Teaching Mathematics In Third Language Through Team-Teaching: Facing the language challenge and Difference Between West And Post-Soviet Mathematics

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Research Methodology: Action Research

- A research was conducted during 2014-2016 at the NIS Semey and Aktau Kazakhstan

- Written and oral questioning with the use of multiple choice and free response questions

- 71 upper secondary school students and 25 faculty members, from both local and international staff

Working in Team-Teaching

ADVANTAGES:

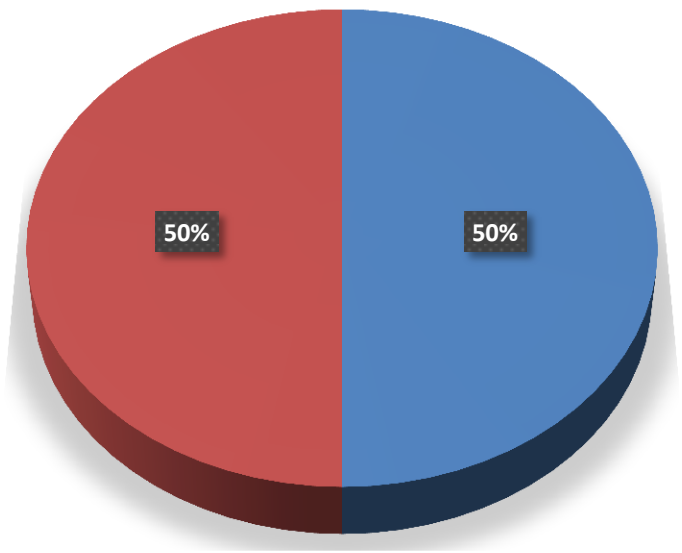
- ✓ Improves language skills
- ✓ Promotes sharing teaching materials
- ✓ Helps to learn new skills
  - Statistics and geometry
    - International exams
  - applied mathematics

CHALLENGES:

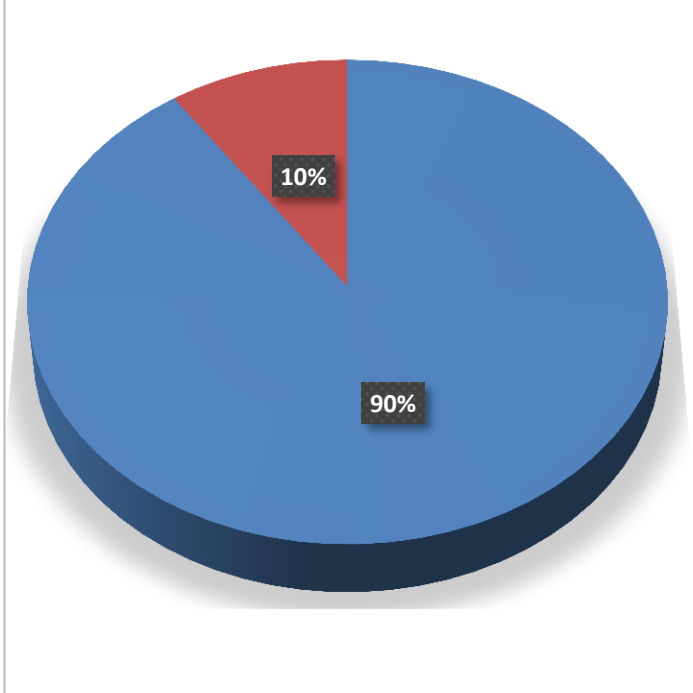
- ➢ Can create communication barrier between co-teachers
- ➢ Can cause disagreement and debates between teachers on lesson plan
- ➢ Can restrict their freedom of teaching

Students’ opinions

Are you satisfied with mathematics level of international teachers?



Are you satisfied with mathematics level of local teachers?



