# TEACHING FUNDAMENTAL MATHEMATICS for STUDENTS of IT-SPECIALTIES in the TRANSITION PERIOD

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Today the need for IT specialists significantly exceeds the graduating ability of universities that train such specialists.




One at all

The main directions in solving the problem can be described as follows:

- increasing the orientation of fundamental mathematical courses (algebra, mathematical analysis, discrete mathematics, probability theory and mathematical statistics, etc.) to train high-level specialists in the development of digital resources;

- the formation of skills of high-performance independent work in obtaining, mastering new knowledge in the professional sphere

of developing digital resources based on fundamental mathematical disciplines.

# Problems of the Transition Period


The transition from the classroom-lesson system to the lecture-practical system is often accompanied by a relaxed attitude of students to study, in contradiction with a much more intense and concentrated presentation of the educational material.

Yesterday's entrants master the fundamental mathematics during this period with great difficulty and very superficially and pay more attention to programming and information technologies.

For the transition period, these aspects can be clarified as follows:

- it is necessary to demonstrate to students the conceptual unity of mathematics and programming as a sphere of scientific and industrial activity;

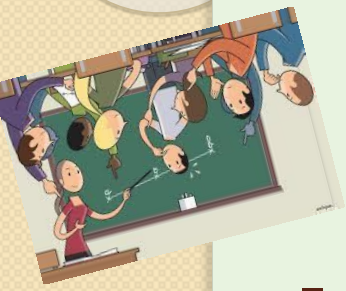
- a radical change in the style of students' educational activities is necessary in order to significantly increase the role of independent work in obtaining and mastering new knowledge;

- it is necessary to create conditions for the development of individual abilities in the fulfillment of creative tasks.

# Intensive course on introducing basic mathematical concepts and constructions

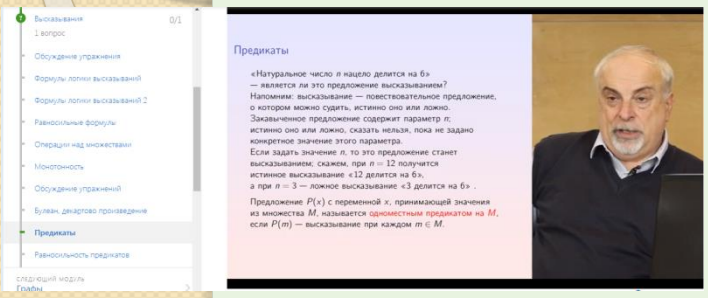
- Sets and elements of mathematical logic.
- Graphs.
- Relations.
- Math mappings.
- Math operations.
- Mathematical induction method.
- Basics of combinatorics.

# Pedagogical technology: Flipped class



- self-dependent study of theoretical material and the implementation of a few tasks;
- analysis on a practical lesson of questions that students had in self-dependent work;
- solving productive problems on the given topic;
- fulfillment of individual (optional student) creative tasks.

# Technological basis for implementation: the network platform Ulearn developed by SKB Kontur




For each topic of the course under study, this platform contains
- video lectures (Vodcast),
- text versions of lecture material,
- tasks for self-fulfillment,
- tasks designed to be completed in a practical lesson.

Individual tasks of a creative nature were not placed on this platform.

For most of the self-independently completed tasks, an automatic verification of the correctness of decisions is provided.

For those tasks where automatic testing is not provided, the student himself notes whether he, in his opinion, coped with this task.

All information about students completing assignments for independent decisions is available to the teacher conducting practical classes.

