Associative charachters (models) comprehension and creation in hard sciences

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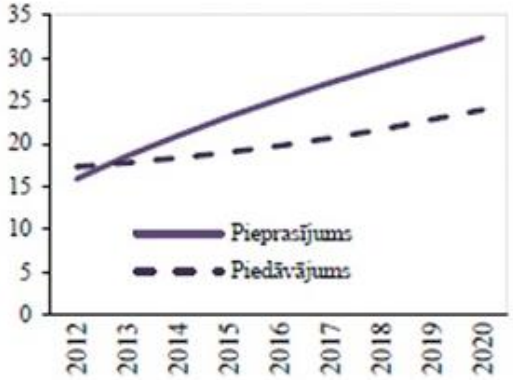
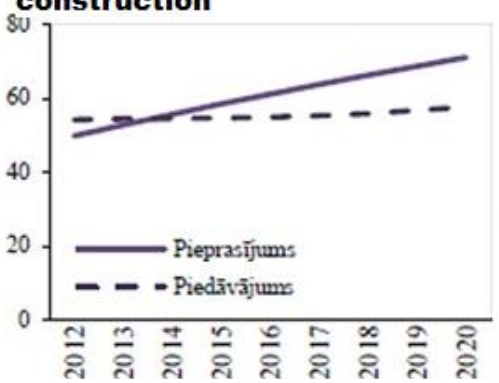
FEW FACTS