Results of IMO

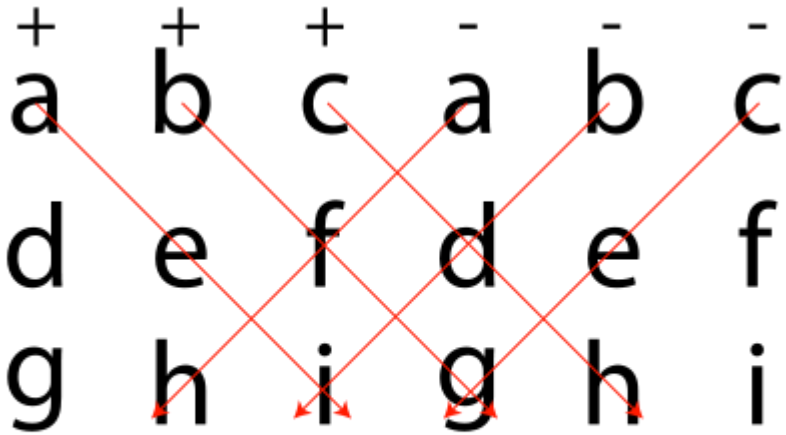
Country	First participation	Awards		
		G	S	B
Brazil	1979	9	36	71
Brunei	2000	0	0	0
Czech Republic	1993	4	25	59
Finland	1965	1	8	49
France	1967	23	53	105
Hong Kong	1988	7	47	74
India	1989	11	62	59
Kazakhstan	1993	13	24	54
Malaysia	1995	3	9	17
Netherlands	1969	7	28	67
Philippines	1988	0	5	21
Russian Federation	1992	87	48	9
Singapore	1988	11	45	66
South Africa	1992	1	9	38
Spain	1983	0	5	39

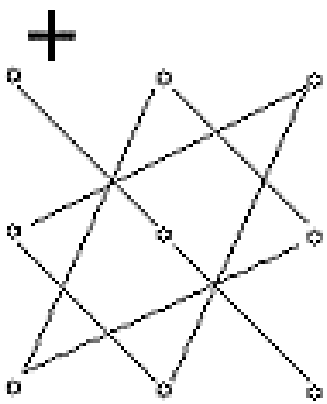
“At first, I did not like to learn in team teaching, but then I started feeling that my English became better. It helped me to gain some self-confidence”

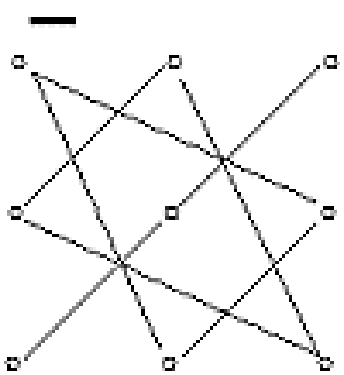
12 grade student

Differences between West and Soviet mathematics from the perspective of local and international teachers of NIS Semey and NIS Aktau (25 teachers)

How to calculate the determinant of 3*3 matrix?







aei + bfg + cdh - afh - bdi - ceg

Methods of explaining

Soviet	Western(English-speaking countries)
Teacher centered classroom	Student-centered
Less emphasis on application of what is being taught in real life	Concepts are related to real life activities
A topic is introduced followed by numerous problems.	Mostly focuses on explaining each component of the problem
Students are excellent at solving rather than mastering the concepts.	Loses the fact, that student will thing by himself, because all the information is presented to him so he doesn’t need to think further.
Focuses mostly on different varieties of problems	Focuses on understanding the idea of the topic for everyone
Understanding of mathematics is not for all	

Differences of the ways of introducing mathematical topic “Derivative and differentiation”

Soviet	Western(English-speaking countries)
1. Continuity and limit of a function 2. Derivative determines as a limit 3. Derivative of all functions 4. Geometrical and mechanical meaning of differentiation, gradient of a tangent 5.Behaviour of functions around critical points and the practical application of maxima and minima	1.Differentiation as an operation of finding the gradient at a point. 2.Gradient graphs. 3.Differentiation of ax^n 4.Behaviour of functions around critical points and the practical application of maxima and minima. 5. Expansion the differentiation to other functions

Differences in math books

Soviet	Western(English-speaking countries)
Give basic idea, formulas and laws Student thinks a lot to understand the content Has no step by step explanations Academic knowledge rather than application Less practical tasks No relationship of mathematics to real life problems.	More examples on practical use of mathematical knowledge Topics explained in detail. Students themselves are able to understand mathematical topics Over explains topics, so students do not need to think themselves It does not make student think, but understand.

