Methodology

Transformation of education system supported by the government
Integrity (whole) and fuzzy education model

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Summary. The article describes the transformation of the existing education system into a model of holistic and fuzzy education. The authors indicate that in order to solve the problem of the activity of thinking in the process of teaching the learning goal «teaching and assimilation», they must be transformed into the goals of «learning and creation». To achieve this, the knowledge structures that students learn in the learning process must be logically modeled. The authors also note that when replacing the teaching theory of the currently established educational system with the theory of learning, thinking begins to act. When the movement of thinking is constructed using the tools of the theory of natural and artificial intelligence created by J. Piaget and L. Zade, the existing educational system is transformed into a new model of education – the Model of integral and fuzzy education development.

Keywords: sustainable education, transformation, learning theory, theory of study, the theory of natural perception, the theory of artificial knowledge.

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İntroduction

The goal of reforms in the education system is to ensure that students acquire and improve their academic, intellectual, social knowledge and skills meeting the requirements of life. In modern times, learning often involves acquiring knowledge, remembering it, and using it correctly. This is the elementary level of thinking skills: the learner acquires the knowledge, comprehends and applies it. But high-level thinking skills begins with the analysis and synthesis of the knowledge. After an individual has established these structures in his/her thinking, he begins to perform operational activities on knowledge. By continuously performing operationalactivities on knowledge, the individual enriches, replaces, and acquires the ability to create and evaluate new knowledge by applying it in many areas having common relationships.

Moreover, one of the main challenges today is to find and improve students' high intellectual abilities in their thinking and to find solutions to the practical application of these skills in life.

It was hoped that the rapid development of information and communication technologies and their implementation to the learning process would solve problems in education as soon as possible. However, its widespread application to the learning process has not had a serious impact on the solution of these problems so far. The reason is that while applying ICTs as an artificial form of human cognition to the learning process, unsystematic, logically unrelated knowledge and the knowledge that did not take into account the individuals' differences has been accumulated in it for centuries.

It is methodically focused on visual transmission of knowledge through sight and hearing. This led to the visualization of the learning process and increased the percentage of knowledge acquisition. However, the memory in human brain is not infinite, it also has limits. The way out here is to stir up thinking. Today, the movement of thinking in the learning process is about 2-3% [Gordon Drayden., Dr. Jeannette Vots, 2002]. If we raise the factors that influence thinking in the learning process, then the quality of education will change dramatically.

In order to solve the problem of provoking thinking in the learning process, the purpose of the training that bears **teaching and acquiring** should be changed into the training that bears **learning and creating.** In order to achieve this goal, the structure of the knowledge that the students are in contact must be logically changed during the training process.

In the 40s of the last century, Swedish scientist J. Piaget described the ways through which human thinking evolved [J.Piajete, 2001]. He used mathematical logic to illustrate the development of cognition and created the logic of integrity. For the first time, an «Integrity Model of Mother Language Knowledge» was cre-

ated by applying psychological tools of integrity logic that reflect the ways of improvement of natural cognition by Piaget in didactics [F.Bunyatova, 2008].

In this model, the linguistic knowledge is shown in the logical scheme of integrity. During the training, the knowledge in the integrity scheme is activated logically with the help of psychological tools by Piaget. Students encountered this logical knowledge begin their learning by starting to build their thinking structures and their knowledge as an isomorph to the logic of integrity.

In the 80s of the last century, Zadeh mathematically showed ways of creating artificial cognition with fuzzy logic [Lotfi Asker Zadeh, 1976]. The explanation of mathematical tools that instil the artificial cognitive logic coincides with the explanation psychological tools by Piaget, and based on these explanations it is possible to create of an artificial model of the Azerbaijani language with the help of artificial cognitive tools. The researchers R Ilahi, I Widiaty and A G Abdullah, while examining the use of artificial intelligence in education, came to the conclusion that Bunyatova applied artificial intelligence in the content structure of education for the first time in 2007 [R Ilahi., I Widiaty., A G Abdullah].

Thinking activates while substituting **the teaching theory** of the Education System Supported by the Government with **the theory of learning.** When this is built on the natural and artificial cognitive theories created by Piaget and Zadeh, the Education System Supported by the Government is transformed into a new education model called **«Integrity (whole) and Fuzzy Education Model» – IFEM.**

Created «Integrity (whole) and Fuzzy Education Model» – IFEM is being carried out since 2017 as a project called «Transition from teaching to learning» at the Secondary Experimental School # 23 named after T. Hasanov.

