



Preparing for the IOI through Developmental Teaching

Vladimir Kiryukhin

Marina Tsvetkova



The main content of the presentation

- To pay attention of teachers and coaches not on the competitive and the academic component of the preparation for the Informatics Olympiads
- To consider main advantages and disadvantages of traditional methods of preparation for the Informatics Olympiads
- To offer more effective model of preparation for the Informatics Olympiads, including IOI, based on developmental teaching
- To show how the proposed models are implemented in modern conditions of education informatization on the Russian example



What is the main goal of the IOI?

To win in the future as many as possible competitions in informatics?



Integration into the academic community and receiving awards for scientific achievement?



IOI Regulations, article S1.7:

“The main objectives to be accomplished by the IOI are:

- to discover, encourage, bring together, challenge, and give recognition to young people who are exceptionally talented in the field of informatics;
-

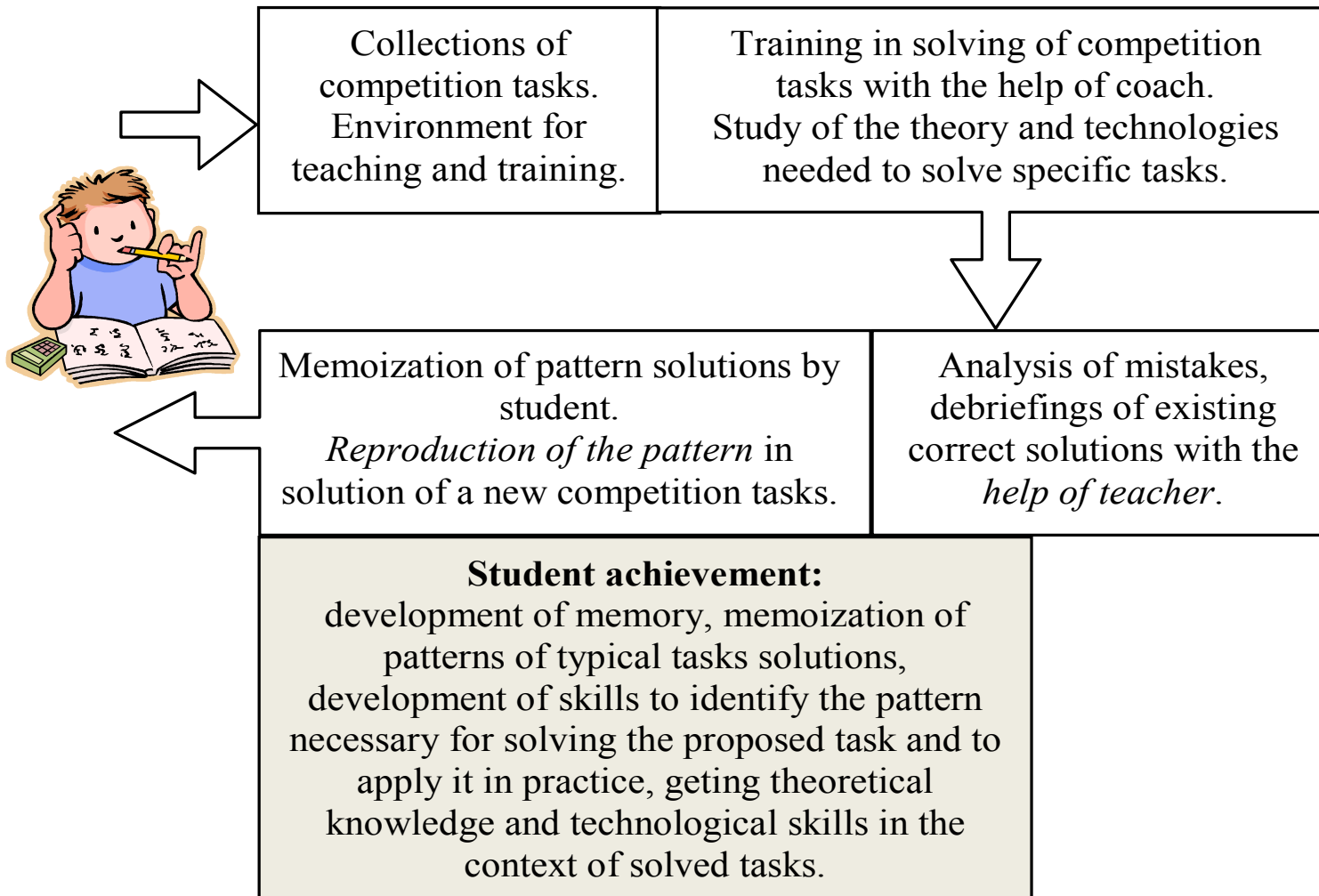


Traditional models of preparation for the IOI

- Model of reproductive teaching
«Reproduction of patterns with support on memory» (sporting approach)
- Model of productive teaching “Stages of development” (academic approach)



The model “Reproduction of patterns with support of memory”





Variation of the reproductive teaching model

The participation in as many different programming contests as possible, which are currently carried out often enough, especially on the Internet, with subsequent analysis of unsolved or partially solved tasks.