He takes it into account when planning the next lesson on this topic

| я Имя | Сумма | | Множества и логик... | | Графы | Отношения | Отображения | | Операции | | Комбинаторика |
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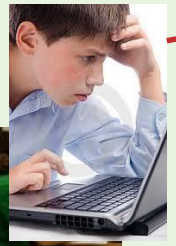
| | Lec | Qz | Lec ▸ | Qz ▸ | Qz ▸ | Qz ▸ | Lec ▸ | Qz ▸ | Lec ▸ | Qz ▸ | Qz ▸ |
| | 4 | 66 | 2 | 10 | 19 | 9 | 1 | 5 | 1 | 17 | 6 |
| ин Данил | 1 | 57 | 1 | 6 | 18 | 8 | 0 | 5 | 0 | 16 | 4 |
| ов Роман | 3 | 43 | 1 | 10 | 18 | 9 | 1 | 0 | 1 | 4 | 2 |
| агин Дмитрий | 1 | 48 | 0 | 6 | 16 | 4 | 1 | 2 | 0 | 16 | 4 |
| нко Никита | 3 | 27 | 1 | 8 | 14 | 1 | 1 | 0 | 1 | 4 | 0 |
| ов Дмитрий | 3 | 63 | 1 | 10 | 17 | 9 | 1 | 4 | 1 | 17 | 6 |
| алов Артем | 4 | 50 | 2 | 6 | 15 | 6 | 1 | 3 | 1 | 15 | 5 |
| ицын Александр | 4 | 51 | 2 | 5 | 16 | 6 | 1 | 2 | 1 | 16 | 6 |
| в Александр | 2 | 56 | 0 | 7 | 17 | 7 | 1 | 5 | 1 | 14 | 6 |
| ых Сергей | 3 | 64 | 1 | 9 | 18 | 9 | 1 | 5 | 1 | 17 | 6 |
| Ярослав | 2 | 42 | 0 | 2 | 18 | 7 | 1 | 3 | 1 | 11 | 1 |
| ев Иван | 2 | 49 | 0 | 3 | 18 | 5 | 1 | 4 | 1 | 14 | 5 |
| а Алиса | 3 | 49 | 1 | 3 | 18 | 6 | 1 | 2 | 1 | 15 | 5 |
| ов Сергей | 4 | 46 | 2 | 3 | 13 | 8 | 1 | 5 | 1 | 12 | 5 |
| Артемий | 2 | 54 | 1 | 9 | 16 | 7 | 0 | 5 | 1 | 12 | 5 |

Преподавателю предоставляется информация не только о том, решена или не решена та или иная задача данным студентом, но и насколько полно им был изучен теоретический материал по видеолекции.

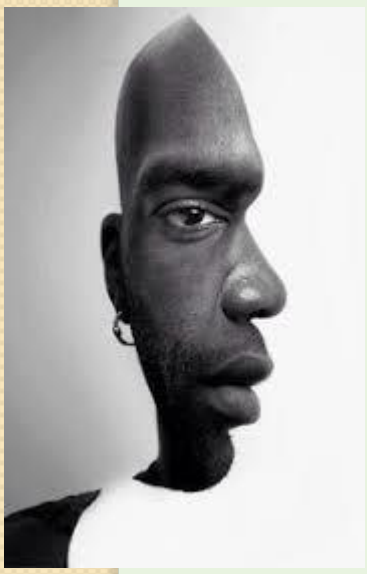
Платформа Ulearn предоставляет возможность обратной связи с преподавателем. Это позволяет оперативно отвечать студентам на возникающие у них вопросы, а также в режиме on-line давать поясняющие комментарии к материалам курса.



Video lectures and text versions of lecture material were not literally the same.

The definitions and formulations of the main statements were uniform.

As for the given examples explaining the introduced concepts and the proofs, here we strove for an enough variety.



*Two glances at one object*

# Organization of the experiment and its results

The training was conducted in two groups of students (65 people) who entered the direction "Fundamental Informatics and Information Technologies" of the Department of Mathematics, Mechanics and Computer Science of the Institute of Natural Sciences and Mathematics of Ural Federal University.

More than 70% of students coped with at least 80% of the tasks of the reproductive level (as part of self-independent work).

From tasks of a productive level, depending on the topic, 50% to 65% of students coped.

