institutions scholars and state school teachers.

Explanatory Note

Subject programme is an educational and normative document that determines the content and scope of knowledge, skills and abilities for each academic subject/discipline in accordance with the age-related cognitive abilities of learners.

Subject programme focuses the learning process on the use of the methodological potential of each subject for the learners' conscious learning of knowledge and skills in subject areas, the development of independence by mastering the methods of educational, design, research activities, acquiring skills to orientate themselves in the sociocultural space.

Subject programme harmoniously combines the traditional functions of a teaching and regulatory document with descriptions of innovative pedagogical approaches to the organization of the educational process in a modern school. Teaching approaches are the main reference points to build a fundamentally new structure of the subject programme. Value-oriented, activity-based, learner-centered and communicative approaches – as classical education frameworks – are used to strengthen the priority of the learning objectives system and educational process outcomes set out in the new structure of the subject programme.

At this stage one of the main requirements to the learning process is to organize active work of a learner in independent “acquisition” of knowledge. This approach alongside with acquisition of subject knowledge, as well as social and communication skills, contributes to development of personal qualities that enable learners to identify own interests, perspectives and make constructive decisions. Active cognitive activity of a learner becomes more sustainable in terms of co-creation and support of a teacher as a partner and an advisor.

Such strengthening of the learner-centered education is possible with the use of interactive teaching methods, which in various combinations provide the basis for cooperation of all the educational process participants avoiding authoritarianism in the relationships. The use of interactive and reflective technologies is combined with the organization of project and research activities of learners. All the innovative approaches to the organization of educational process transform the learning into a model of learners’ communication in real-life creative process, which involves active exchange of knowledge, ideas and work methods. The programme of particular subject enables developing the learner’s cognitive and social activity through arrangement of the learning project activity focused on the use of regional materials

(objects, enterprises, sources of information). Educational project work, carried out within the framework of the learning objectives of this particular subject, can be organized in partnership with parents and representatives of the local community.

Each subject programme provides for the implementation of trilingual education, which alongside with learning three languages also involves the organization of extracurricular activities of learners in three languages (Kazakh, Russian and English). The contribution of each subject to creation of multilingual learning environment provides for implementation of trilingual education policy. Communicative approach, being the basis of language learning, is considered as a leading principle in the development of learners' speech by means of each academic subject – exchange of knowledge and skills in a variety of educational contexts, proper use of the system of language and speech norms.

In the process of acquisition of the subject content and achieving the learning objectives it is necessary to create conditions/environment for the development of learners' skills of application of ICT, including searching, processing, retrieving, creating and presenting necessary information, cooperation to exchange information and ideas, evaluation and improvement of their work through the use of a wide range of equipment and applications.

The Subject programme suggests expected outcomes stated in the form of a system of learning objectives that form the basis for identification of the subject content. In terms of content subject programmes describe the contribution of a particular academic subject to educating a learner as a self-learning and interpersonal communication individual. The subject programmes ensure the principle of learning and education unity based on interconnectedness and interdependence between education values and learning outcomes and the learning objectives system for a particular subject at the output. The distinctive feature of the subject programme is that alongside with subject and integrated knowledge and skills, it is also focused on forming a wide range of skills. The system of learning objectives forms the basis for development of the following wide range of skills: functional and creative application of knowledge, critical thinking, conducting research activity, using information and communication technologies, application of different communication methods, ability to work in group and individually, problem solving and decision making. A wide range of skills is a key to learners' success in school educational experience, as well as in the future, after graduating from school.

Modern innovations in economy, changes to the labor market imply the necessity to possess skills which combination will enable learners to analyze and evaluate situations, ideas and information in order to solve complex problems or to develop new ways of solution, apply gained knowledge and experience creatively in synthesizing new ideas and information. Such personal qualities as initiative, curiosity, willingness to change, interpersonal skills are becoming relevant.

The content of the educational process in a particular subject builds on the learning objectives and focuses on forming the willingness of learners to apply gained knowledge and skills creatively in any educational and real-life situations, develops commitment to success and encourages lifelong learning.

