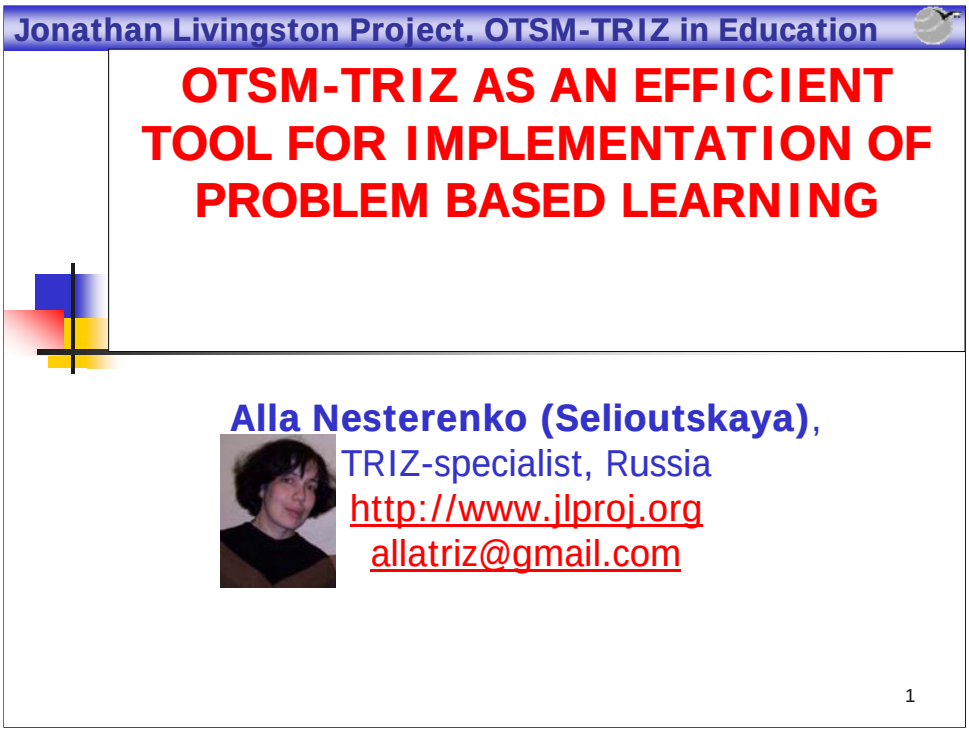
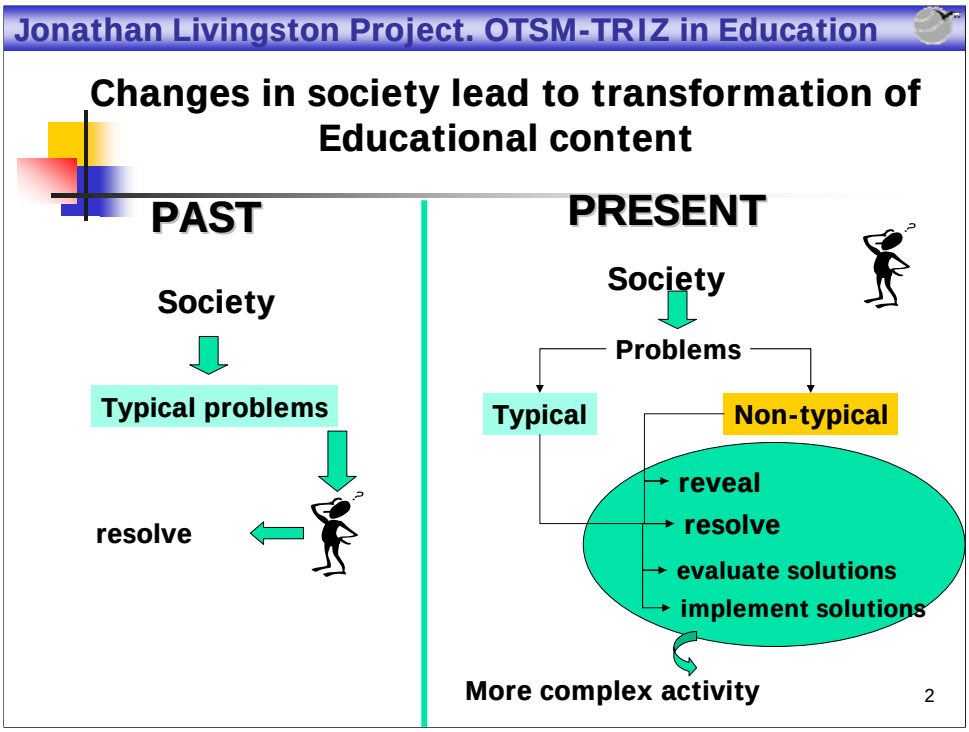


Last year Tatiana Sidorchuk showed what kids could achieve by learning and using TRIZ and I will talk to you about School education.

I will not tell you how teach kids TRIZ.

I would like to talk with you about what should we teach students today.

I will also consider that I achieve the goal if I will convince you that TRIZ, OTSM and TRTL give some answers for those questions and could resolve some contradictions.



A hundred years ago educational system was oriented to teach students what could be done in certain typical situations.

For most people it was enough to learn once and use during their whole life.

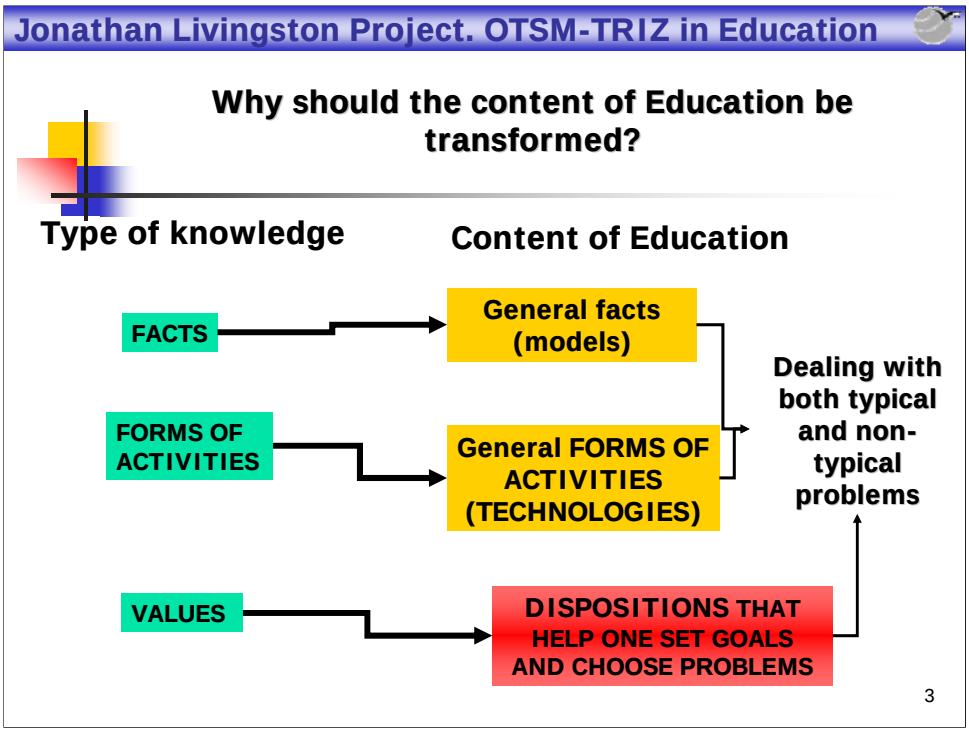
Today it is difficult to imagine situation that could appear in 10, 20, 50 years. Therefore it is necessary to pose new goals for educational system.

Someone should be able to survive in the world of highly accelerated changes. It means be able to handle non-typical problems.

In the past social environment pose typical problems someone should be able to solve in real life. Therefore Educational system was oriented to teach how to handle typical problems.

Non typical problems usually arise in the fuzzy unclear situations. Therefore it require much more complex thinking activity.

New goals of education could be formulated this way: students should be able to manage complex non typical, often interdisciplinary problems.



The most important request for educational content could be presented this way:

To manage non typical problems Students should be able fluently manipulate by the specific knowledge in order to represent it in the form which could be helpful to analyze and solve specific problems.