Hard sciences, mathematics & IT

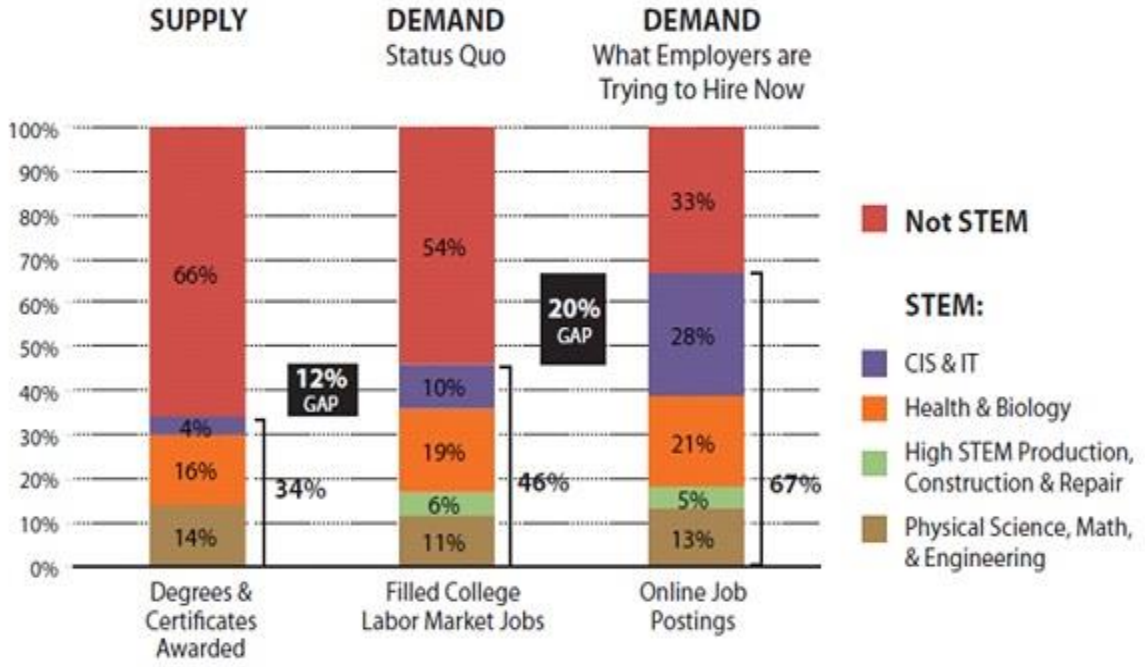


Engineering, manufacturing & construction

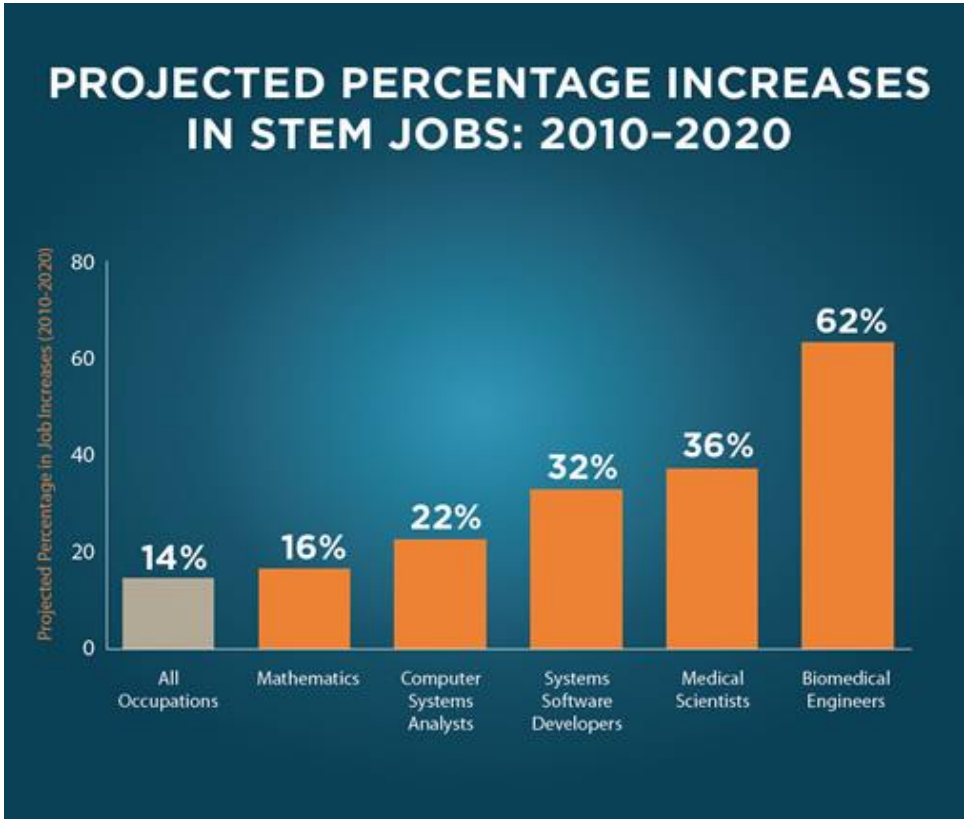


supply

demand



"... Leadership tomorrow depends on how we educate our students today—especially in science, technology, engineering and math."
— President Barack Obama, September 16, 2010