Development of personal qualities in conjunction with a wide range of skills set up the basis for teaching core values of education: “kazakhstani patriotism and civil responsibility”, “respect”, “cooperation”, “work and creativity”, "transparency" and “lifelong learning”. These values are designed to become constant personal reference points for each learner motivating his behavior and daily activities.

Conceptual provisions and ideas, as the basis for the development of subject programmes, are presented visually and consistently in the following image (appendix 1). In the center there are values as the main reference points for determining the content and procedures of education in schools, and then there is a wide range of skills as the outcomes of school education. The next circle presents educational domains indicating functional comprehensiveness of the education content. And the outer circle contains all the innovations introduced to the educational process.

1. Aims and objectives of studying «Computer science»

Information technologies have become an integral part of our everyday life and gradually spread into all spheres of human activity. Use of information technologies speeds up and simplifies the process of working with different types of information, presented in digital form.

One of the priority directions of education in a number of countries is the formation of computer literacy of learners. On the one hand learners’ acquision of these competencies is the imperative of our time, on the other hand, this requirement is dictated by fact that information technology has become a new tool in studying other subjects, providing resources and technical means for integration with different educational areas.

The aim of studying the subject «Computer science» is to provide learners with basic knowledge, skills and abilities to work with modern information technologies for their effective use.

Main objectives:

- form learners' understanding of the role of information processes in society, technical capacities and perspectives of using information technologies in various spheres of human activity;
- promote formation of learners' abilities to use information technologies effectively in their daily lives, at school and further career;
- develop learners' understanding of basic principles of computer operation to enable them to analyze systems, to develop solutions, software applications, to develop and improve them and to assess products;
- teach learners to solve various problems through analysis, abstraction, modeling and programming;
- develop learners' logical, algorithmic and computational thinking,

including generalization, analogy, decomposition of a task into its components and definition of general patterns, finding effective and efficient ways to achieve the objectives;

- form learners' information culture - to follow generally accepted rules and act in the interests of individual and the whole Kazakhstani society;
- promote learners' acquisition of the academic language and reinforcing the conceptual apparatus on the subject.

Through the study of Computer Science, learners will understand that:

- computational thinking and modeling skills acquired in the course of Computer Science can be used to analyze various situations;
- systems can be modeled by means of abstraction, algorithms and programming;
- application of knowledge gained in the course of Computer Science can have a key influence on the development of science, technology, medicine, education and culture;
- use of programming skills allows to create applications that can improve the current activity, and enables the generation of new ideas.

2. Pedagogical approaches to the organization of educational process

At the present stage one of the priorities of education is the principle that learners should «learn to learn» and become independent, motivated, interested, confident, responsible and intellectually developed persons.

Teachers are expected to nurtureand develop these qualities by using a variety of teaching and learning strategies that include:

- listening to learners' opinions and recognition of the importance of using existing knowledge and understanding for further development;
- encouraging and extending teaching through carefully scaffolding tasks and activities;
- modeling problem-solving strategies providing learners with clear examples;
- support learning through "assessment for learning";
- promoting learners' research activities and active learning, based on analysis and problem solving;
- development of learners' critical thinking skills;
- organization of individual, pair and group work of learners as well as

whole class work.

Pedagogical approaches:

- Differentiated approach allows to actively develop creative and critical thinking of learners, to find other approaches to learning motivation, encourages creative development of personality;
- Activity approach allows to focus learning on executive activities that form key information and communication competencies on the basis of fully independent cognitive activity of learners;
- Learner-centered approach implies equal interaction of teacher and learner in the process of achieving educational goals. It allows achieving the following learning objectives: breaking down the barriers between a learner and a - teacher; establishment of dialogue relations; promoting the demonstration of personal qualities, creativity, aspiration to cooperation and social activity;
- Competence approach implies the acquisition of complex knowledge and skills, rather than in isolation from one another;
- Integrative approach allows for strong connection of«Computer science» with many other disciplines;
- Systemic approach in teaching «Computer science» lies in the fact that the course sections are considered in interrelation, rather than separately.