15-17% of students completed individual tasks.

# Assessment of the role of the presentation of theoretical material

For the first time, 85.7% of students watched the theory of fully video lectures.

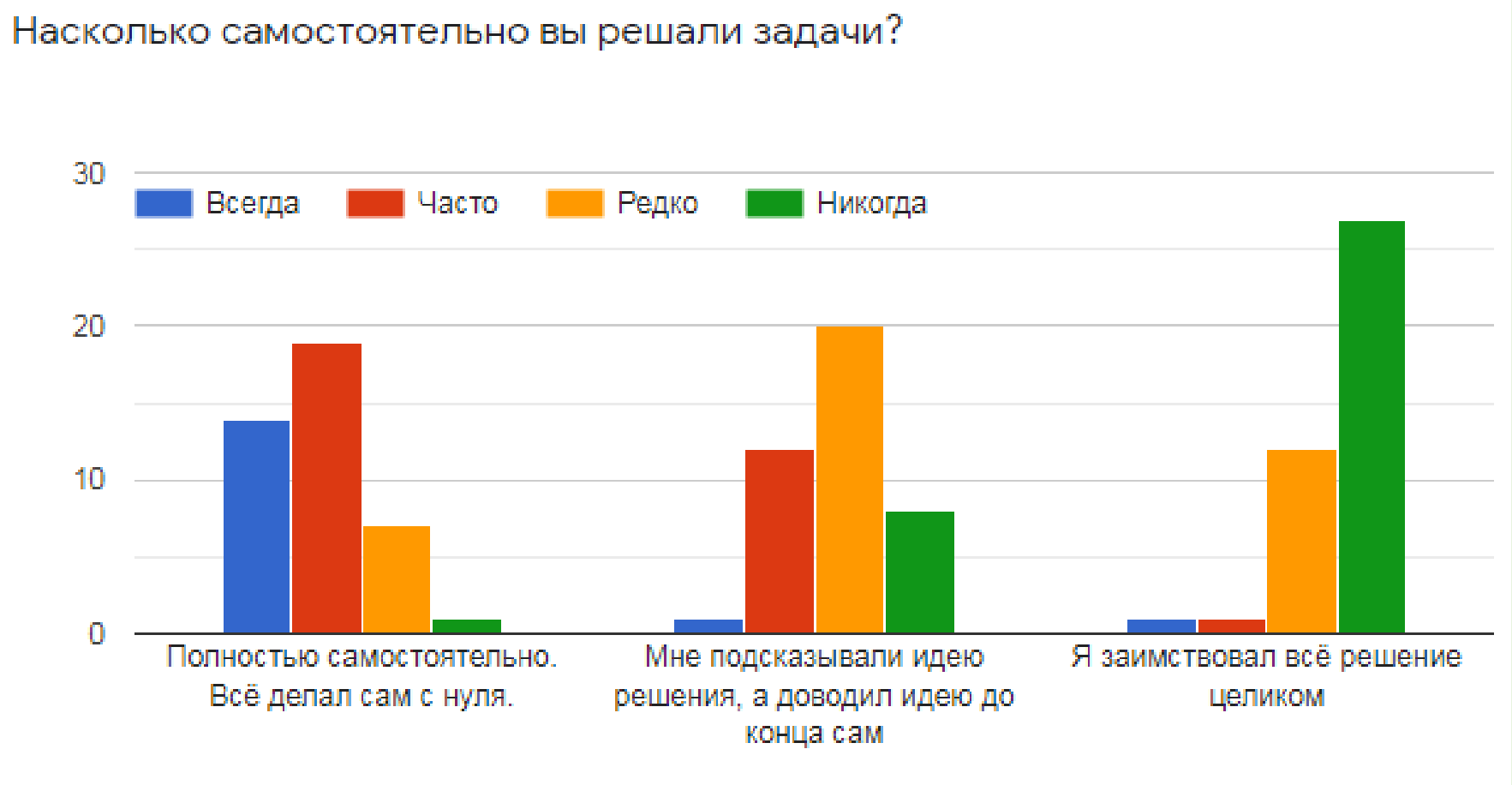
Only 33.3% of students used the video lecture to repeat the material.