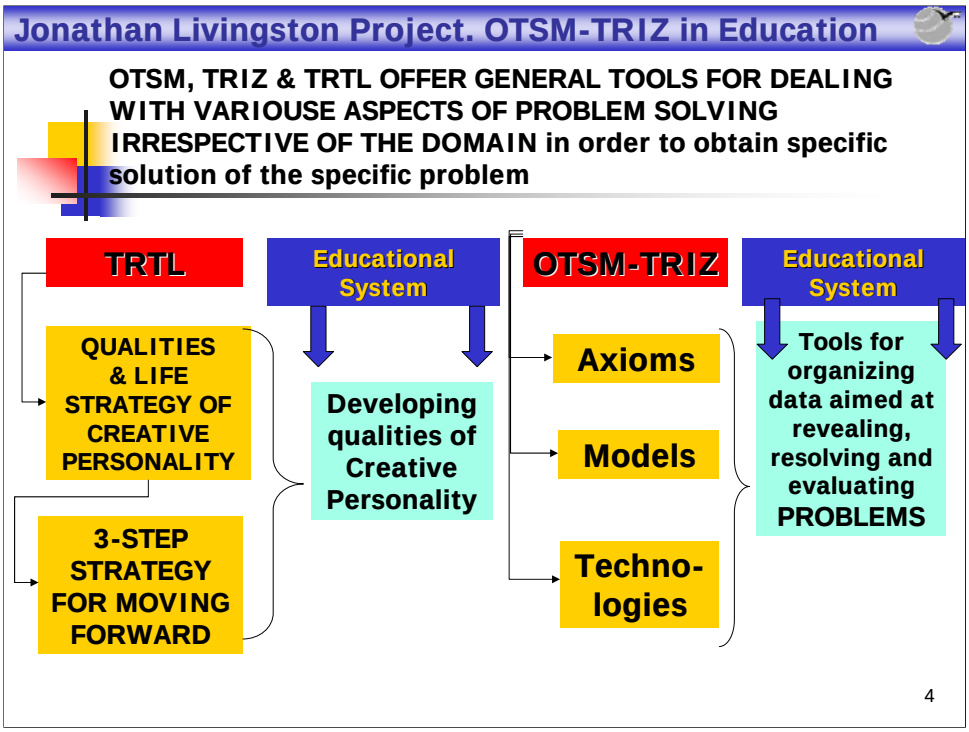
Therefore we should teach students not only to specific knowledge but also to useful general models and rules how those models and templates should be applied to solve specific problems efficiently.

Those models and rules should work for both typical and non typical problem situations.

We also should find the way to motivate students learn those models and rules.

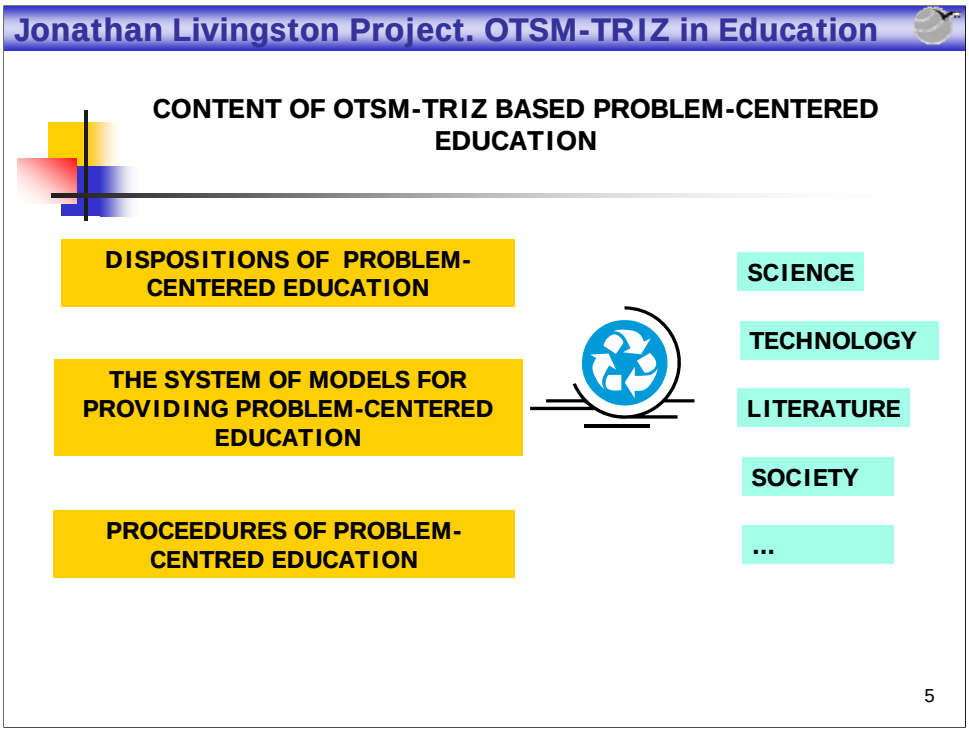
Those models should help student use his own previous experience during educational activities.

Today we already have such kind of instruments.



In order to be effective innovator it is not enough just be a good problem solver.

Various social and human factors should be taken into account.



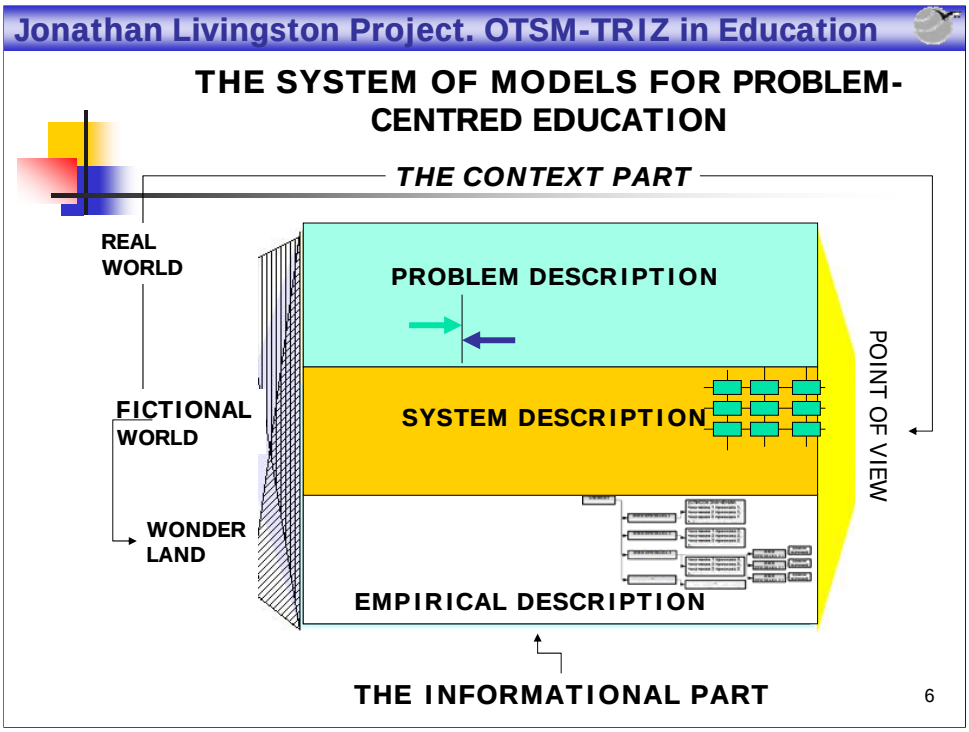
Here it is a content of problem Centered Education.

I would like to stress it out that we are talking about very specific content of education.

The content is a system of meta-models to represent various specific knowledge by the system specific general templates and rules how to use those templates to be efficient problem solver in in various domain of human activities.

Those models are helpful for students to understand specific knowledge and fluently operate them. As a result we can decrease time to learn new subjects without degradation of the quality of education.

Will be discussed now.



What is it a system of instruments we use in our education approach?

Main block has 3 levels.

First one we use to teach kids operate with any features of objects interpreting for kids. For instance when students describe tables they can pay attention to the materials those tables mad of. Or take into account shape, weight etc.

Second level is about features important for function performance. On this level it is important, for instance pay attention to the structure of the system and how is it functioning in time. In other words – multi-screen schema.

On the Third level we pay attention to the features that describe the problem situation. For this we use Contradiction notion.

Contextual block help us teach kids how they can use their own psychological recourses. It include two models: point of view and 3 worlds model.

The “point of view” model help us teach to consider various aspects of the problem situation.

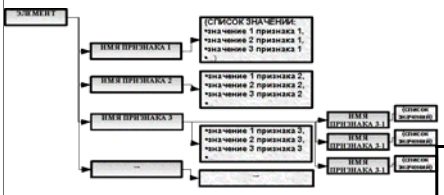
The “three worlds” model help us teach students dealing with imaginary and real objects and processes.

Dealing with Fictional World help us develop left cerebral hemisphere an d conduct mental experiments.

Wonderland dedicated to developing right cerebral hemisphere: imagination, associations, emotions.