Language preferences

	Traditional way of writing at Kazakhstan schools	Western way: From the book "SAT subject test: Math level 2" (from the page 34)
Composition of functions	f(g(x)) and g(g(x))	(f◦g)(x) and (g◦g)(x)

Students are allowed to use engeeniring calculators

If $f(x) = e^x$ and $g(x) = \sin x$, then the value of $(f \circ g)(\sqrt{2})$ is

(A) −0.01
(B) −0.8
(C) 0.34
(D) 1.8
(E) 2.7

Differences between in the content preferences

If {(3,2),(4,2),(3,1),(7,1),(2,3)} is to be a function, which one of the following must be removed from the set?

(A) (3,2)
(B) (4,2)
(C) (2,3)
(D) (7,1)
(E) none of the above

SAT Subject Test: Math Level 2

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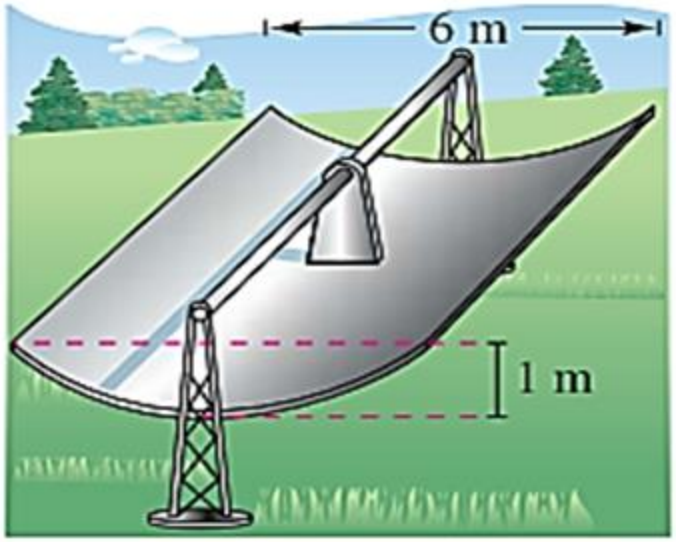
Statistics versus geometry

Soviet	Western(English-speaking countries)
Statistics is the weakness of the Soviet curriculum	Geometry is the weakness of the Western curriculum
Statistics are taught only in Olympic classes or in extra classes.	English geometry is very weak Teach only basics and non-difficult examples and tasks.
Soviet geometry is difficult, and requires a lot of thinking and imagination in 2D and 3D planes.	Consist very well explained topics of statistics and teach students to process statistical data
However, some catching up in Statistics is happening in the New Integrated Curriculum in Kazakhstan.	Teaches students to use different kind of software and applications to monitor, research statistical data

Theory versus practice

A solar collector for heating water is constructed with a sheet of a stainless steel that is formed into a shape of parabola. The water will flow through a pipe that is located at the focus of the parabola. At what distance from the vertex is pipe?