Structure of the «Integrity and Fuzzy Education Model» – IFEM

In this model, the subject knowledge looks like the integrity and fuzzy structure. In the learning process, this logical structure of the knowledge in student's thinking is stirred up constructively and the tools of integrity logic by Piaget and fuzzy logic by Zadeh alter all the components of the teaching.

What changes take place in transformation from the existing Education System to the «Integrity and Fuzzy Education Model»? How does it change?

A brief reference to Education System in AzerbaijaThe criteria of these approaches like progressivism, experimentalism, existentialism, pragmatism, realism, essentialism are reflected in modern curriculum programs [F. Bunyatova., G. Salamov] (from 2007 to present) and they all stimulates the development of education. However, this development has goal to teach – to acquire the given knowledge, it is not possible to develop high-level thinking skills. Updating programs every 5 year is not always effective as these are focused on only teaching.

Change of components

What is changed in the education system?

1 . Training has the purpose to teach.	1. Training will have the purpose to learn.
2. Active learning is the strategy of training.	2. Constructive training will be carried out.
3. The concept of knowledge units.	3. To the concept of knowledge structures.
4. Traditional structure of program knowledge.	4. To the structure of the «Integrity and Fuzzy Model of Knowledge».
5. Vertical structures of knowledge.	5. To the integrity scheme of knowledge.
6. Determined systematic program structure of subject knowledge.	6. To the «Integrity and Fuzzy Model of Knowledge» program structure.
7. Training activities aimed to memorizing.	7. To the intellectual activity.
8. Tasks to consolidate knowledge in memory.	8. To the tasks that stimulate thinking.
9. Lesson planning.	9. To the projecting of the lesson.
10. Traditional program structure.	10. To the genetic program structure.
11. The system of classroom lesson.	11. To the multi-level syllabus system.
12. Criteria for acquiring knowledge.	12. To the creating knowledge and criteria for the level of developing of thinking.
13. The role of the teacher is to transfer knowledge, and the role of students is to receive knowledge.	13. To the lesson designer, moderator, tutor. To the creator of the knowledge as a mental and educational activity.
14. Psycho-pedagogical approach.	14. To the nano-psycho-pedagogical approach.

1. Changing the teaching objective of training into the learning objective. Active training is the teaching strategy of the curriculum. The teaching objectives of the **active training** are changed into **the learning objectives** of the «Integrity and Fuzzy Education Model» – IFEM. The objective of active learning is that teachers teach their students scientific and cultural heritage through knowledge, and students should acquire knowledge actively and apply them effectively. Acquiring knowledge, working with knowledge means teaching, and these activities are considered to be the elementary level of cognition. In the process of learning, work is carried out on knowledge. High-level cognitive activities such as analyz-

ing, creating, replacing and evaluating knowledge are carried out. **The teaching** objective of education is changed into **learning.**

2. Active training that is considered to be the teaching strategy of the education system is replaced by constructive training. The learning paradigm changes when the purpose of knowledge acquisition is replaced by the creation of knowledge. Teaching – the theory of behaviourism is replaced by the theory of learning-constructivism. «In the constructive training by F. Bunyatova which is considered to be the basis of the model [F.Bunyatova, 2008], students perform logical thinking on their knowledge by introducing their inner senses and cognitive levels. In the result, they become creative by acquiring new knowledge. This creativity has the features of individual and cooperative activity. In this process, students create their high-level mental abilities and develop them».

3. Concepts of knowledge units are changed by the concept of knowledge structures. Didactic units of knowledge are the elements of teaching material. They are studied in a discrete, irrelevant way. This approach creates unrelated, unsystematic knowledge in student's thinking.

While changing the concept of knowledge unit to the concept of knowledge structures, the logical connections between knowledge structures are seen, and according to these connections, knowledge structures are not studied separately, they are studied in a related way.

Transformation of knowledge structures into logical knowledge structures

«After converting the concept of knowledge unit into the concept of knowledge structures, using the psychological mechanisms of «Theory of Cognition» by Jean Piaget, we find that knowledge structures have logical association and separation, associative, identical relationships with each other. These related knowledge structures are Logical Knowledge Structures – LKS presented by Bunyatova» [F. Bunyatova., G. Salamov].

Logical Knowledge Structures:

- Connecting knowledge structures;
- Separating – reflexing structures of knowledge of rotation; knowledge structures;
- Associative knowledge structures;
- Identity knowledge structures;
- Liquidating knowledge structures.