EDUCATIONAL TOOLS

Graphic & verbal templates
for specifying the models



The constructor of exercises for mastering the system of models

Procedures for presentation of the models

Element	Name of Feature	Value of Feature	Type of exercise
?	!	!	Guessing a riddle
!	?	!	Creating a plan
!	!	?	Constructing a riddle

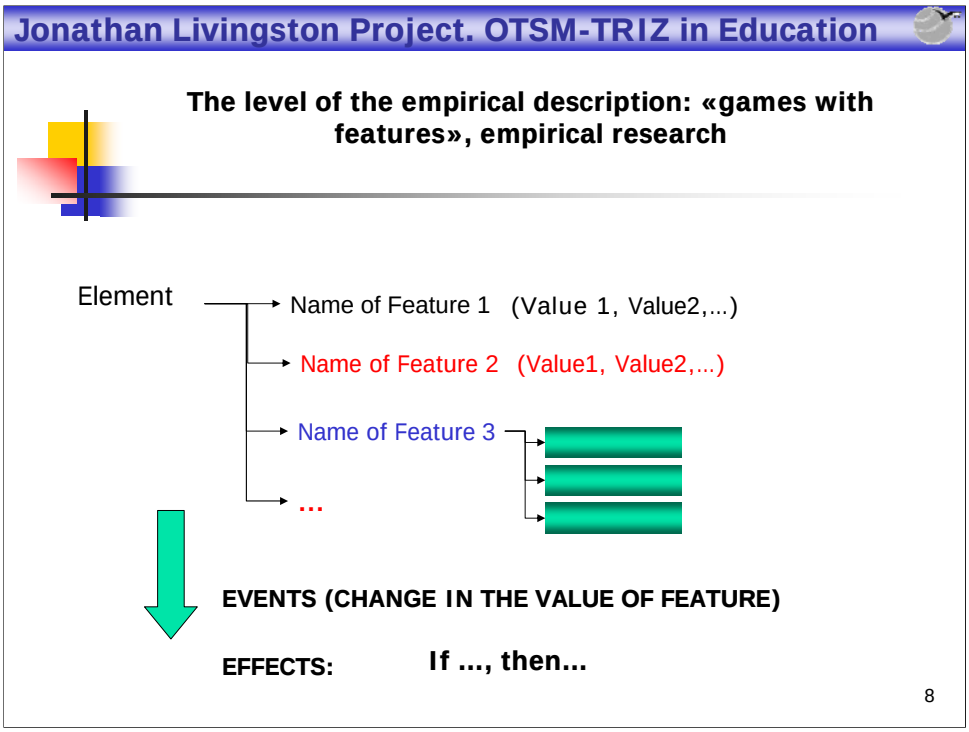
7

To teach kids all of those models we use various pedagogical instruments. We will not discuss it here now. If somebody are interested in detail we can talk in the lobby or arrange round table for further discussion.

To teach kids those models we use games and individual experience of each kid.

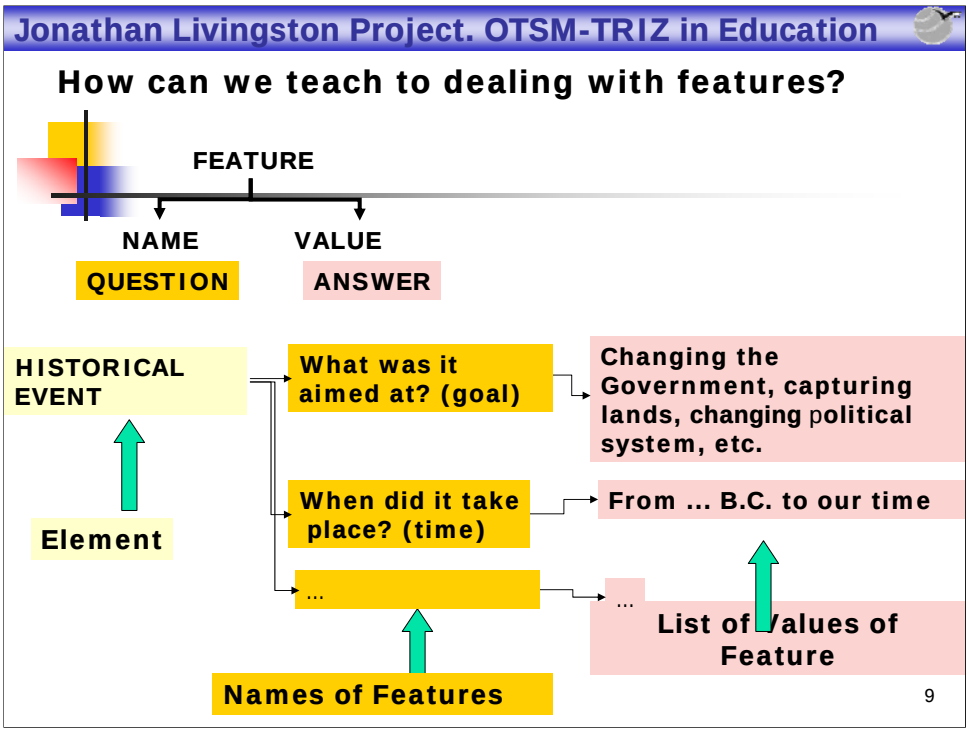
To create assignments of kids teacher could use special constructors.

For instance: If I will do this then kids will not prevent me from delivering lectures but they will learn nothing. Try to guess What is it?



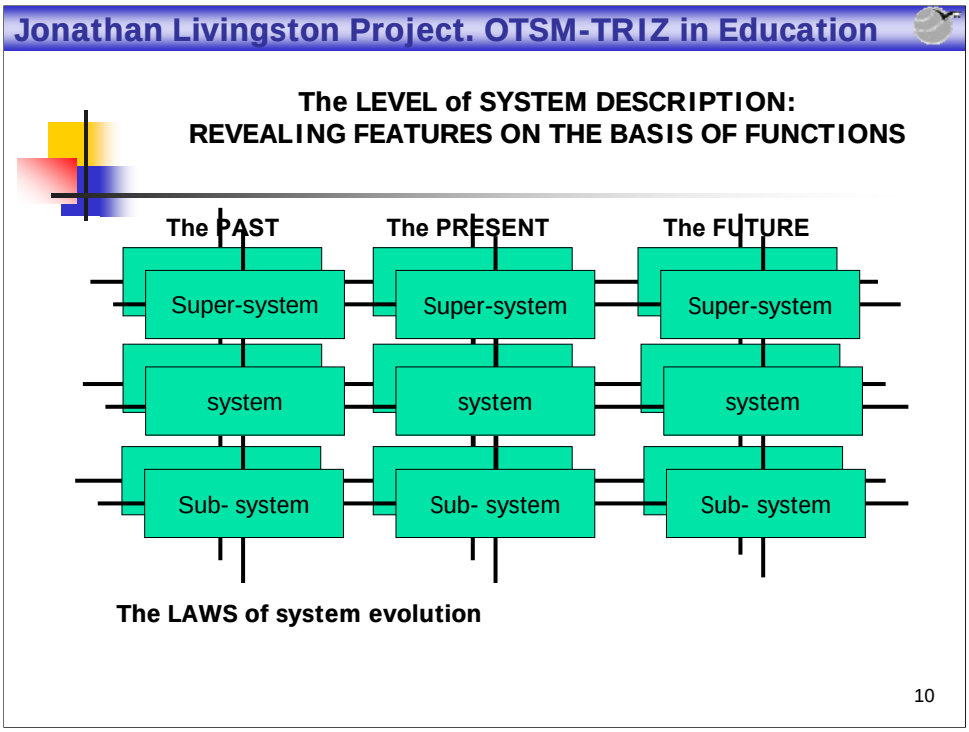
This slide present oversimplified model ENV.

Next slides will show some examples of the model application.



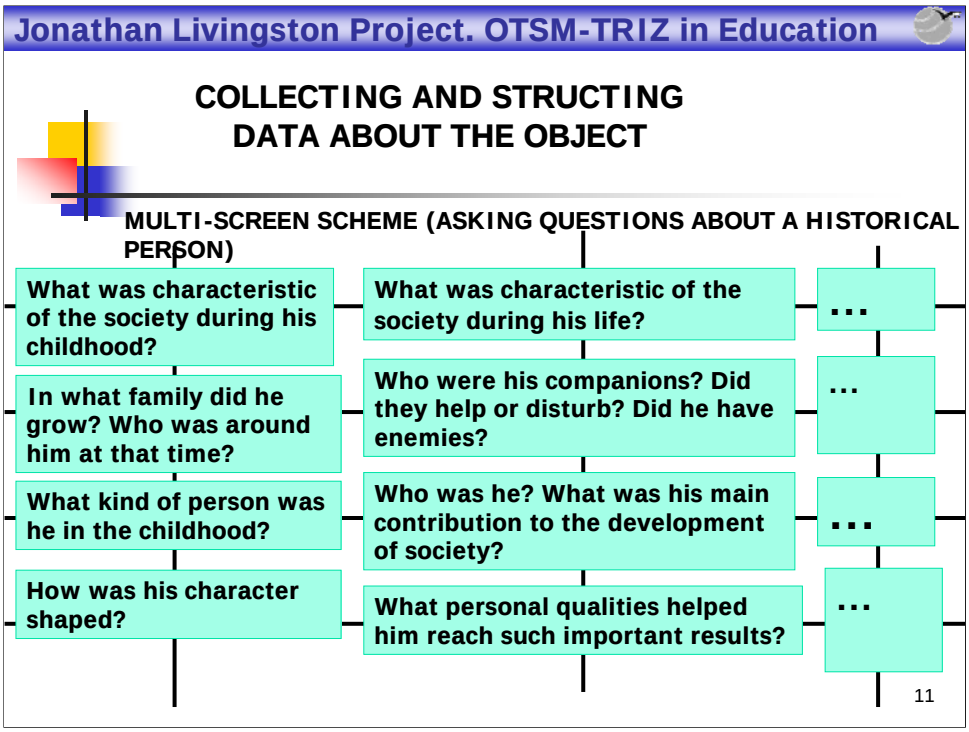
Here it is an example of application of ENV model for historical event.

the most important thing in this model is that we should split feature in to two components – value of the feature and the name of the feature. Then we teach kids to ask questions about an object and possible answers.