These approaches are implemented:

- group work, when learners carry out a joint project in groups - cooperation plays an important role as all programme products are created by groups of people, and each of them contributes to the overall project results;
- stimulating research activity- study of specific learning examples that contribute to the development of analytical, practical, communication (public speaking) skills and the use of theory, methods and principles to solve practical tasks;
- problem-oriented teaching- ability to solve problems inventively;
- use of critical thinking in collection, processing, storage and transferring information - ability to use only the «high-quality» information;
- project work - ability to plan further work, set goals, get necessary information from various sources, present and prove a hypothesis, conduct experiments, present the results of the work, analyze and evaluate, as well as the ability to protect the project;
- encouraging learners to use acquired skills in different real-life situations;
- setting open problems that require creative approach and interpretation;
- use of problems integrated with other subject areas, in order to demonstrate the applied nature of Computer science.

The use of information and communication technologies.

Learners develop skills of using ICT during the course by searching, creating and processing information, cooperation and exchange of information and ideas, evaluation and improvement of their work with the use of a wide range of equipment and applications.

The subject program on Computer Science includes the following skills of using ICT:

- application and development of computer models to simulate real-life systems and situations, as well as exploring these situations to ensure further understanding;
- using software to process texts, spreadsheets, images, create animations; process audio and video materials to solve practical problems;
- development of programmes in high-level language, which requires logic and computing skills;
- creative approach to using ICT tools to solve practical problems;
- collecting materials and exchanging experience through electronic means that allows to carry out collaborative group work on a particular topic;
- skills of independent learning and professional development;
- strengthening personal values and life priorities, taking into account own opinions about such issues as plagiarism, viruses, computer addiction, etc.;
- development of communicative skills, including selection of materials from various sources for a particular purpose and audience.

The subject of «Computer Science» should demonstrate examples of using computersin teaching and learning.

3. Approaches to evaluation of educational achievements

Assessment of the learning outcomes of the Informatics is carried out by criterial evaluation system.

Criterial assessment is a process of assessment based on a comparison oflearners' learning achievements with evaluation criteria that are well-known to all participants in the learning process (students, school administartion, teachers, parents and other legal representatives), consistent with the goals and content of basic primary and secondary education promoting cognitive abilities of learners.

Criterial assessment is based on the relationship between teaching, learning and assessment.

The results of the criterial assessment are used for effective planning and organization of the educational process.

The system of criterial assessment in senior school includes formative assessment and summative assessment.

Formative assessment – an assessment that determines the level of learning and developed skills of learners in day-to-day work at the lesson and/or at home and implements an interactive relationship between the learner and the teacher during learning, allows learners to understand to what extent they correctly complete activities in learning new material and achieve the goals and expected learning outcomes.

Summative assessment – an assessment that determines the level of learning and developed skills of learners after completing the study of the units of the subject programme over the term, after completing the level of education.

4. Arrangement of Informatics content

4.1 Distribution of academic load:

Grade:	The number of hours per week	Total number of hours per year
8	**1**	**36**

4.2 System of learning objectives

Content of the subject is organised into strands of learning. Strands are further broken down into sub-strands, which contain learning objectives allocated by grades in the form of expected outcomes: skills, knowlege or understanding. The learning objectives demonstrate the progression within each sub-strand allowing teachers to plan and assess, sharing with learners the next steps they should take.

№	Strand	Sub-strand
1	**Computer basics**	1.1 Correct ways of using a computer
		1.2 Measuring data: bits and bytes
		1.3 Encoding information
		1.4 CPU
		1.5 Network
		1.6 Bandwidth
		1.7 Cybersecurity
2	**Spreadsheets**	2.1 Spreadsheets
		2.2 Creating your first spreadsheets
		2.3 Formatting table
		2.4 Formulas
		2.5 Functions
		2.6 Charts/If statement
		2.7 Problem solving: Functions and Formulas
3	**Programming fundamentals**	3.1 Intro to programming
		3.2 Your First Program
		3.3 Variables
		3.4 Input. Comments
		3.5 Tracing an algorithm
		3.6 Conditional statements (If/else)

		3.7 Conditional statements (If/elif/else)
		3.8 Logical operators (AND, OR, NOT)
		3.9 Problem Solving: Conditional statements and Logical operators
4	**Programming**	4.1 For loop
		4.2 While loop
		4.3 Problem Solving: While loop
		4.4 Project work: Guess the number
		4.5 Project work: A quiz game
		4.6 Project work: "Rock, Scissors and Paper" game