4. The traditional vertical structure of program knowledge is changed into the «Integrity and Fuzzy Model of Knowledge – IFMK». Till today, the subject

knowledge has been arranged vertically in the program. This means that students should have been learning for years to acquire the whole knowledge. As a result, knowledge is not formed in their thinking as a whole, and it is difficult to establish relationships among them. To overcome this problem, the structure of the subject knowledge is changed and the knowledge is modelled in the full scheme. Knowledge structures are modelled in the integrity scheme according to the «Modeling Technology of Knowledge on the basis of Integrity and Fuzzy Model of Knowledge» [F. Bunyatova., G. Salamov]. This logical modelling consists of two stages.

I Stage: «An integrity model of knowledge» is created on the basis of integrity logic by Piaget.

II Stage: Concepts of the «Integrity Model of Knowledge» are replaced by the concepts of fuzzy logic by Zadeh and an «Integrity and Fuzzy Model of Knowledge» is created.

I Stage Steps taken to create an «Integrity Model of Knowledge» i.e. an «Integrity Model of the Azerbaijani Language Subject Knowledge».

The question arises: Why is the model of language knowledge being created first? This is due to the fact that people express their thoughts through language. If a logical model of language knowledge is created, then a logical model of all scientific knowledge can be created, since each science is explained by language.

The following psychological terms are used as didactic terms in order to use the psychological tools of integrity logic by Piaget.

- *Didactic knowledge units – are understood as knowledge structures* and their internal structures are visible. Piaget has shown psychology in cognitive theory in two psychological structures: **invariant** (invariable) and **categorical** (variable).
- *Psychological invariant structures of cognition* are understood as invariable knowledge structures in didactics. For example, in the Azerbaijani language, invariant knowledge structures are defined as **parts of speech** and they are composed of 10 parts.
- *Categorical psychological structures of cognition are understood as categorical knowledge structures.* Categorical knowledge structures in the Azerbaijani language are understood as language categories – i.e. single and plural, tense, case, etc.

The categorical and invariant knowledge structures are interconnected. While transforming knowledge structures into logical knowledge structures with the help of mechanisms of the integrity logic by Piaget, intense logical relationships are formed among them. Based on the transformed didactic terms, the integrity model of knowledge is created isomorphically in the cognitive development.

Creating an integrity model of knowledge

Technological steps:

• The knowledge structures of the Azerbaijani language are classified and divided into variables and invariables. Variable knowledge is denoted by ***y***, invariable knowledge is denoted by ***x.***

• Invariable ***x*** knowledge – parts of speech are classified internally and numbered as ***x1– x10.*** Here ***x1– noun; x2 – adjective; x3 – numeral; x4– pronoun; x5 – verb; x6 – adverb; x7 – x10 structural parts of speech.***

• Variable knowledge y is also internally classified, marked and numbered as ***y1– y9.*** Here are some categories: ***y1 – is singular and plural; y2 – case; y3 – the category of possession, y4 – the category of tence , y5 – the category of person, y6 – the category of transitiveness and intransitiveness, y7– the category of voice, y8 – indicativeness, y9 – negation.***

• Marked and numbered invariable ***x1– x10*** knowledge is placed horizontally in the coordinates of the model.

• Marked and numbered variable ***y1-y9*** knowledge is placed vertically in the coordinates of the model.

The vertically placed variable ***y1-y9*** knowledge and the horizontally placed invariable ***x1-x10*** knowledge are integrity models of language knowledge. It is also a model of the **natural cognition of the Azerbaijani language** (Scheme 1).

Transformation of the «Integrity model of the Azerbaijani language knowledge» into an Artificial Intelligence model.

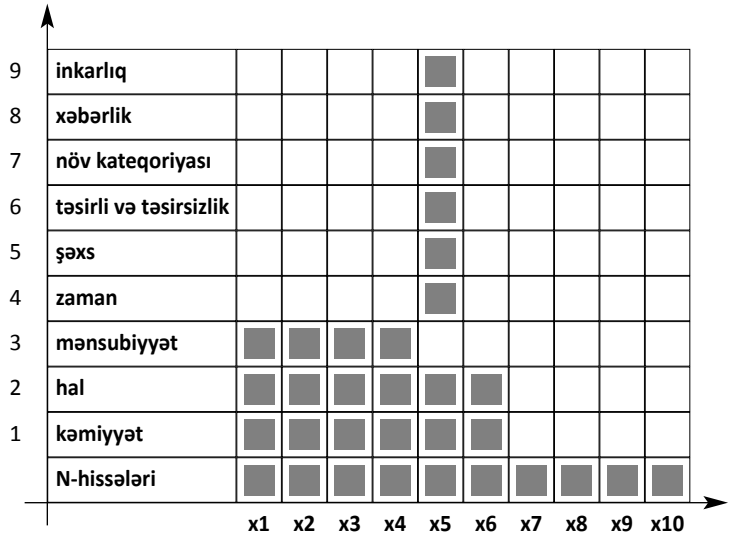
Piaget pointed out the natural structure of the cognition by integrity logic while Zadeh pointed out it by fuzzy logic. The concepts of integrity logic by Piaget coincide with fuzzy concepts by Zadeh [Fatma Khanum Bunyatova, 2012]. In order to make the model rational and apply it universally, the tools of the fuzzy logic by Zadeh is replaced by the psychological tools of the integrity model by Piaget. So a new knowledge model called «Integrity and Fuzzy Model of Knowledge» is formed and this model is considered to be the artificial model of language model which was constructed by the tools of the artificial