- In this case competitive activities are only implementation and demonstrate only the already achieved capabilities of students.
- A gifted student falls into the training environment imposed by the specific competition, where they could not choose new trajectories or discover more useful for him topics and tasks.
- New knowledge is perceived in the context of the proposed tasks. It is formed haphazardly and is not fixed as a private intellectual achievement of the student.



Disadvantages of the reproductive teaching model

- The absence of a developmental aspect, as it is constructed on a reproduction of patterns.
- Gifted student cram into memory patterns for various difficult tasks and the techniques to solve them, subsequently reproducing the stored solutions.
- Development of theoretical knowledge and technological abilities is subordinated to features of the tasks and aimed at accumulation, not on discovering the underlying problem-oriented situation.
- Results of participants prepared in such a way at the IOI are often rigidly differentiated: 80-100% of the points if the pattern of a solution is known or 0-30% if the pattern is not known.



Improvement of the reproductive teaching model

The formation and phase expansion of the so-called in Russian pedagogy *the zone of nearest development* of the student, which is an area of further in-depth and phase learning topics in informatics required for olympiad preparation and interesting to student.

In this context, solving competition tasks has to play the role of mediator, leading the talent on a trajectory of development.

Model of productive teaching “Stages of development”



1. Productive stage in the zone of nearest development

Self-study work:
solving of competition tasks, the multiple approach to solve of them with the possibility of obtaining partial solutions, analysis of mistakes.

Student achievement:

maximum progress toward the complete solution using partial solutions tasks with support on current knowledge.

2. Reproductive stage in the zone of nearest development

Teaching with teacher:
analysis the pattern of complete solution, identifying needs in the theoretical and technological preparation and study identified shortages.

Self-study work:
Repeated multiple approach to solving of tasks and obligatory obtaining a complete solution.

Student achievement:

receive a full solution of competition tasks with support on the pattern, acquisition of new knowledge and new information technology skills.

3. Productive stage of expansion of the zone of nearest development

Self-study work:
solving of competition tasks with self-produce full solutions by own original way, developing like tasks and tests for them.

Student achievement:

discovery of new knowledge, progress in obtaining of new information technology skills and ability to develop of products of creativity.



How to improve traditional models?

- Applying of the theory of *developmental teaching* for the development of creative abilities of students, that is the shift from a teaching process to a process of learning and development.
- Development of abilities not only to generate ideas and to develop algorithms for the solution of a competition task, but also to implement it correctly in the given programming environment, including testing of programs.
- Using in the process of preparation for the IOI the basic principles of *cooperative pedagogy*, which assumes the refusal of intellectual slavery and is implemented on the experience both of the student and the teacher.
- Formation a development horizon of a particular gifted student in the area of their cognitive interests, which is called the “mental horizon” – the upper bound of developmental teaching during the given age period.



Anticipatory teaching model «Development horizon»



7-12 years (2-6 grades)

The formation of the zone of nearest development in the school curriculum

Formation of individual development horizons:
classes in the preparatory groups for gifted students in informatics and mathematics, clubs of programmers

Student achievement:
Winner/prize winner of school or municipal stage of the RusOI

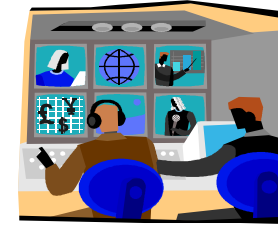


13-15 years (7-9 grades)

Zone of nearest development – in-depth study of the of school courses in informatics and mathematics

Extension of the horizon of individual development:
specialization courses, external study in informatics, summer/ winter regional computer schools, lyceum in informatics and mathematics, interdisciplinary project work in school

Student achievement:
Winner/prize winner of regional or final stage of the RusOI



16-17 years (9-11 grades)

Zone of nearest development – study of profile school courses in informatics and mathematics

Formation of professional development horizon:
elective courses, training sessions of Russian team candidates for the IOI, lyceum in informatics and mathematics, project work in school-university system

Student achievement:
Winner/prize winner of the IOI



Methodical supports for the anticipatory teaching model

- The support on individual culture
- The support on heuristic knowledge
- The support on technology
- The support on systematic
- The support on creative activity



Conditions of implementation in practice anticipatory teaching model

- The further development of traditional forms of preparation for the IOI
- Active introduction of network forms of preparation for the IOI
- Increasing the role of self-preparation for the IOI
- Creation of the environment of anticipatory teaching of gifted students in informatics



Network forms of preparation for the IOI

- The creation of network olympiad communities all over the country and the world
- Development of methodical digital collections (topics in olympiad informatics and competition tasks, real time evaluation systems) for support of the olympiad communities
- The organization of on-line programming contests
- Distance teaching (schools with remote access, remote teachers, distant centers of additional education, video web sessions and etc.)
- The formation on the Internet of a distributed portfolio of each student, participating in on-line programming contests