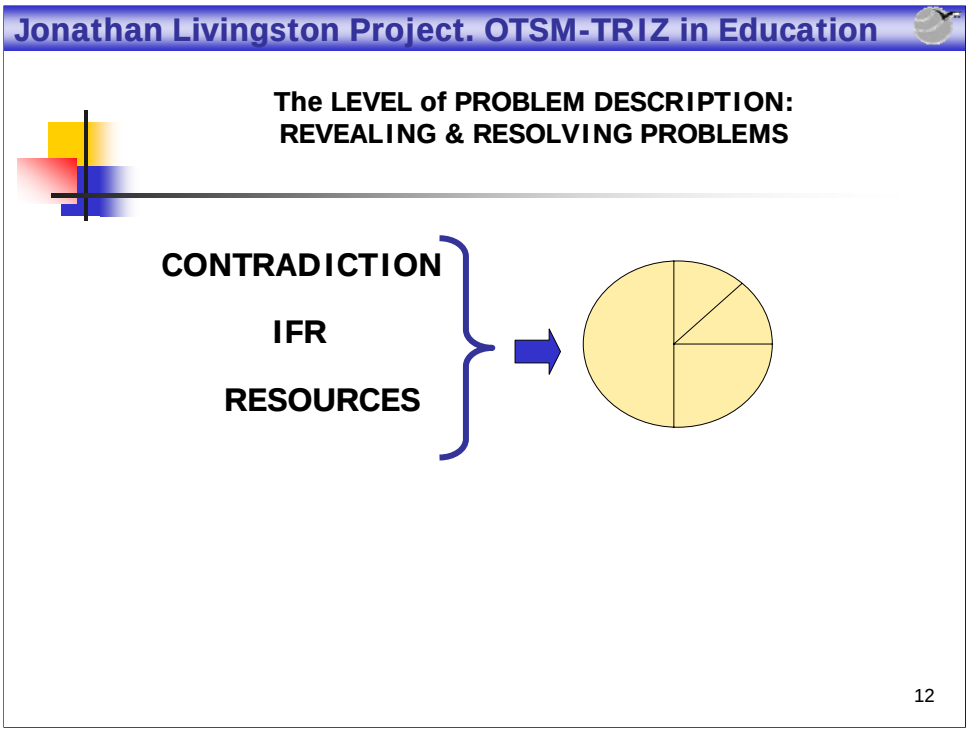


Next level of teaching ENV model dedicated to learn that for handmade objects first of all necessary to identify function. Then we should identify evaluation parameters of the function performance. We use here System operator – multi-screen schema.

As soonas we consider Element as a system it is important to learn what is a structure of the object and how it is changed in time.

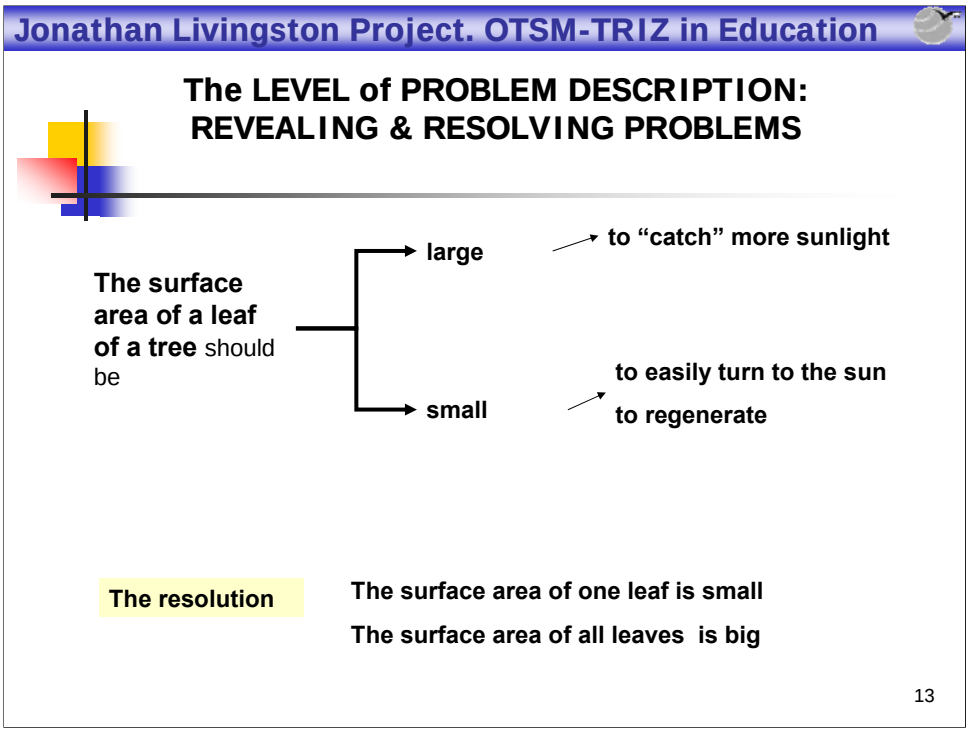


Here it is an example about gathering information about historical person.



For problem description we use some components of ARIZ: Contradiction, IFR, Resources and their relationships.

It help us teach kids how to narrow area of research to develop solution of the problem.



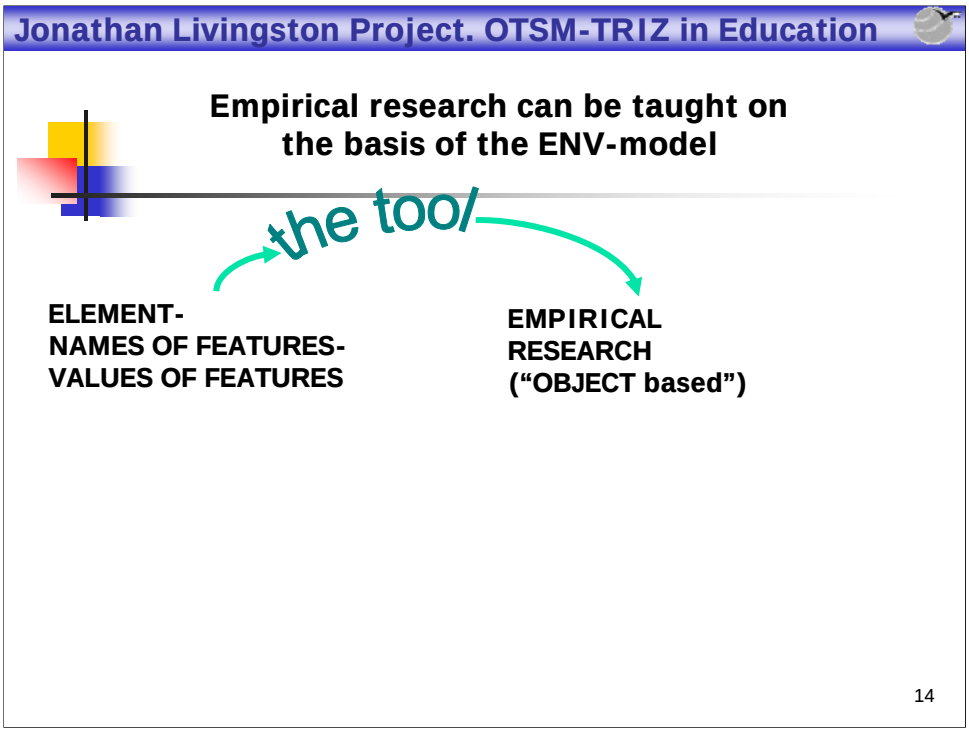
This slide present an example of the contradiction about leafs of the tree.

Why trees has many leafs instead of one big leaf?

What problem was solved by the solution?