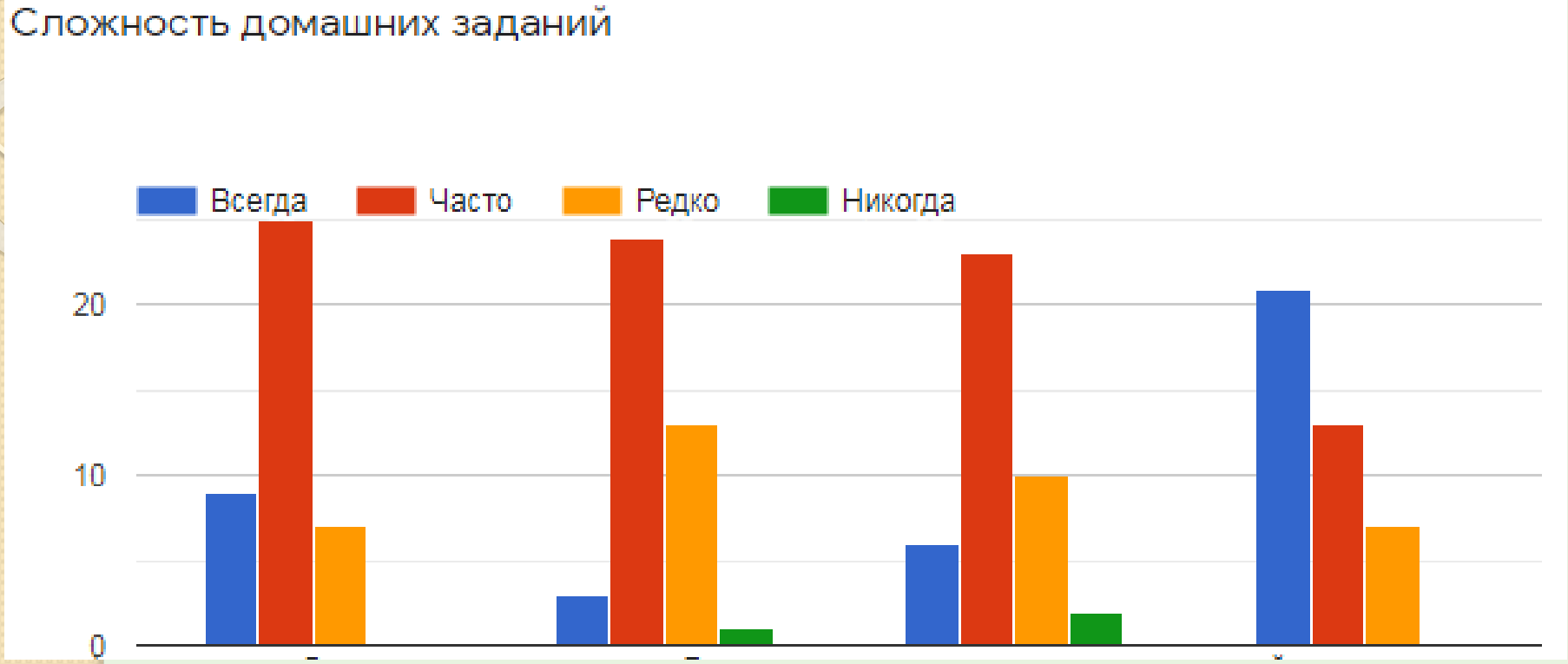
For text materials, these indicators were 45.2% and 73.8%, respectively.

- Although 15-17% of students completed their creative tasks, more than 80% of students find it useful to get to know them in laboratory and practical classes. They were unhappy that, in their opinion, little time was devoted to solving such problems.