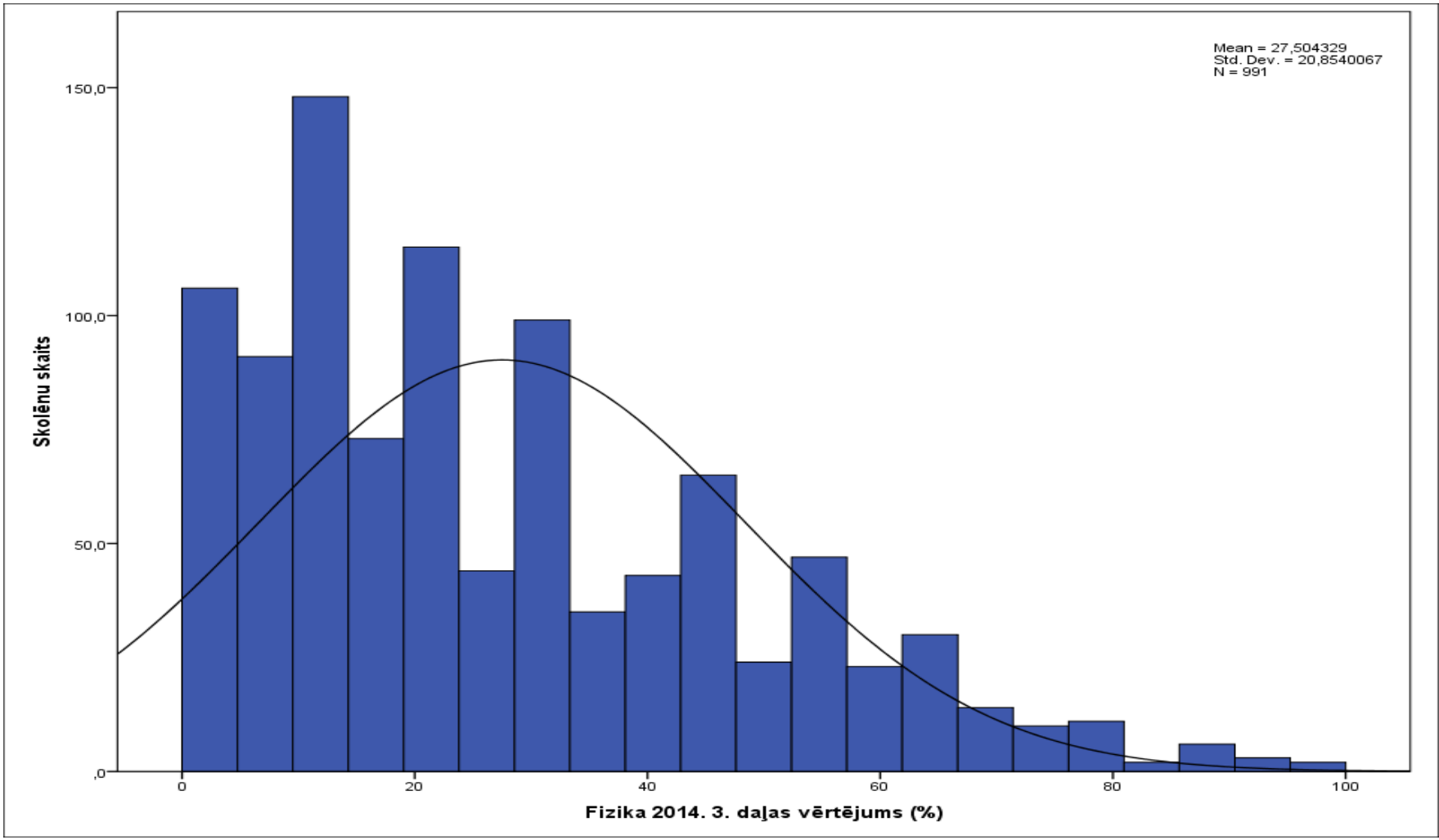


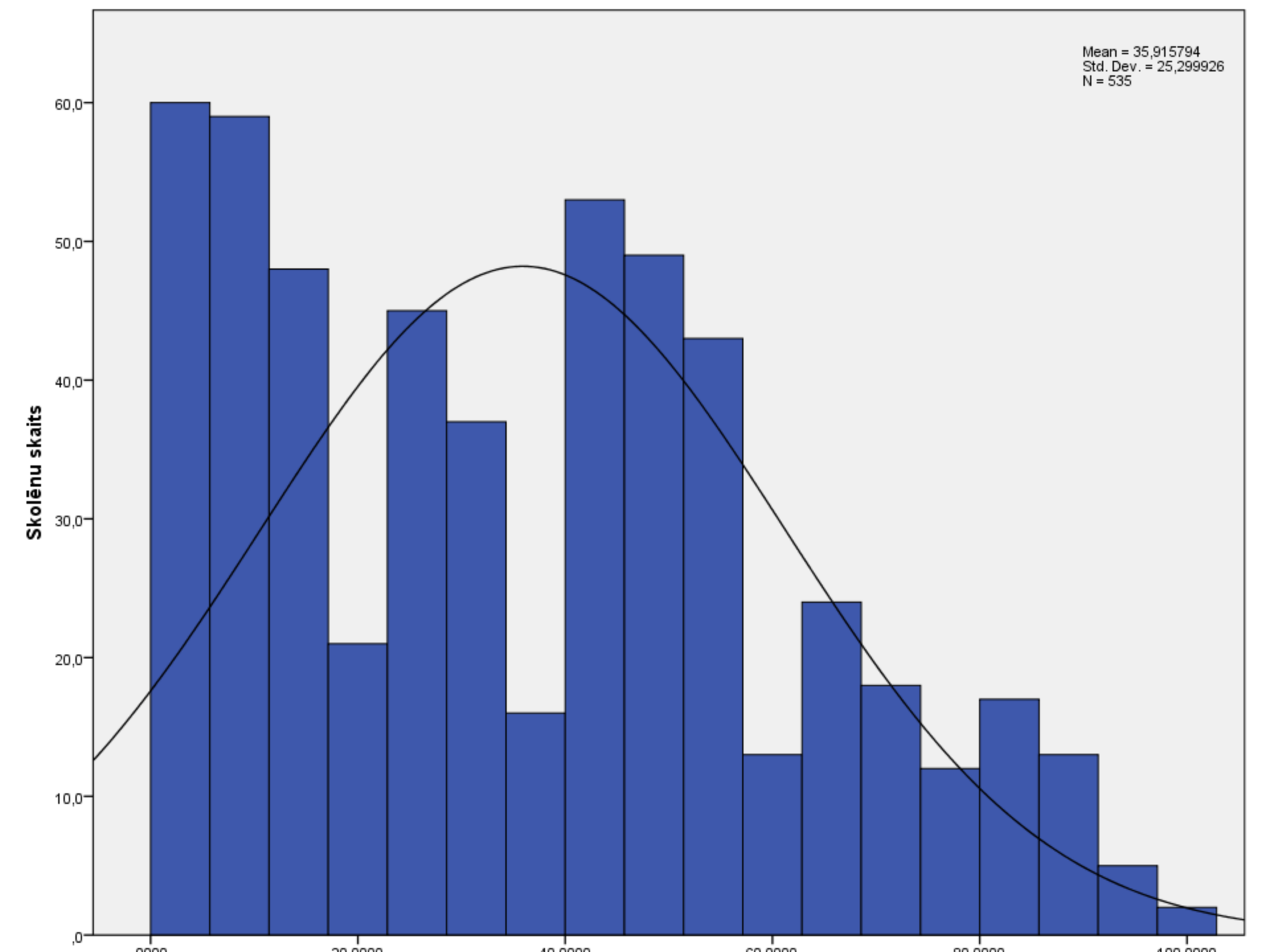
http://www.ed.gov/stem

http://www.lsm.lv/lv/raksts/latvija/zinas/iespejams-domas-par-obligatiem-eksakto-zinatnju-eksameniem.a67169