In this replacement:

• The conception of categorical knowledge ***y1-y9*** by Piaget is replaced by the conception of **linguistic variables** by Zadeh and placed vertically in the coordinate network by ***y0,1–y0,9.***

• Invariable knowledge ***x1-x10*** (word stock of the language) is defined as ***«fuzzy set»*** and placed horizontally on the coordinate network as ***x0,1–x1.*** In this model, the ***«elements of the cluster»*** are marked like: ***x0,1– noun; x0,2 – adjective; x0,3 – numeral; x0,4 – pronoun; x0,5 – verb; x0,6 – adverb; x0,7, x0,8, x0,9, x1*** structural parts of speech.

Scheme 1. İntegrity Model of Azerbaijani Language Subject Knowledge (morphologically)



y9 – negation; y8 – indicativeness; y7 – the category of voice; y6 – the category of transitiveness and intransitiveness; y5 – the category of person; y4 – the category of tense; y3 – the category of possession; y2 – the category of case; y1 – the category of quantity.

x1 – noun; x2 – adjective; x3 – numeral; x4 – pronoun; x5 – verb; x6 – adverb; structural parts of speech – x7, x8, x9, x10.

Accordingly, the possession function of the «fuzzy cluster» is understood lexically (Scheme 2).

• ***y0,1 – y0,9*** linguistic variables are understood as co rrelative-categorical knowledge of the language.

The created model is integrity and fuzzy model, i.e. a completely **artificial model of the Azerbaijani language.**

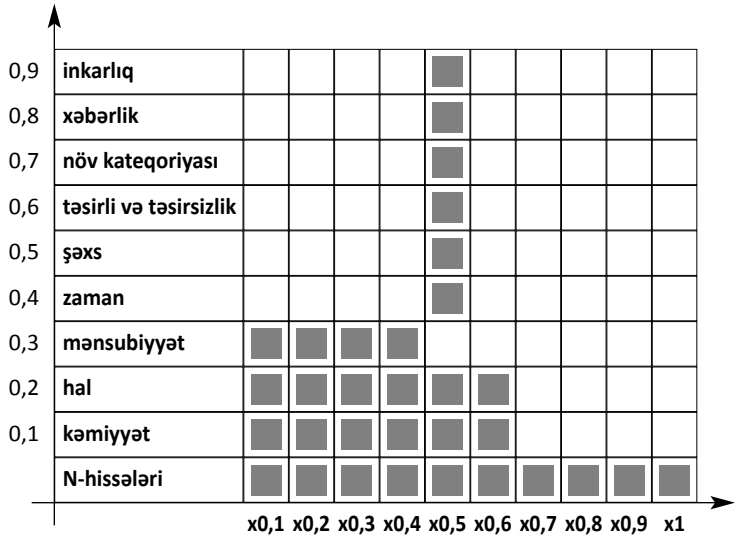
In this model:

• When invariant knowledge structures come into contact with changing knowledge structures, knowledge stir up and new knowledge emerges.

• Knowledge about the element of the cluster and linguistic variable knowledge are collected in the slot at the intersection of ***x, y.*** For example, the knowledge about the noun, its being singular and plural is collected in the knowledge nest at the intersection of ***x0,1, y0,1.***

• The knowledge structure shown in the scheme is a complete structure of the Azerbaijani language knowledge. In this structure, knowledge is not divided

Scheme 2. Integrity and Fuzzy Logical Model of Azerbaijani Language Subject Knowledge (morphologically)



y0,1 – the category of quantity; y0,2 – the category of case; y0,3 – the category of possession; y0,4 – the category of tense; y0,5 – the category of person; y0,6 – the category of transitiveness and intransitiveness; y0,7 – the category of voice; y0,8 – indicativeness; y0,9 – negation.

x0,1 – noun; x0,2 – adjective; x0,3 – numeral; x0,4 – pronoun; x0,5 – verb; x0,6 – adverb; structural parts of speech – x0,7, x0,8, x0,9, x1.

into academic years, i.e. classes.