(read the text in the slide)

A tree should gathering as more light as possible.



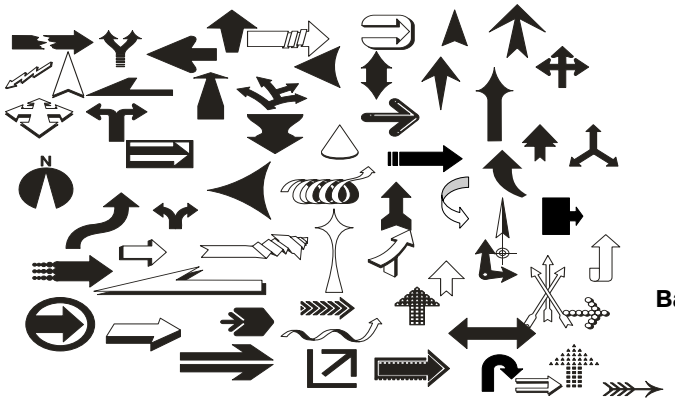
The most simple example of the research project – research started from an obgect.

For the starter it is enough ENV model.

This kind of the research start from gathering information about objects of certain kind.

SKILLS FOR DEALING WITH FEATURES IS THE BASIS FOR LEARNING TO CONDUCT RESEARCH

DATA BANKS are banks **OF OBJECTS OR DESCRIPTIONS OF OBJECTS.**



EQUATION
names of rivers
complicated words
steps of animals
stories about friends

Bank of arrows

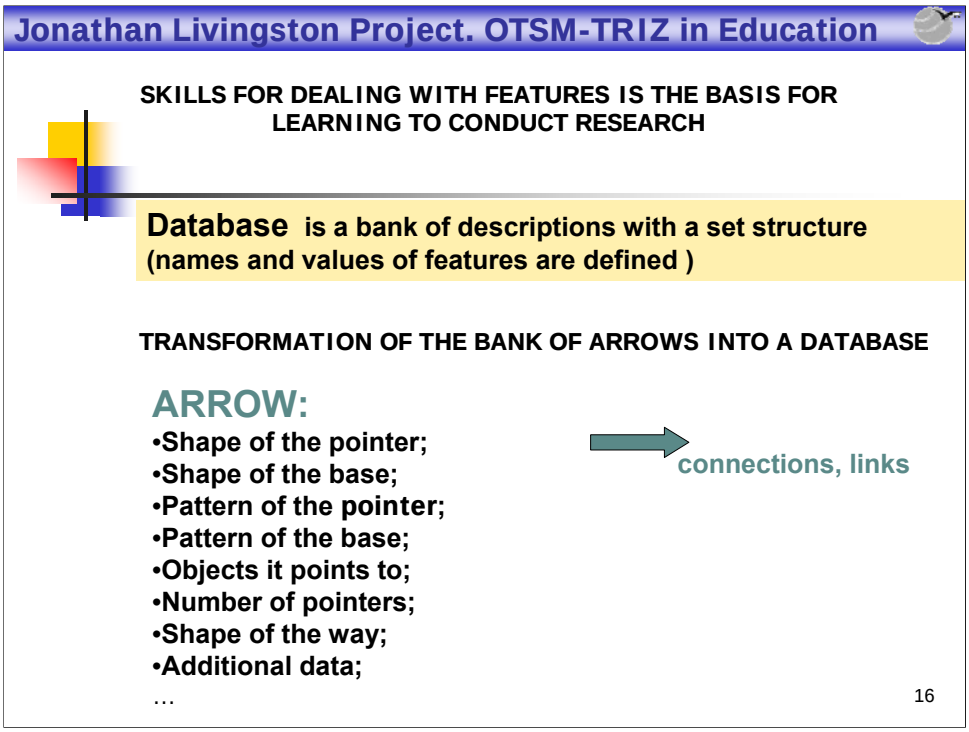
15

Here it is example of data bank of arrows.

I use it to teach teachers.

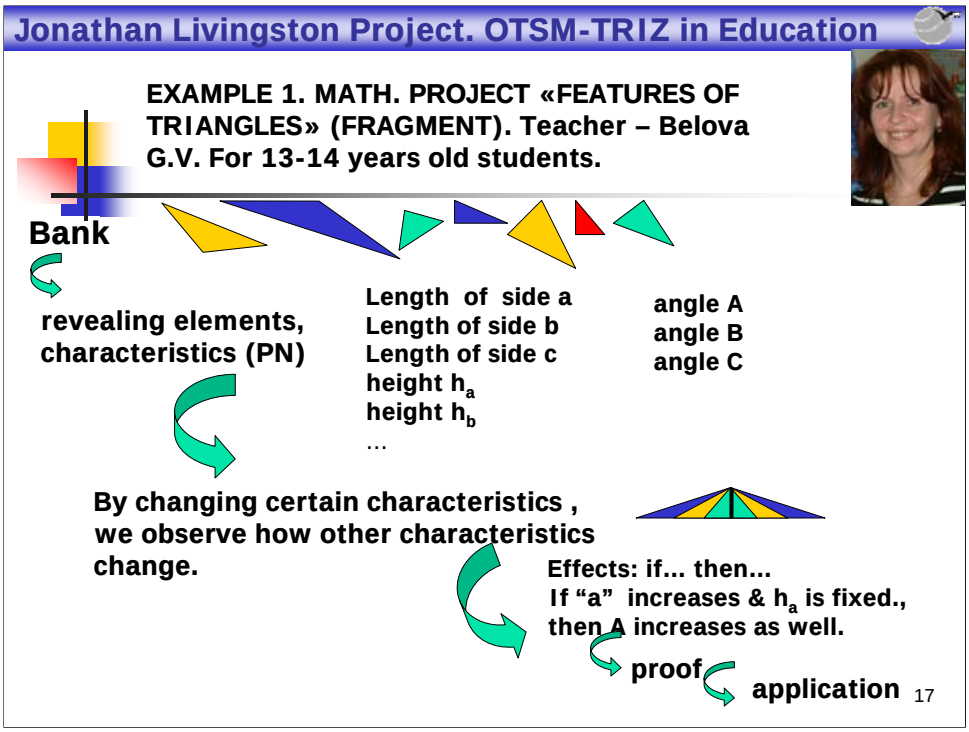
For different educational subjects students gathering various objects to be studied. Gathering of this data bank motivate kids a lot.

Through my experience this is the most simple way to motivate kids.



As soon as we chose important features (evaluation parameters) that we will use for further research we transform Data Bank into database.

As soon as kids learn it and able to perform by themselves they could carry out certain research.



Here we present some examples of the research in frame of learning certain subjects.

This slide show how it is used in teaching math.

Students gathering triangles.

Then they identify significant parameters they will use to describe triangles.

Then students analyze relationships between those parameters.

To describe those relationships "if… Then…" model is used.

Then it could be used for problem solving.

It means they discover new knowledge by themselves.

Jonathan Livingston Project. OTSM-TRIZ in Education

EXAMPLE 2. LITERATURE FOR KIDS. THE PROJECT «THE BOOK OF LIMERICKS». Nikitina M.V., teacher. For 10-11 years old students.

Record: model of limerick

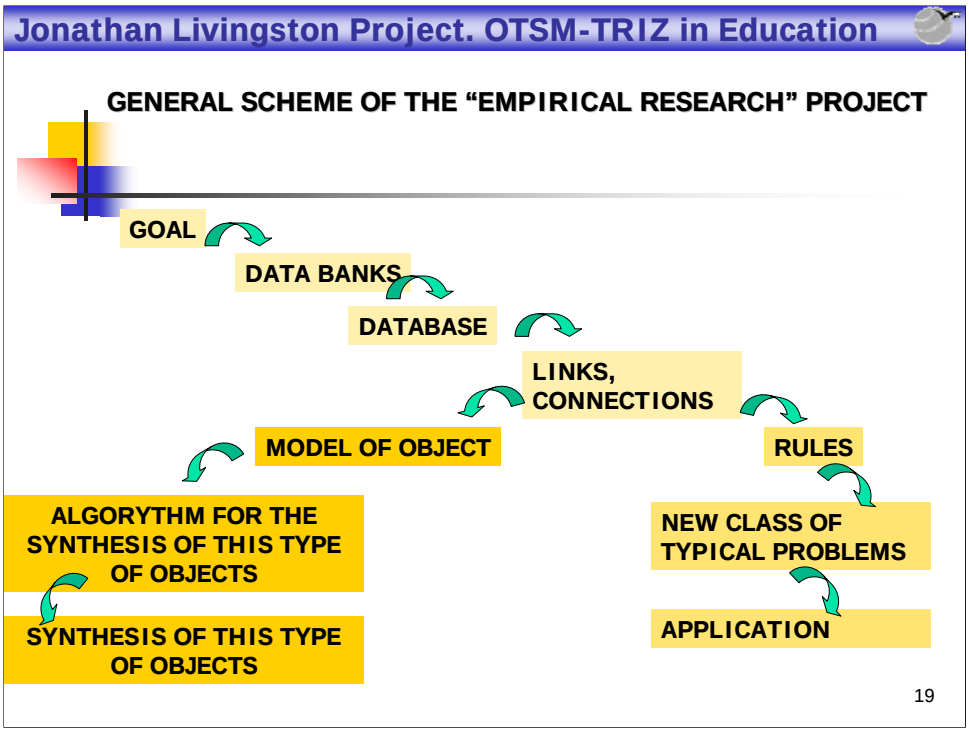
<table>
<tr><th colspan="2">shape</th><th>content</th><th>means</th></tr>
<tr><td>rhythm</td><td>rhyme</td><td rowspan="3">✓object
✓Description or comparison of object
✓event
✓results of the event
✓conclusion</td><td rowspan="3">✓repetitions ;
✓similes;
✓metaphors;
✓interjections;
✓puns.</td></tr>
<tr><td>1=2≈5
3=4</td><td>1=2≈5
3=4</td></tr>
<tr><td colspan="2">LW1=LW5
(LW - last word)</td></tr>
</table>

18

One more example of a research.