# Student’s Survey

Two questionnaires were conducted: after the first day of classes and after the end of the course.





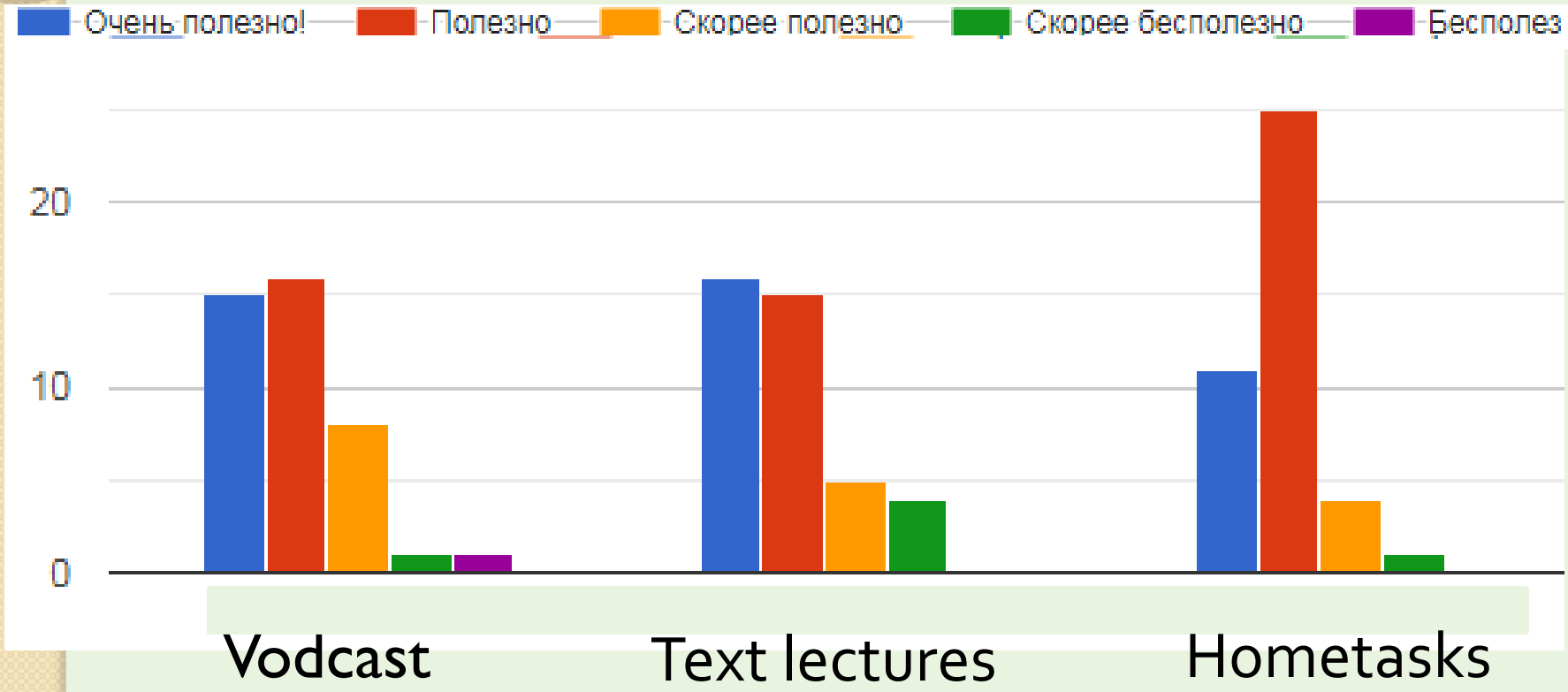

The wording was clear

In principle, it was immediately clear how to solve

It was clear how to apply the lecture material.

I returned to theory in solving problems

# Evaluation of inverted technology components



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Thanks for attention!