The role of self-preparation for the IOI

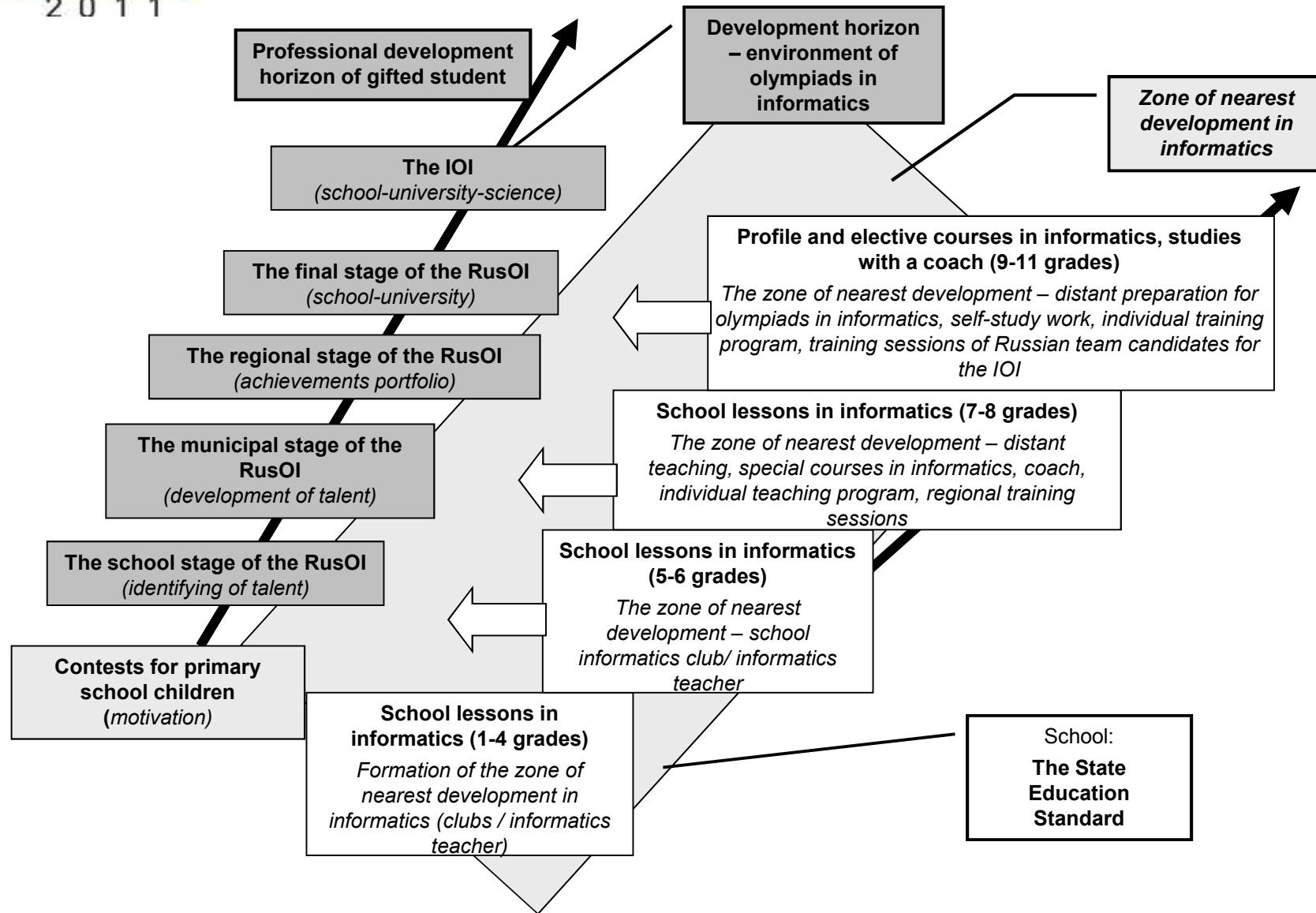
Self-preparation for the IOI – individual horizon of student development.

The basis of self-preparation for the IOI and constructing individual trajectories of such preparation consists of the following methodological and didactic materials on informatics olympiads:

- IOI Syllabus and Complex Curriculum of Olympiad in Informatics Preparation that define the content of preparation;
- materials for theoretical preparation, presented in printing or/and electronic forms, including video lectures;
- collections of competition tasks of all levels of complexity and topics, with short methodical instructions for their solutions;
- websites with competition tasks collections and the possibility of automatic on-line evaluation of submitted tasks solutions;
- websites providing regular on-line programming contests.



Environment of anticipatory teaching



Main conclusions

- Successes in the IOI is largely determined by the quality of work with gifted students in the country.
- For successful performance at the IOI a preparation methods of gifted students should be based on anticipatory teaching.
- Development of student talent should begin in primary school and by using a computer to solve developing tasks.
- Victory in informatics olympiads should be not a goal but a means of high achievements of talented students in their future live.





Thank you for your attention

vkiryukhin@nmg.ru

tsvetkova@LBZ.ru