• The knowledge to be learned in each academic year becomes the logical development of the knowledge in the knowledge slot.

• The model shows that, according to the rules of categorical knowledge structures, i.e. according to the -y, they can be combined with parts of speech ***<y0,1x0,1>*** and separated from parts of speech ***<y0,1>; <x0,1>*** logically. They may associate ***<y0,1, x0,1, x0,2, x0,3>*** and so on.

• The belonging of the categorical knowledge to parts of speech defines substitution, multiplication, enrichment, and identity logic operations on speech parts. In this case, categorical rules are always mobile as parts of speech.

• The created coordinate network can be regarded as an integrate scheme of the natural and artificial language. For example, ***«It has been snowing heavily since evening»*** is given in a natural language. This sentence will be written in an **artificial language** in the following way: ***<x0,4$_3$>; <x0,5$_3$, x0,5$_3$, x0,5$_3$, y0,1$_1$>; <x0,6>; <x08>; <x0,6>.***

Here it is given like:

It – ***<x0,4, y0,1, y0,5$_3$> pronoun, singular, 3 person, ; has been snowing <x0,5, y0,1, y0,5$_3$, y0,4; <x0,5, y0,1, y0,5$_3$, y0,4; <x0,5, y0,1, y0,5$_3$, y0,4; – verb, singular, 3 person, tence <x0,6> adverb; <x0,8> proposal <x0,6> adverb.***

While modelling a defined program structure of subject knowledge with the help of technological tools of «Integrity and fuzzy modelling of knowledge – IFMK» [Fatma Khanum Bunyatova, 2012], **we will have an «Integrity and Fuzzy Program Model» of knowledge.**

While modelling the traditional subject programs with the help of the tools of the «Integrity and fuzzy model of knowledge», the missing knowledge is added to the integrity scheme of knowledge. As a result of the modelling, the traditional program structure is transformed into a genetic structure of the subject, that is, from the most elementary to the most advanced. According to the English psychologist Fleyvell [Флейвелл Д, 1967], if a genetic program of knowledge is created, many problems in teaching can be solved, that is, everyone can succeed in education.

Students' memory-oriented learning activities are changed into intellectual activities.

When acquiring much knowledge by memorizing them directed into intellectual activity carried out on knowledge, students' learning activities change into intellectual activity. This transformation occurs during the transition from knowledge-oriented questions to thought-provoking questions.

Memory-oriented tasks are changed into tasks that develop thinking.

The tasks in the textbooks are aimed at acquiring the subject. The tasks given to students to achieve this goal consist of the following instructions: taking notes, identifying, applying, filling in the gaps, etc. These tasks are performed on one or two knowledge structures. Using tools of integrity logic by Piaget, tasks are given to perform logical thinking activities on knowledge. Through these tasks, students learn to integrate knowledge structures, to discover their interrelations, to clarify their relations, to classify, to enrich, or to substitute them with other knowledge structures.

Lesson planning is changed into lesson designing.

The teacher is at the centre of the lesson while planning the lesson . He becomes the leader of the lesson in a planned manner. As students always work and learn mentally in constructive teaching, the teacher designs their activities and at this time, the lesson planning changes into the lesson designing. Co-operative teaching structures[1] are used to create social skills during the design process.

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[1] https://ejercongress.org/public/assets/images/B%C4%B0LD%C4%B0R%C4%B0_%C3%96ZETLER%C4%B0.pdf

The classroom-lesson system is transformed into a multi-level lesson system.

In the classroom-lesson system, students are divided into classes according to their age and knowledge. This division causes difficulties for the weak students and keeps strong students from improvement as it focuses on the average students. According to the integrity and fuzzy program structure, the classroom-lesson system is transformed into the multi-level lesson system as every student can begin to improve his/her knowledge from his/her own level.

Assessment criteria for acquiring are changed into criteria for knowledge creation and improvement of thinking.

Criteria for assessing knowledge are considered to be knowledge, understanding, and application. When acquiring knowledge is replaced by knowledge creation, the criteria for acquiring are replaced by the criteria for comprehension-knowledge-application-analysis-evaluation-creation. These criteria are considered to be the measure of the high-level improvement of thinking.

Changing traditional training roles of teacher and students

During the transition from teaching to learning, the role of a teacher in the lesson is also changed and he/she becomes a designer, manager, moderator, mentor, and tutor. Students who passively receive knowledge change their roles according to the basis of learning. They make students change [Cooperative Learning Strategies]. from the students who acquire knowledge to the students who create knowledge, interact and develop themselves.