http://www.ir.lv/2014/1/23/fizikas-kimijas-eksamens-starp-divam-valdibam

Information from state exams – situation in Latvia




Mean = 35,915794
Std. Dev. = 25,299926
N = 535
Skolēnu skaits
60,0
50,0
40,0
30,0
20,0
10,0
,0

Questions for discussion

- Do you believe that the lack of creative thinking and understanding amongst students is an actual problem in learning hard sciences?
- Is it a common tendency or indvidual student problem?
- What kind of solutions for this problem do you see (or already use) ?

One of the solutions – cearfully look in to natures every day sites ,process or phenomenon.

Analyzing them, reveals similarities with complex exacta systems.

At the base of this idea alternative hard sciences teaching approache– ***Comprehension models*** creating and using in educational processes.

WHAT IS GOERUDIO?

Goerudio

1. It is a learning method;
2. It is based on users' direct involvement in learning process;
3. It encourages user to explain complex formulas, laws of physics and other concepts presented by teachers through simple examples.

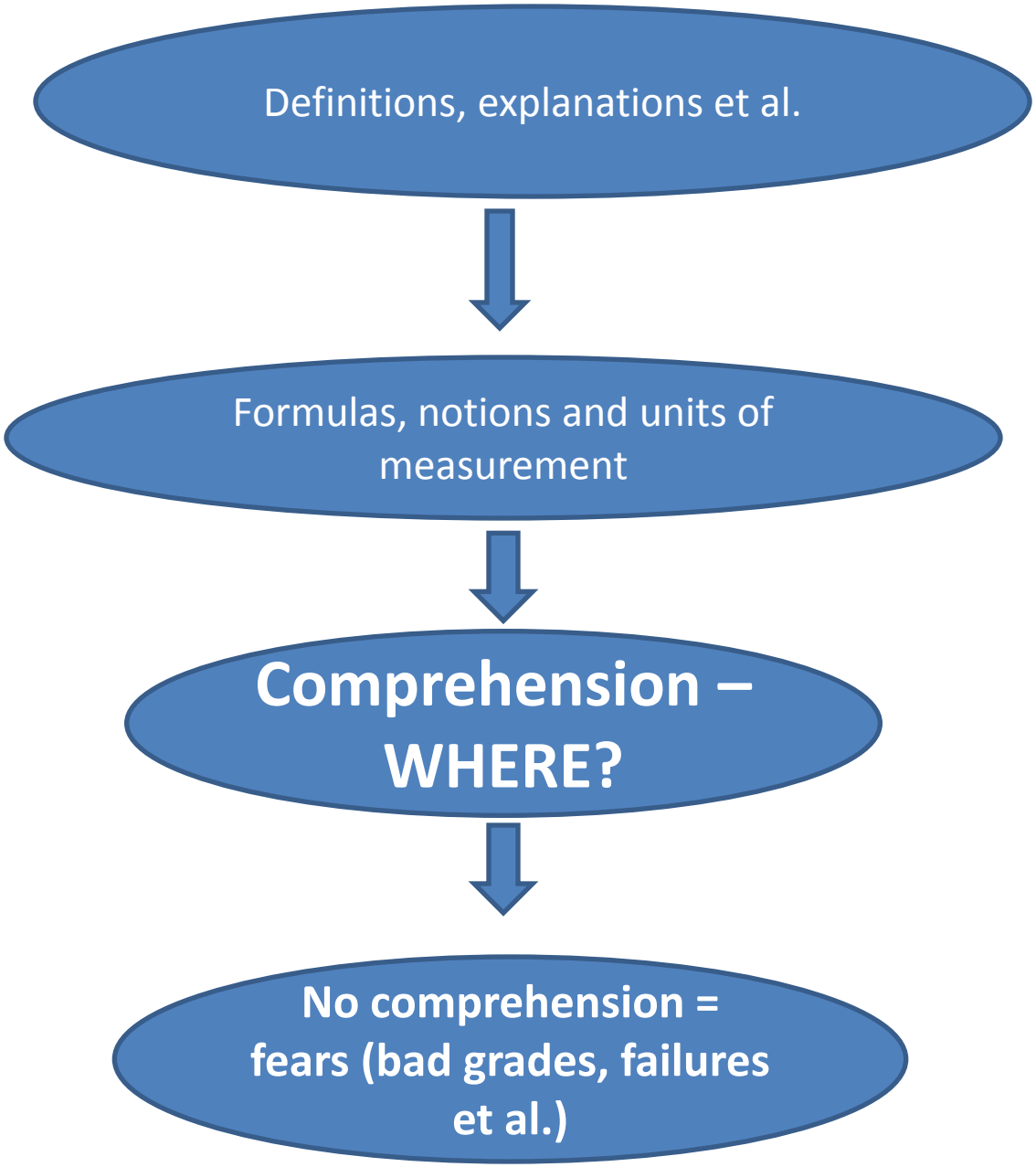
HOW GOERUDIO DIFFERS FROM OTHER METHODS?

