Problems and Prospects of Remote Teacher Training
in Uniform Environment of E-Learning

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Intensive development of information and communication technologies (ICT) promotes their using within of educational process at various levels, including in high school. However the basic criterion of ICT application within of educational activity is the organization of optimum schemes of integration ICT with various standard techniques of subject training and independent activity of pupils. The modern period in ICT development can be characterized by two essential tendencies. On the one hand, gradual transition from using ICT of local user by directly on the realization of remote interaction between various users (pupils and teachers) within local or global networks is carried out. On the other hand, gradual transition from using of stationary ICT resources to the application of mobile ICT, treated as small resources of information (graphic calculators, a handheld computer, cellular telephones, smart phones, communicators etc.) is observed. It is necessary to notice that now the given directions are considered as completely independent, not having essential points of functional crossing ([1], [6]).

1. The Organization of remote educational process (REP) within local and global networks is carried out to active using of interaction between pupils and teachers in various operating modes ("Prometej", "WebTutor", Moodle, etc.). There are most often used a mode on-line with direct display of contents, as a rule, in a browser, with necessity of constant connection to a network, or a mode off-line with possibility of necessary material downloading on the local computer with the purpose of further studying without necessity of connection to a network. Two various interconnected environments for work of users depending on their accessory to pupils or to teachers are realized [8, 9, 10]. It is obvious that there are certain distinctions in the organization of work with REP for the given basic categories of participants of educational process.

On the basis of characteristics research of modern REP it is possible to formulate of essential lacks modern REP, used in Russia:

• Absence within REP some realizations of uniform database on teachers and students, considering names of high schools, faculties, specialties, groups and subject matters. It is necessary to underline that the given problem is actual owing to possibilities, on the one hand, teachers to work in several high schools simultaneously, and, on the other hand, as possibilities of training in various high schools, besides on different specialties within one high school as a whole;

• Absence of uniform methodical complex on similar subjects in homogeneous high schools as from the point of view of structure, and the maintenance of methodical and didactic materials. The given problem directly follows from the first problem as absence of a uniform relational database on teachers, students and subject matters directly reflects the absence of a uniform methodical complex in Russia;

• Absence in REP some dynamic resources for realization of educational settlement projects including interconnected works. From the given point of view modern REP are at all adapted for application in educational process of various settlement projects. Unfortunately, available for today REP allows to realize of independent students work only on four components. The *first:* acquaintance of pupils with the lecture contents presented in the form of the electronic textbook. The *second:* testing of students (use both directly total tasks is supposed, and generating of demos) by in advance teacher completely making by manually of questions and corresponding variants of answers to each of them (there are no automated processes, both generation of various values initial given, and logic chains in tasks in general). The *third:* dialogue within of forums or

guest books (as a rule, within considered subject matter as a whole), and also the *fourth* possibility of export-import files of documents by user. Now design activity is reduced to creation of presentations and similar documents, that there are no computing and logic projects as those that also is inadmissible. It is necessary to notice that as a whole there are information possibilities of realization not only computing or logic operations within educational projects on science, but also application of various logic chains and operations to realization of educational projects on humanities.

- At the most modern REP there is a monitoring of educational students activity only within total control on a subject matter as a whole. It is obvious that the received estimation only indirectly reflects true level of knowledge, skills of pupils. Absence of the intermediate control on each of sections within subject matter is caused, as it was marked earlier, the absence of possibility on performance of projects and intermediate testing on each of subject sections;

- Absence of intuitively clear and at the same time high-grade system of navigation within REP which finds the negative reflexion in realization of the unfriendly user interface. The given circumstance is caused by necessity of using in REP a considerable quantity of the program modules which are responsible for various functionality, including beyond educational process from the point of view the realization on direct activity of pupils within educational disciplines.