Psycho-pedagogical Approach of the Traditional Training transforms into Nano– psycho-pedagogical Approach in the training constructed with the help of an «Integrity and Fuzzy Logic».

When a high-tech approach is carried out on the psycho-pedagogical process in training, the psycho-pedagogical process in training and education transforms into the nano-psycho-pedagogical process.[2]

Experimental application of the «Integrity and Fuzzy Education Model– IFEM».

The «Integrity and Fuzzy Education Model» has been implementing in the learning process within the project «Transition from Teaching into Learning» since 2017 at the elementary grades of the experimental school № 23named after T. Hasanov, Baku.

The following tasks have been done to start the experiment:

- instructive trainings delivered for teachers to help them to teach with Constructive Teaching Technology which is considered to be the training technology of the model.

[2] https://edtech4beginners.com/2017/08/03/10-top-cooperative-learning-strategies-and-some-tech-tools-that-could-come-in-handy/

• The state programs of the Azerbaijani language for the primary schools have been modeled as «Integrity and Fuzzy the Azerbaijani Language Program» on the basis of the «Integrity and Fuzzy Modeling of Knowledge» technology;
• programs on mathematics were adapted in accordance with the students' improvement level;
• tasks that stimulate thinking (the Azerbaijani language and mathematics) were created;
• new assessment criteria and open and closed tests related to them have been developed [Fatma Khanim Bunyatova. Sudaba Hasanova];
• certain social and intellectual skills that students will acquire have been assigned;

During the experiment, a preliminary, interterm, and final monitoring of cognitive, academic, and social skills of the students' of the pilot classes was conducted.

Tutorship and mentoring services were provided to teachers participating in the project throughout the year, and their demonstrative lessons were corrected. In the second year of the experiment, the goal was to design a freely constructive course with «Integrity and Fuzzy Model of the Azerbaijani language programs», to prepare creative tasks, to evaluate them, and to construct students' learning activity in a team in a multi-structured way. At the same time, it was intended to pursue the intellectual and social development of students' cognition. In the alternative program, the focus was on the regular development of students' written and oral speech. This development was aimed at making the students understand what they did not understand, comprehend the meaning of each word.

The ability to ask thought-provoking questions and answer these types of questions is one of the most important language skills. Once this mental skill is formed in the thinking of each student, it turns into a universal skill that opens meanings of every new word and new concept.

At the end of the school year, demonstrative lessons were conducted in pilot classes. The main purpose of these lessons was to show how the students created their own knowledge. The lessons were listened to and discussed. The students' knowledge (within the program and beyond the program), their performance of intellectual activities on knowledge, their ability to build their knowledge, their learning activity within the team was discussed and evaluated psychologically and pedagogically.

The results of the project were compared in 3 formats to check their accuracy and sustainability.

• The comparison of the content and structure of state programs on the Azerbaijani language [F. Bunyatova] with the «Integrity and Fuzzy Azerbaijani Language» programs.

• The comparison of the lessons of teachers working with government programs with the lessons of teachers working with pilot classes;
• Comparison of cognitive performance of students studying with both programs by applying cognitive tests.

Comparison within format 1 displayed that the content of the «Integrity and Fuzzy Azerbaijani Language» program was 35-40% higher than the content of state programs. The knowledge of the Azerbaijani language program is presented in a comprehensible way. Digitization of knowledge creates infographics of knowledge. These infographics form the ability in students to apply their knowledge in a different way.

In the second format, open classes were conducted at the primary schools (1-4) not participating in the project, and the results of both sections were compared based on the cognitive development paradigm. There were significant differences between the pilot lessons and the lessons conducted within the state program. The teachers participating in the project showed how the students built their knowledge in their lessons, they showed how they use the knowledge and skills they have acquired to build their future knowledge within the program and beyond the program. Answering to the logical questions posed in the process of cognitive knowledge-creating process, students demonstrated how they create new knowledge. The lessons conducted by teachers working with the state program were mainly aimed at emerging their students' knowledge and transferring new knowledge in a convenient way using technological aids. Teachers used Internet resources to organize colourful lessons and students who were cognitively passive responded mechanically to the knowledge-oriented questions posed by teachers. This teaching activity reflected the level of knowledge students acquired. During the discussions of the lessons, teachers working with government programs said that they built their work based on the knowledge within the framework of the program and they mentioned that there is not much difference between their own lessons and the lessons conducted by the teachers who participated in the project. According to their viewpoint, learning means to memorize something by revising it repeatedly. Comparing the structure of the questions posed in the lessons and the structure of the tasks with Blum's cognitive taxonomy, the students' cognition studying with state program was at the elementary level – I knew, understood, and applied. The structure of the questions and tasks that teachers and students put during the pilot lessons was consisted of high cognitive skills – analyzing and synthesizing of knowledge, their creation, and operationally and continuously changing of knowledge. More importantly, most of the students' questions were open questions like ***«Why? How?»*** and the teacher's response was like ***«Why do you think so?»,*** «Cognitive tests» were prepared to check the development of the intellectual level of students participating in the project for comparison in the 3rd