4.3 Long-term plans

Strand	Titles	Learning objectives
Computer basics	1.1 Correct ways of using a computer	identify harmful effects of electronic devices; learn ways of protecting from negative effects of using electronic devices.
	1.2 Measuring data: bits and bytes	learn how a computer stores information; learn how to convert binary to decimal and decimal to binary number system.
	1.3 Encoding information	identify encoding standards; calculate the amount of information.
	1.4 CPU	define the main functions of CPU; compare CPU performance.
	1.5 Network	define how network works; identify network parts.
	1.6 Bandwidth	define what a bandwidth is; measure the bandwidth speed.
	1.7 Cybersecurity	identify possible threats; learn how to protect computer against cybercrimes.
Spreadsheets	2.1 Spreadsheets	identify what a spreadshet program is; define the features of Google Sheets.
	2.2 Creating your first spreadsheets	create a new spreadsheet; customize a spreadsheet.
	2.3 Formatting table	apply formatting to the table; use different data types.
	2.4 Formulas	learn how to use formulas; use relative and absolute values.
	2.5 Functions	identify Google Sheets functions; apply functions.
	2.6 Charts/If statement	apply charts and diagrams; use If statement.
	2.7 Problem solving: Functions and Formulas	use functions and formulas to solve problems
Programming fundamentals	3.1 Intro to programming	understand the programming languages; understand the meaning of programming.
	3.2 Your First Program	identify components of IDE; learn how to write a code in Python.
	3.3 Variables	learn purposes of variables;

		learn how to input data; solve problems in Python.
	3.4 Input. Comments	apply input commands to enter data; solve mathematical problems.
	3.5 Tracing an algorithm	apply tracing an algorithm; solve the problems.
	3.6 Conditional statements (If/else)	apply if statement; identify comparison operators; apply if/else statements.
	3.7 Conditional statements (If/elif/else)	apply if/elif/else statements; solve problems.
	3.8 Logical operators (AND, OR, NOT)	learn and apply Logical operators (AND, OR, NOT).
	3.9 Problem Solving: Conditional statements and Logical operators	apply Logical operators (AND, OR, NOT).
Programming	4.1 For loop	understand Loops; apply 'FOR' loop to solve the problem.
	4.2 While loop	improve understanding of Loops; apply 'While' loop.
	4.3 Problem Solving: While loop	identify Loops; apply 'For and While' loops.
	4.4 Project work: Guess the number	make a project.
	4.5 Project work: A quiz game	simulate solution for solving problem; make a project.
	4.6 Project work: "Rock, Scissors and Paper" game	make a project.

Appendix 1. Visual representation of conceptual ideas of the Curriculum Reforms in Secondary Education Initiative.


ENABLING LEARNING ENVIRONMENT
TRILINGUAL EDUCATION
INNOVATIVE PEDAGOGICAL APPROACHES
EXTRA-CURRICULAR ACTIVITIES
LEADERSHIP IN EDUCATION
ASSESSMENT FOR LEARNING
PROFESSIONAL COMMUNITY
MATHEMATICS AND COMPUTER SCIENCE
NATURAL SCIENCES (Science, Physics, Chemistry, Biology)
PROBLEM-SOLVING AND DECISION-MAKING SKILLS
COMMUNICATION SKILLS
TECHNOLOGIES AND ARTS (Music, Crafts)
RESEARCH SKILLS
CORE VALUES
- Respect
- Collaboration
- Openness
- Kazakhstani patriotism and civil responsibility
-Work and creativity
-Life-long learning
CRITICAL THINKING SKILLS
HUMANITIES (World understanding, Self-cognition, History of Kazakhstan, World history, Geography, Basics of Law, Economics, Kazakhstan in the modern world)
ICT SKILLS
CREATIVE APPLICATION OF KNOWLEDGE
PHYSICAL EDUCATION
TEAMWORK AND INDIVIDUAL WORK SKILLS
LANGUAGES (Kazakh, Russian, English) AND LITERATURE