About methods to create limericks.

Students first develop this model based on data bank. Then they use it to create limericks.



At the beginning we use next procedure:

1. Students have to clarify the aim of the certain research.
2. Gathering Data bank.
3. Select evaluation parameters they consider as an important for the research.
4. Discover links between values of different parameters.

As a result students obtain model of the object which show evaluation parameters and links between them.

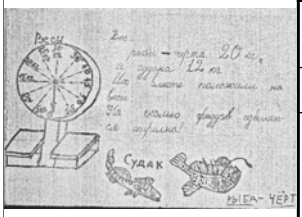
First application of the model: developing algorithms to create new objects of this kind.

Second application of the model: creating new typical solutions. For the problems were considered before as non typical.

Jonathan Livingston Project. OTSM-TRIZ in Education

Examples of projects students conducted on the basis of the proposed technology

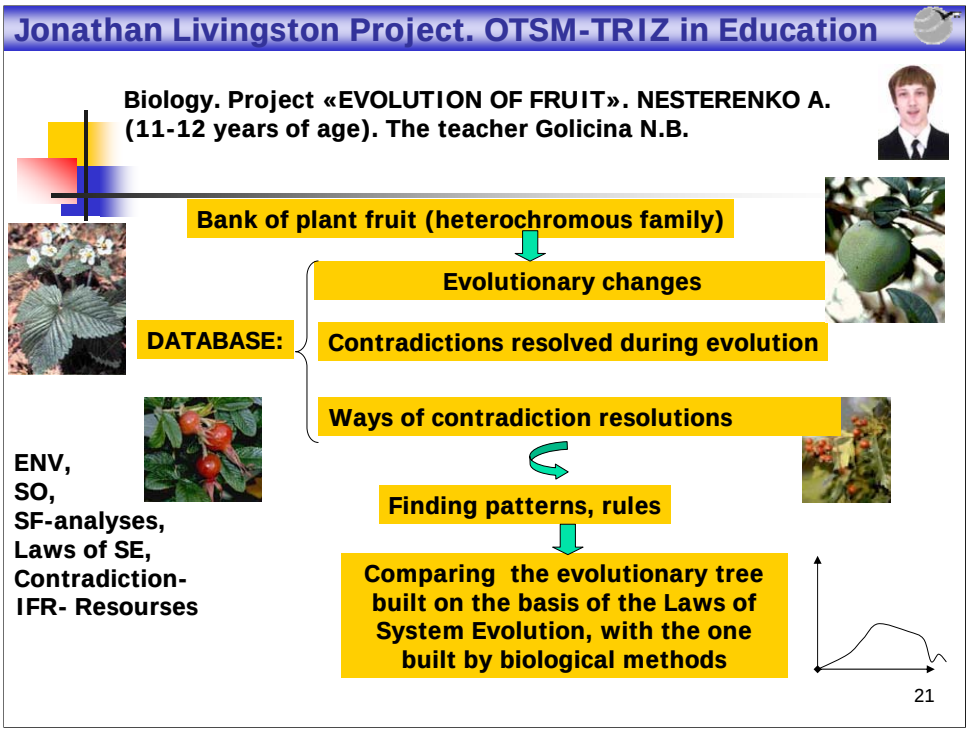
«Riddle-book» (7-8 years old students) collaborative project		
input	tool	output
banks of riddles	ENV model	The book of students' own riddles



«Book of Problems on Math & Biology» (9-10 years old students), collaborative project		
input	tool	output
bank of «measurable features» of biologic living organisms	ENV-model, Models of math problems	The book of students' own problems

20

Here it is some examples of research done by our students.



This is an example of more complex research. It was done according dame procedure but large amount of models was used.

The research started from gathering Data bank of certain plant fruit.

Then Database was created according evolutionary changes.

Links between parameters were discovered and set of contradictions was formulated. For these contradictions potential way of resolutions were analyzed. SuField analysis were done. As a result some hypothesis were created and compared with the model that were created by professionals in biological research was done in USA. The student find the researcher and contact him. The results were identical.

Jonathan Livingston Project. OTSM-TRIZ in Education

Transformations of movements in the Kinder-surprise toys
D. Ageev, V. Piterski, 13
(diploma of the Republic conference for school students)

On the synthesis of biological hypotheses.
Biology (A. Corzunina, 17)

How to create an image?
(E. Eremushkina, 16)
Literature (1 award of MATRIZ-competition, diploma of Republic conference for school students, a paper)

Trap-problems: questions, constructing, resolving
(N. Carginova, 16 years old)
TRIZ& Physics (1 award of MATRIZ-competition, diploma of the Republic conference for school students, a paper)

Perspectives of our spine in the view of TRIZ? (E. Mikheeva, 16)
Biology, Medicine (2 award of MATRIZ-competition, (diploma of the Republic conference for school students)

Inventive problems in bench modeling (J. Sabantsev, 16)
Technology Moscow students conference, a paper)

22

List of examples.

Jonathan Livingston Project. OTSM-TRIZ in Education

Evolution of Fruit Biology. A. Nesterenko, 11-12
(2 award diploma of the Republic conference for school students, a paper)

The topics of rubrics in youth magazines?
(E. Eremushkina, E. Mikheeva, 12-13) Literature (1 award of MATRIZ-competition, diploma of the Republic conference for school students)

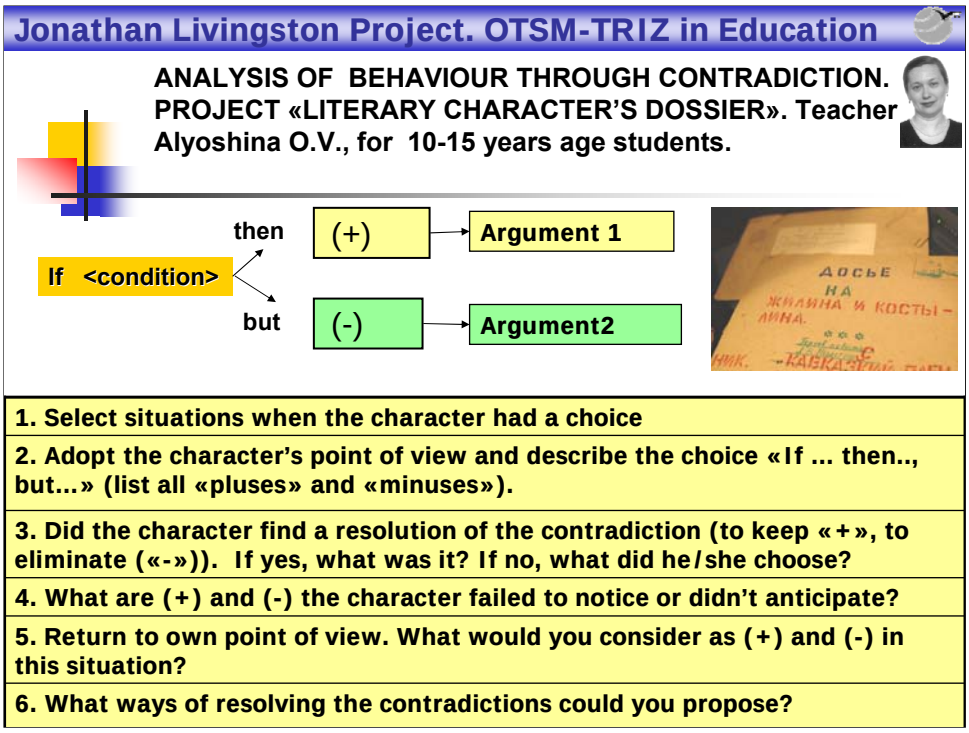
Using geometric effects for creation of water attractions
(N. Baranova, 16 years old)
Geometry

Inventive physics in toys
(Collaborative, 14-15) Physics

Teaching software on Little Creations Method? (D. Antipov, 15-16) Phisics (1 award of MATRIZ-competition)

23

List of examples.