format. Each of the six questions posed in the tests was regarded as an indicator of the level of the development of cognitive skills. The questions were based on mechanisms indicating operability of thinking in the cognitive theory by Piaget. 3rd and 4th-grade students participating in the project were given tests. To compare the results of the tests, these tests were given to the 4th-grade students studying with state programs.

Content and interpretation of cognitive tests.

- Measurement of the scope of program knowledge. (associative thinking; synthesis). Each knowledge is evaluated at 2 points. Extra program knowledge is evaluated at 3 points.
- Dividing the cluster into elements (classification; analytical thinking). Each correct division is evaluated at 3 points.
- Continue the series (substitution operation; creative thinking). For every variable («+»); («–») 2 points; («x» «:») 4 points; mixed variables («+» – «x» «:») 6 points.
- Conjugate (multiplicative operation; ability to find the similarity) 2 points for each correct conjugation, 4 points for extra program.
- Constructing of geometric figures.

(creative thinking) Each figure is evaluated at 4 points.

Continue (creative thinking).

(Interesting plot) 6 points; author's voice – 4 points; moment that provokes to think – 6 points; 40-50 words -4 points; 60-80 and over – 6 points.

Without mistakes – 5 points; 2-4 mistakes – 4 points; 5-6 mistakes 3 points; 7 ... – 2 points.

The test was assessed at a 100-point system.

Students who score more than >50 points have high level thinking skills.

Those who score less than <51 points have lower level thinking skills.

The monitoring involved 75 students from the experimental classes and 147 students from the state program classes.

Test results:

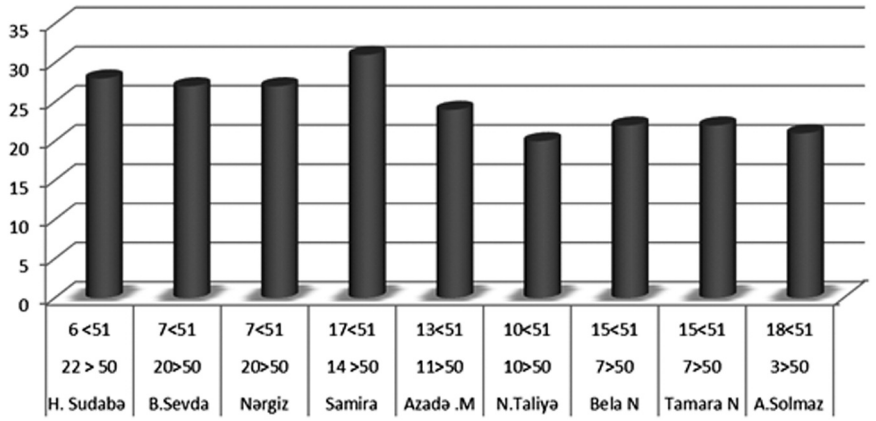
1. 50 students out of 75 pilot classes scored more than 51 points and reached the highest cognitive level and it accounts for 66.6% of the students.

2. 62 students out of the 147 students from the state program classes demonstrated high level cognitive abilities. It accounts for 42.1% of the students.

3. 20 students out of 27 students in one class studying with state programs had a score more than >50 points, which was the highest among the class of the same age. This is regarded as an indication of the teacher's work on knowledge while working with the state program.

4. The students of two teachers who are the coauthors of the manuals written by the by the state program, demonstrated the lowest cognitive results (3rd and 4th grades). (Scheme 3).

Scheme 3.



The results of the «Cognitive Tests», taken as a measurement mechanism for cognitive development show that the development of student cognition depends on several factors. These factors depend on the purpose of the training, the structure of the programs, the teacher, the constructive learning environment, the tasks given, the mental and learning activities of the students, and other components of the education system. This is the basis of the «Integrity and Fuzzy Education Model» proposed for the transformation education systems. When we apply this model in the future in the upper classes, we will have to find answers to these questions:

– How do individuals develop their knowledge in accordance with their cognitive development?