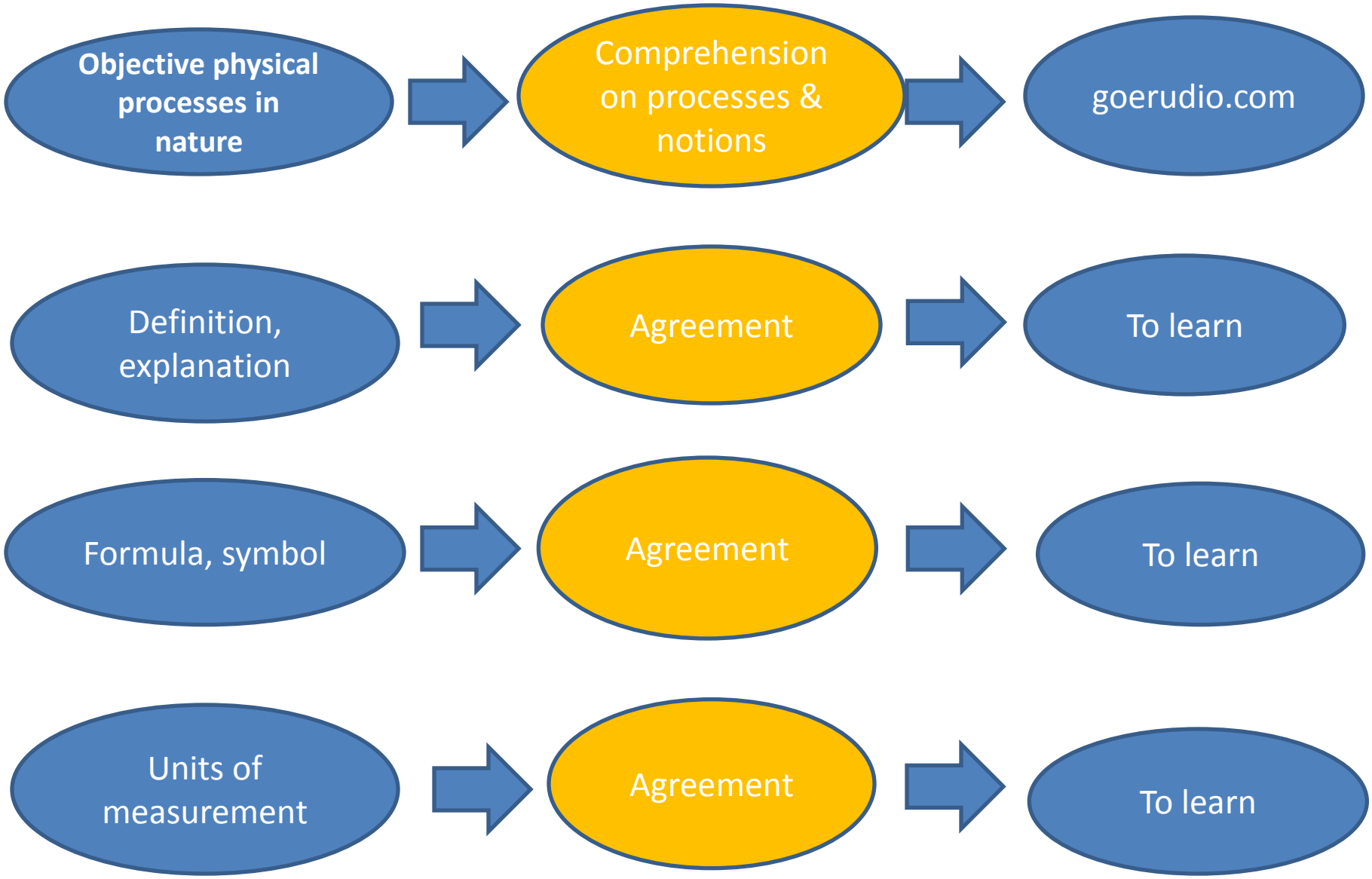
1. It facilitates learning rather than teaching and does not conflict with traditional teaching methods.