One more research presented here.

It is about behavior of certain individual. Could be character from literature.

In this case character should make a choice. And the problem of choice presented as a contradiction.

Usually people make a choice between two or more opportunities. But it is better to resolve contradiction. However sometimes we do not have resources to resolve the contradiction then choice should be done somehow.

For instance in the short novel of Richard Bach - Jonathan Livingston Seagull.

Parents were afraid that Jonathan did his experiments and try to fly unusual way. For instance one of his dream was to stay in the air unmovable.

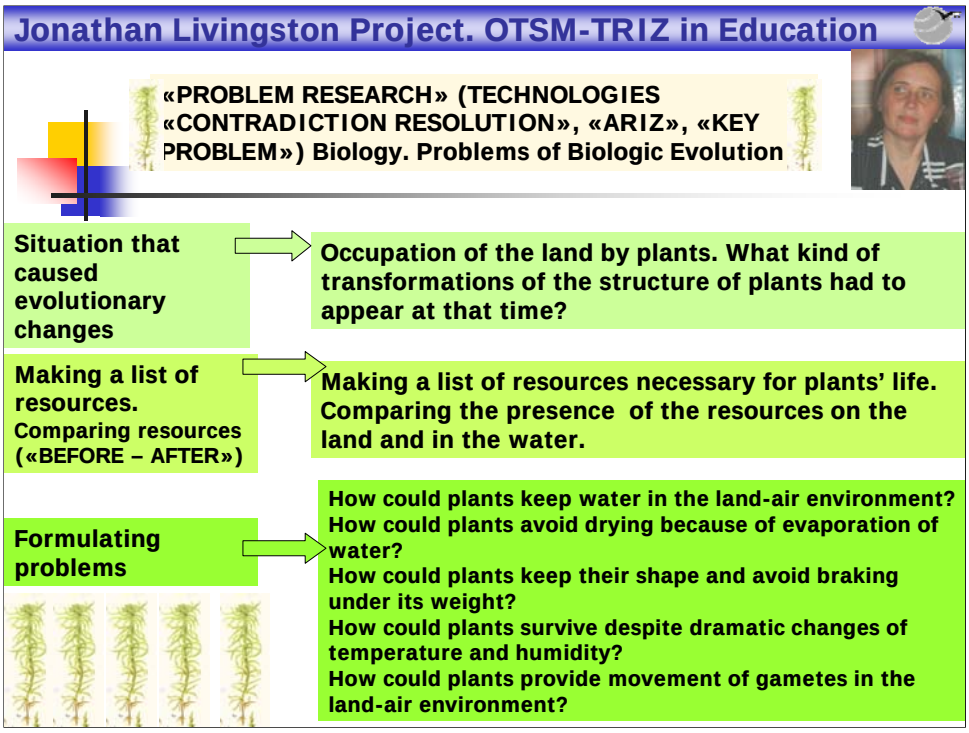
Parents were trying to convince him stop his experiments and be as everybody are.

If Jonathan follow his parents advice then he will never achieve his goals. What should be done?

What is positive in case Jonathan will chose typical behavior of seagulls that his parents want him to accept. Then what he will gain and what could be lost? (Wait for reaction of auditorium 3+ and 3-).

You can see that opinion are different. For one something could be considered as positive for another it could be considered as negative. For the third – neutral.

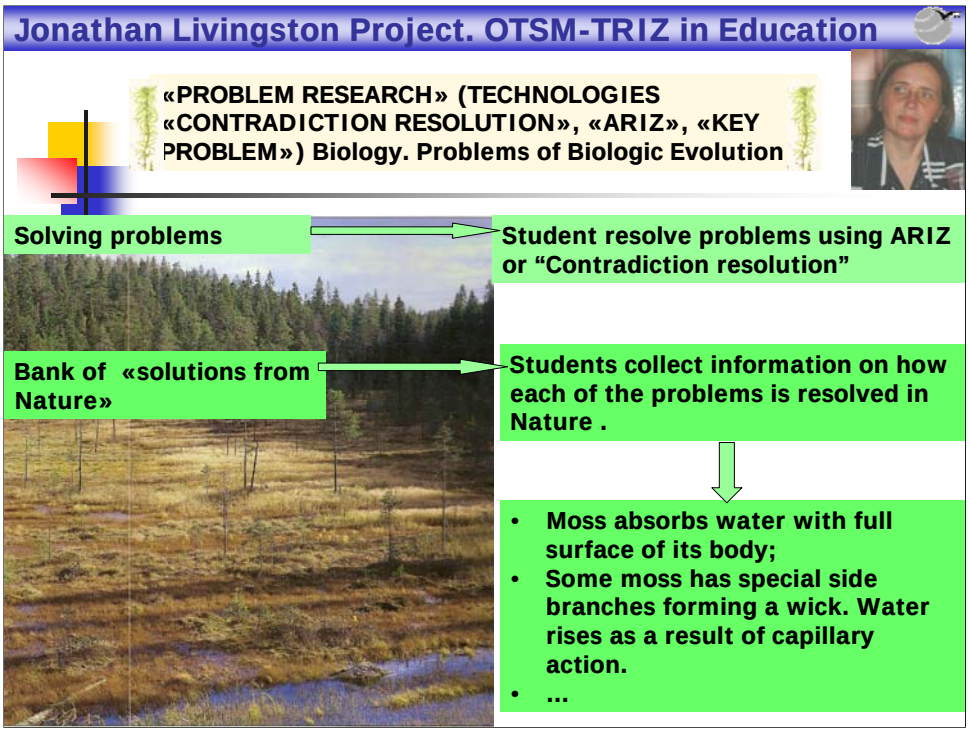
We consider situation of choice to be done as an effective pedagogical



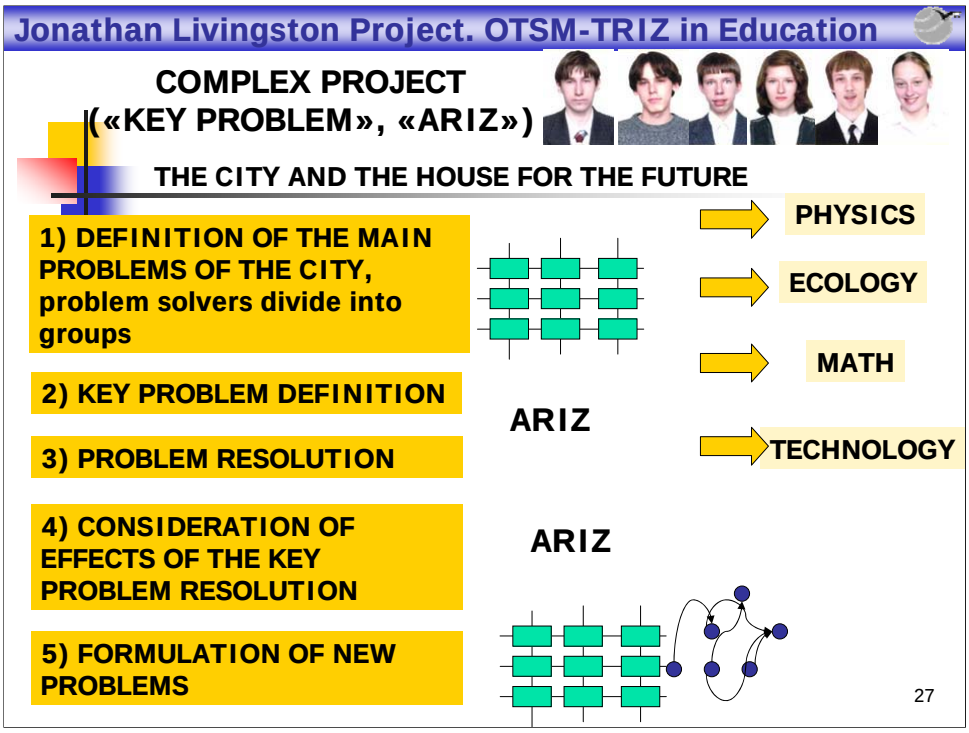
This research was started not from the gathering of object by from the problem situation.

This slide present a problem situation that provoke evolutionary changes of biological system.

This kind of problem underline TRIZ based, problem centered, biological education.