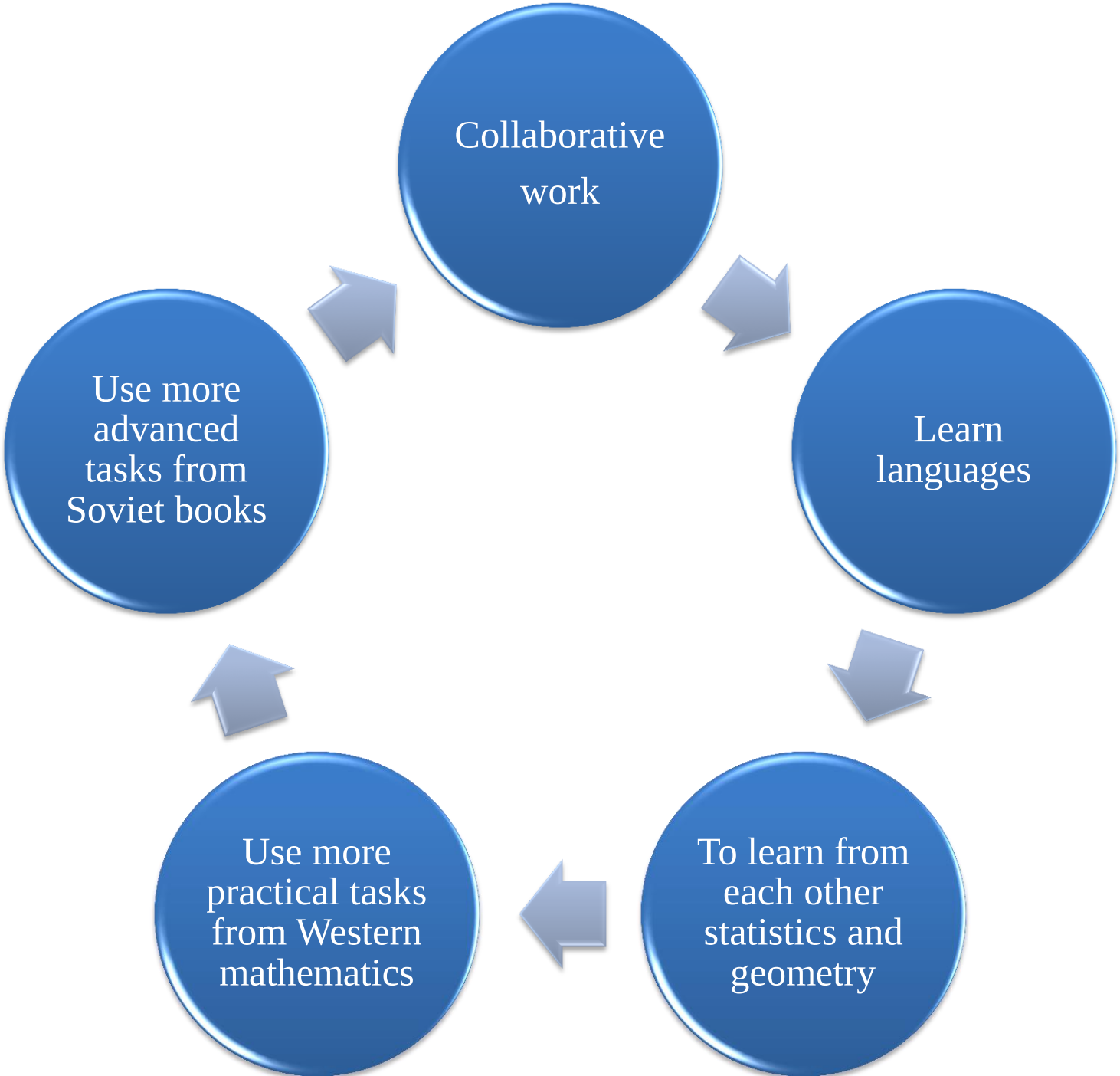


Parabola is symmetrical regarding to x axis and passes through the point $A(4, -1)$. Its vertex lies on the origin. Construct parabola's equation.

PISA results

Results of Kazakhstani students on PISA
49th place from 65 participant countries in the year 2013

The results say that local teachers teach students to solve complicated tasks; however, teachers need to improve teaching students to the ways of applying academic knowledge to real life situations, which required mathematical modeling.


Collaborative work
Learn languages
To learn from each other statistics and geometry
Use more practical tasks from Western mathematics
Use more advanced tasks from Soviet books

Thank you for attention

1. A-level Mathematics for Edexcel Core 4
2. SAT Subject test: Math level 1-2
3. Calculus 9th edition Larson Edwards
4. Statistics1 by Steve Dobbs
5. Russian mathematics education. Programs and practices.
Edited by Alexander Carp, Bruce R Vogeli Columbia University,USA
6. “Development of mathematical literacy of students in the framework of international research PISA” application 3
7. Shynybekov A.A Algebra 9
8. Shynybekov A.A Geometry 9-11
9. Pogorelov A.B Geometry 9-11
10. Atanasyan A.K Geometry
11. https://www.imo-official.org/results_country.aspx