2. Goerudio provides an internet based framework through which the user pool (students) refine the concepts and models in support of any given subject.

3. Through active involvement in the process and the use of familiar examples learners gain a better understanding of the underlying principles or processes;

4. Interaction and communication among the users help to develop a common understanding of the concepts and their relationships to relevant laws of science and mathematics.


Definitions, explanations et al.
Formulas, notions and units of measurement
Comprehension – WHERE?
No comprehension = fears (bad grades, failures et al.)


Objective physical processes in nature
Comprehension on processes & notions
goerudio.com
Definition, explanation
Agreement
To learn
Formula, symbol
Agreement
To learn
Units of measurement
Agreement
To learn

If we teach nature and its processes through models we make hard science more understandable.

We create comprehension.

It refers to any processes including technical ones.

In chemistry and physics, **Dalton's law** (also called **Dalton's law of partial pressures**) states that **the total pressure exerted by the mixture of non-reactive gases is equal to the sum of the partial pressures of individual gases.**

$$p=p_1+p_2+...p_n$$

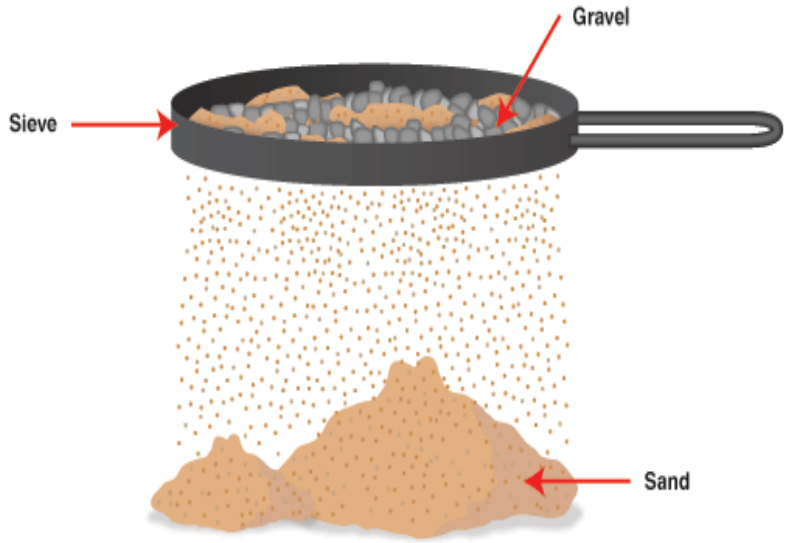
Cocktail, strawberry punch – this cocktail is mixed up by a variety of alcoholic beverages: sparkling wine, red wine, brandy, liqueur. This means that each of these drinks gives a specified amount of this alcohol cocktail. The cocktail composition depends on the amount of several alcoholic beverages.

APSORPTION

Light passing through an optical system can be attenuated by absorption and by scattering. Light absorption is a physical process during which the intensity of the light reduces.

MODEL:

You can compare absorption with gravel which goes through a sieve. A part of the gravel cannot go through the sieve (it absorbs it), but a part of the gravel (in this case – sand) gets through.



The model and it's characteristics (2nd activity)

- Group work
- Use the 2nd activity sheet
- Whilst working come to a collective conclussion
- At the end of the activity one of the members of the group presents the conclussion.

The model's key points

- ***Consistent with the theory***.
- Simple
- Visually attractive
- Easy to remember

Model evaluation (3rd activity)

- Work in groups
- Use the 3rd activity sheet
- Whilst working come to a collective conclussion
- At the end of the activity one of the members of the group presents the conclussion.

Creating the model (4th activity)

- Work in groups
- Use the 4th activity sheet
- Whilst working come to a collective conclussion
- At the end of the activity one of the members of the group presents the conclussion.

Model analysis and evaluation(5th activity)

- Work in groups
- Use the given models for the analysis and the 5th activity sheet
- Whilst working come to a collective conclussion
- At the end of the activity one of the members of the group presents the conclussion.