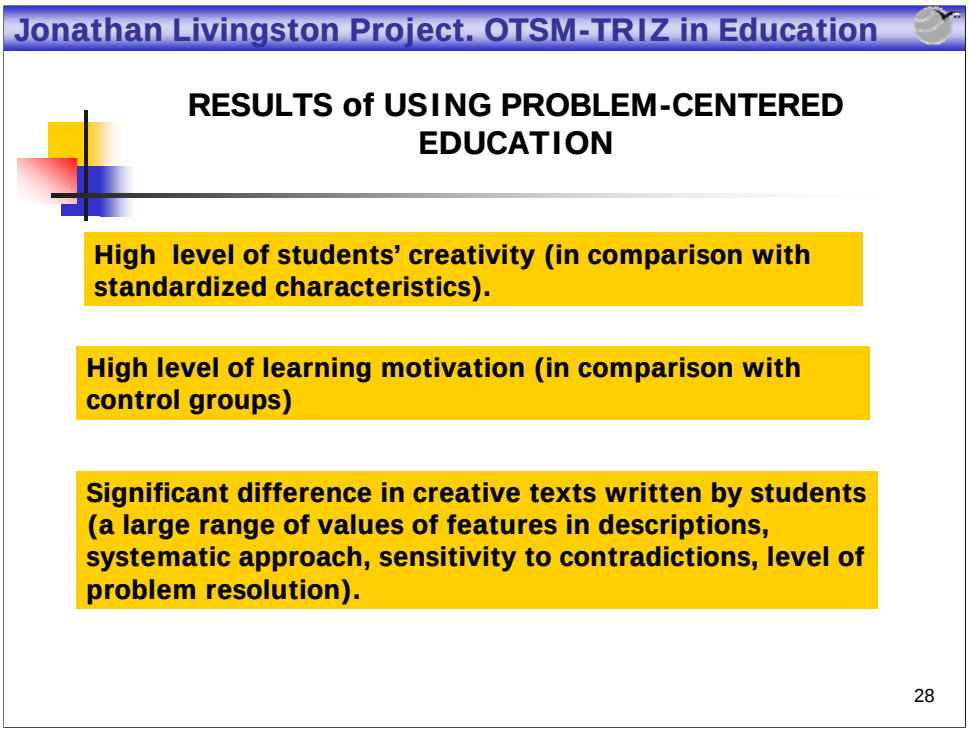


This slide presents next steps toward a synthesis of a specific solution.

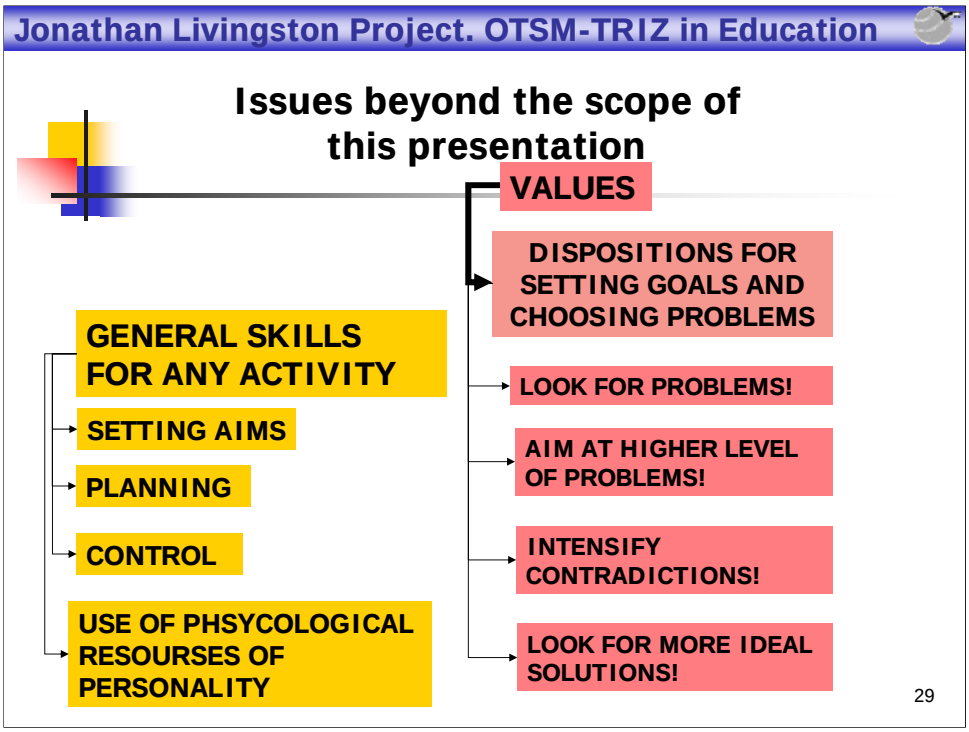


In order to teach to advanced instruments of problem solving and their applications real complex problems are used.

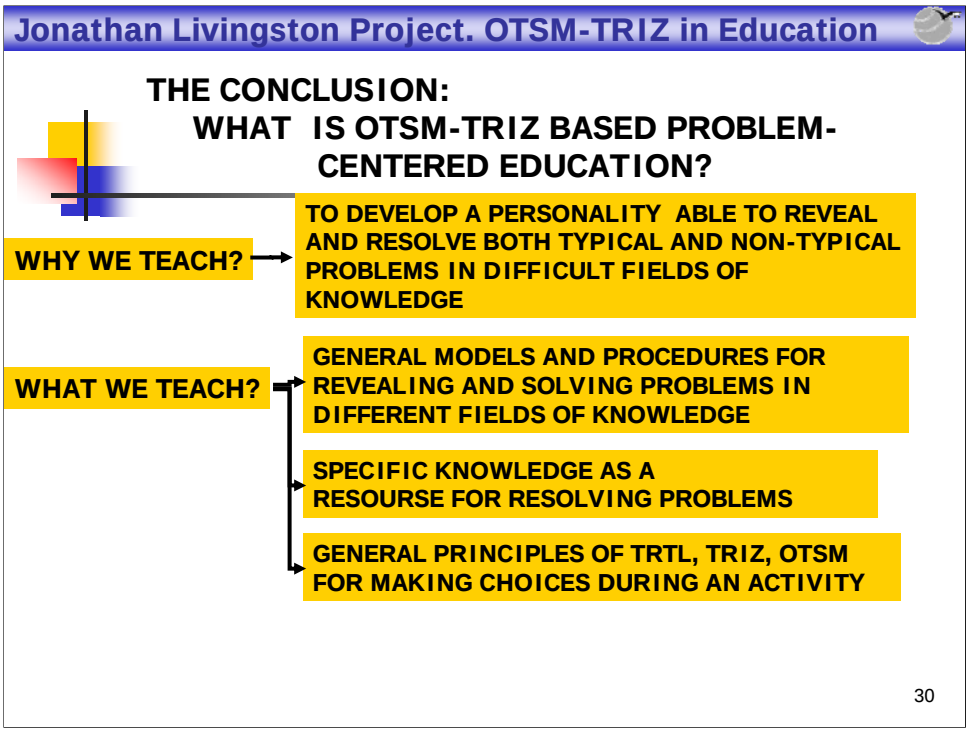
In the course of these research lot of instruments were used as a system in order to identify the key problems to be solved to overcome problem satiation.



Just read the slide.



Ingrida Murashkovska and Galina Therechova and other participants of JL-Project carry out their research in these directions.


THE CONCLUSION:
WHAT IS OTSM-TRIZ BASED PROBLEM-CENTERED EDUCATION?
WHY WE TEACH?
TO DEVELOP A PERSONALITY ABLE TO REVEAL AND RESOLVE BOTH TYPICAL AND NON-TYPICAL PROBLEMS IN DIFFICULT FIELDS OF KNOWLEDGE
WHAT WE TEACH?
GENERAL MODELS AND PROCEDURES FOR REVEALING AND SOLVING PROBLEMS IN DIFFERENT FIELDS OF KNOWLEDGE
SPECIFIC KNOWLEDGE AS A RESOURSE FOR RESOLVING PROBLEMS
GENERAL PRINCIPLES OF TRTL, TRIZ, OTSM FOR MAKING CHOICES DURING AN ACTIVITY
30

TRIZ-group (school №30, Russia, Karelia, Petrozavodsk)

 Nesterenko A. – the leader of the group OTSM-TRIZ, Computer science			Golicina N – BIOLOGY
Belova G. – MATH 		Archipova N. – Word Culture	
 Dragan E. – PHISICS			Aleshina O. – LITERATURE

OTSM-TRIZ APPROACH IN EDUCATION

Nikolai Khomenko – OTSM-TRIZ approach (JLP)		Alexander Sokol – OTSM-TRIZ based thinking approach for language teaching and learning (JLP)	
	Alla Nesterenko – problem-centered teaching and learning (JLP)		Anna Korzun – OTSM-TRIZ based pedagogy course (JLP)
Ingrida Murashkovska OTSM-TRIZ based language and speech development methods, problem-solving in Education		Tatiana Sidorchuk – thoughtivity for kids (JLP)