– How the program knowledge is relevant to the level of development of individuals?

– What are the differences between the implementation of the modelled and not-modelled state programs?

Challenges faced while realizing the project:

• Parents of primary school students welcomed the process as they began to realize the development of intellectual, social and cognitive skills of their children in a real-life program.

• The project continues within two subjects (the Azerbaijani language and mathematics) at the 5th grade. The constructive environment is considered the development of cognition. In other lessons, as no discussion is carried out in a constructive environment, the cognitive activity drops to the minimum;

• Teachers who do not participate in the project are not interested in creating a learning environment and giving thought-provoking tasks as their main objectives in the course of the lesson are to transfer knowledge, to apply them, and

to achieve high test scores;

• Parents and teachers see acquiring knowledge and scoring high points in tests as the main objective to be achieved in learning and they tend to go through this direction.

In the end, we come to the following conclusion:

1. The students of the 4th grade who have been studying with the «Integrity and fuzzy Azerbaijani language» program for two years and their final knowledge was scored 40% more than the state program knowledge. Besides the acquired knowledge on the Azerbaijani language knowledge of the secondary school in the compressed form. This means a 30-35% reduction in time spared for the subject.

2. In the course of learning, when students interrelations and relations among knowledge, classify, replace them with other knowledge, operability, i.e. the skill of making sustainable activity arise in their thinking.

3. Since the digital features of categorical and invariant knowledge allow each student to determine his/her knowledge coordinates, it is possible to create an individual training program out of the genetic program and teach them individually and distant.

4. As the Azerbaijani language and mathematics knowledge of the pilot classes were constructed in an integrity scheme, the students' knowledge expanded and deepened in the integrity scheme throughout the school year.

5. When the students in the constructive teaching environment perform thought-provoking tasks through the integrity and fuzzy modelling of the programming knowledge [Таксоноомия Блума], they are intellectually active during 30 to 40% of the lesson.

6. During the interactivity of constructive teaching, in team and class discussions, students share their academic, social, and intellectual abilities rapidly, and the boundaries of their knowledge and skills are expanded.

7. When the components of the education system are experimentally transformed into the components of the Integrity and Fuzzy Learning Model, a new educational model called «Integrity and Fuzzy Education Model» is formed.

8. All subject knowledge can be modelled with the help of «Integrity and fuzzy modelling of knowledge» technology, as there is variable and invariable knowledge in every subject knowledge.

9. A new model of distant education [F. Bunyatova]. and a new generation of textbooks – digital textbooks can be created on the basis of the technology of «Integrity and fuzzy model of knowledge» and the principles of constructive teaching [Baku, 2015]. In these textbooks, the knowledge should be given in a complete scheme like a. b. c. d. Students at each level can use these textbooks in accordance with their level.

10. When «teaching» is changed into «learning» during the teaching, the school of memory is replaced by the school of thinking.

Dayanıqlı təhsilin transformasiyası
Tamlıq və qeyri-səlis təhsil modeli

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Xülasə. Məqalədə dayanıqlı (dövlət tərəfindən dəstəklənən) təhsilin transformasiyasından, tam və qeyri-səlis təhsil modelindən söhbət gedir. Müəlliflilər qeyd edirlər ki, təlim prosesində fərdin təfəkkü-rünün hərəkətə gətirilməsi problemini həll etmək üçün təlimin öyrətmə və mənimsəmə məqsədi öyrənmə və yaratma məqsədinə dəyişdirilməlidir. Bu məqsədə çatmaq üçün təlim prosesində şagirdlərin mənimsədikləri biliklərin struktur quruluşu məntiqi cəhətdən dəyişməlidir. Müəlliflər həmçinin vurğulayırlar ki, dayanıqlı təhsilin öyrətmə nəzəriyyəsini öyrənmə nəzəriyyəsi ilə əvəz etdikdə təfəkkür hərəkətə gəlir. Bu hərəkəti J.Piajenin və L.Zadənin yaratdıqları təbii və süni idrak nəzəriyyələri əsasında quranda dayanıqlı təhsil sistemi transformasiya olaraq yeni bir təhsil modelinə – «Tamlıq və qeyri-səlis təhsil modeli»nə çevrilir.
Açar sözlər: dayanıqlı təhsil, transformasiya, öyrətmə nəzəriyyəsi, öyrənmə nəzəriyyəsi, təfəkkürün hərəkətə gəlməsi, təbii idrak nəzəriyyəsi, süni idrak nəzəriyyəsi.

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