Riga English Grammar School's experience in creating comprehension models

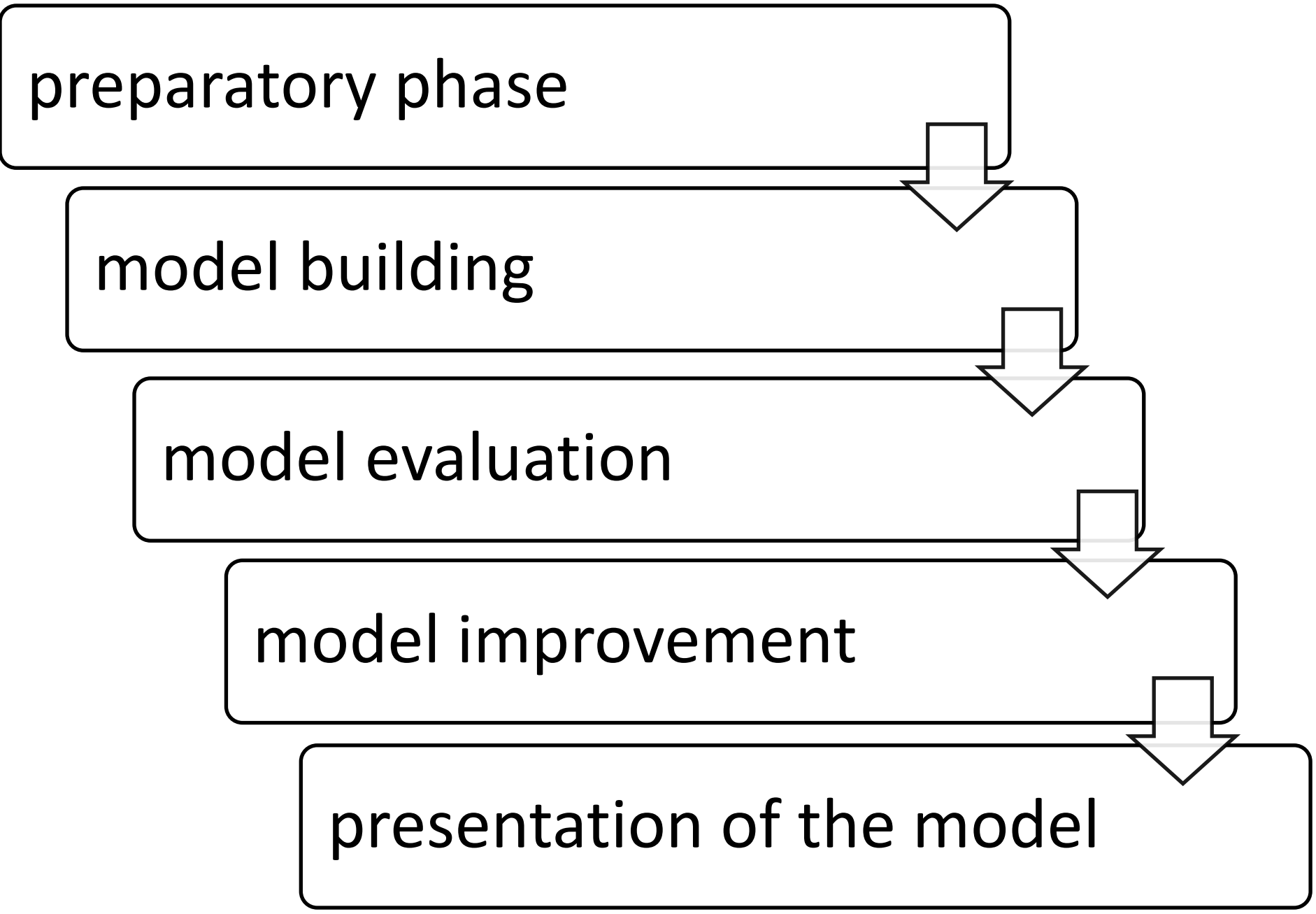
Riga English Grammar School – a school with long lasting traditions,founded in 1919.

Students intensively integrate English language in hard sciences (CLIL)

School's mission – prepare graduates,who:

- Are competitive and responsible
- Are comprehensive and ready for studies
- Can realize their potential (knowledge, skills,talents and resources);
- Are able to work in teams and achieve collective goals

Our experience in model creating


preparatory phase
model building
model evaluation
model improvement
presentation of the model

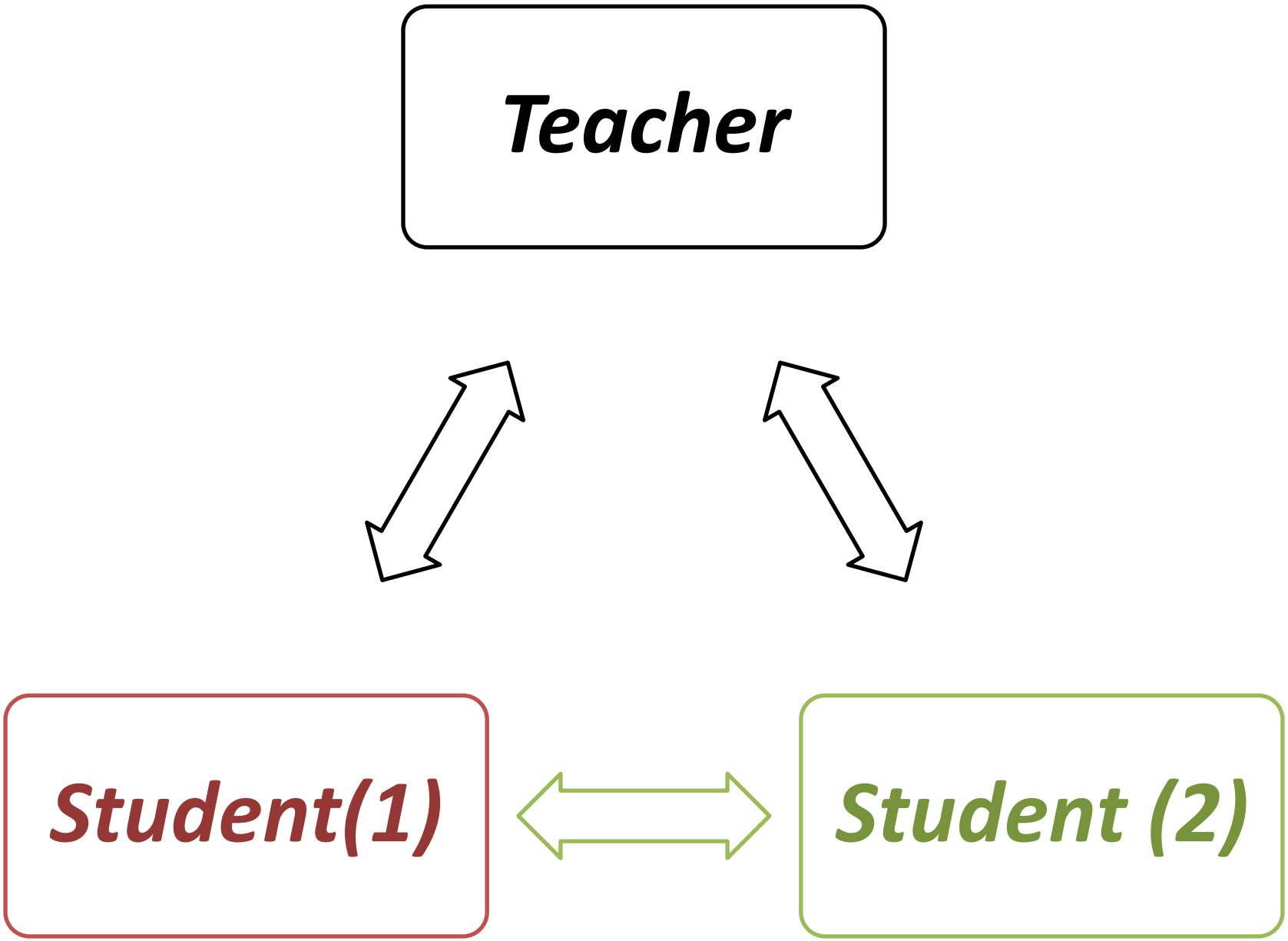
Preparatory phase

- The student understands the used scientific process or phenomenon
- Clearly defined deadlines for carrying out the work.
- The assessment criteria and assessment.

Creating phase– students individual, independent extracurricular work (Worksheet number1).

Evaluation phase

- ***Teacher evaluates*** the models created by students (see evaluation criteria in *methodical suggestions).*
- ***Students evaluate*** *models created by other students* (see ‘’Student worksheet 2.’’).
- ***Teacher evaluates*** the students effort put in evaluating the other student’s model (see worksheet ‘’Evaluation of the model’’).


Teacher
Student(1)
Student (2)

Improvement *stage* – student, evaluates other students created models,offers suggestions to improve the model. (see *“Evaluation of the model 2.”*).

Presenting models – one of the chances

- The teacher organizes the discussion of the models in English.
- Only the students whose models are qualitative,scientifically correct and who expressed the wish to present their models take part in the disscusion.
- Can be organized as a common event for several classes or the online conference for students of different schools.

Darba noslēgums

- The teacher fills in the summary evaluation sheets completely.(see page *“Summary of the model evaluation”).*
- The teacher puts the mark earned by the student in the e-register.

Comprehension model is a student created educational material, which is used by other students to learn hard sciences and math.

Advantages of student created educational material

The creator and the user are roughly on the same knowledge and experience level,understanding of ‘’how things work’’ and a similar way of thinking.

Two different problems

- How to create models more effectively?
- How to use created models more effectively?

Planning lessons with models as a part of educational material. (6th activity)

- Working in groups
- Use the given models for the analysis and the 6th activity sheet
- Whilst working come to a collective conclussion
- At the end of the activity one of the members of the group presents the conclussion.

Countries currently involved in **GOERUDIO project**.

1.Italy-10
2.Bulgaria-3
3.Latvia-4
4.Romania-8
5.Poland-5
6.Slovak Republic-6
7.Spain-5

Goerudio

http://goerudio.pixel-online.org/schools.php