Now Bogun V.V. is carried out technological working out of information system of REP monitoring of students in high schools which is directed on the decision of absence problem in modern REP of dynamic resources for realization of educational settlement projects. Innovations are presented on the basis of using within of dynamic Internet site some algorithms of problems decision generated on program level with the automated processes of initial data generation, processing and monitoring of intermediate and total results. In particular, the corresponding applied software which is based on using of Web-server Apache for realization of virtual server in a combination to technology of dynamic Internet sites creation on the basis of programming language PHP and control systems by relational databases MySQL for realization of necessary inquiries is developed [13]. REP with strengthening adaptive interactions, constructed on the basis of developed information system of monitoring REP of students is characterized by following features:

- The uniform database on teachers and students within region or the state on the basis of automated account of basic signs (the name of high schools, faculties, specialties, groups and subject matters) is realized. On the other hand, the uniform database under educational projects and studies entering into their structure for necessary subject matters is realized. Applying to teaching mathematics is shown that directly reflects the presence of a uniform methodical complex on subject matters in homogeneous high schools;

- The dynamic system of educational projects from the point of view on necessary of didactic and methodical components of pupils design activity includes the description of the considered course within subject matter. The list of names and the description of corresponding projects within of each course, the list of names, the description, theoretical aspect, demos and settlement tasks on corresponding works within of each educational project is realized. Automated generation of independent variants of demos (values of the initial given, intermediate and total results) for the teacher and the student with possibility of demos viewing both representatives and administrations only for one of the parties is used. Generation of tasks (variants of values of the initial data) is made for students unitary, the teacher should get access to work of students only in a viewing mode, students should get access to the work with possibility of viewing on correctly specified values, viewing and editing of intermediate before values intermediate and total results. It is necessary to notice that realization of demos and settlement tasks for student activity is carried out according to decision algorithm of corresponding problems developed on programming level within of activity;

- The dynamic system of pupils testing within of subject matter, the project or activity with completely automated processes of values generating of initial data, correct both obviously erroneous results, and checks of answers correctness on test tasks is realized. Possibility of demos generating of corresponding tests, realization of high-grade monitoring of students educational activity within of necessary subject matters from the point of view as disciplines as a whole and taking into account results of settlement projects performance and activity thanking completely automated mechanisms of data processing is thus used;

- Dialogue between students and the teacher in the form of a forum within learning activity is realized that essentially raises clearness of discussed problem borders in forums. It is necessary to notice that the given process means all-around automation presence. Intuitively clear user interface and navigation within of REP owing to use of various kinds of dynamic menus essentially facilitating an access to the necessary information (the hierarchical menu with tree use, the menu with use hypertexts etc.) is applied.

It is necessary to notice that possible to use as didactic material certain sections of linear algebra (a matrix, system of linear algebraic equations, analytical geometry), mathematical analysis (limits and a continuity, calculus, differential equations), combinatory, probability theory and mathematical statistics.

The organization of educational process with using of students monitoring system of REP is carried out on following algorithm:

1. The Formulation by teacher of necessary methodical and didactic components of educational process with using of design activity, including: the description of considered course within of subject matter, the list of names and the description of corresponding projects within of each course, the list of names, the description and theoretical aspect on corresponding activity within of each educational project with the subsequent reflexion of specified components within of students monitoring system of REP;

2. Working out of settlement algorithms necessary and corresponding programming modules for realization of each problem decision within of educational project with the subsequent reflexion of specified components within of students monitoring system of REP;

3. Generating by the teacher and students of demos independent variants of considered activity with possibility of demos viewing both representatives and administrations only for one of the parties. On the basis of values generating of initial data with using of random numbers and generated initial code of programming module of problem decision should be receipted of automatically calculated values of intermediate and total results;

4. Generating by each students the corresponding variant of activity with possibility of viewing (not editing) by the teacher of intermediate and total results values and possibility for students of correctly specified values viewing , editing and viewing of current values and intermediate and total results on the basis of values generating of the initial data with using of random numbers. There are used proceeding from formulated conditions the generated initial code of programming module of problem decision;

5. Realization of monitoring of students design activity from the point of view as teacher, and students. The main purpose of process analysis is the performance by students of project work and formation of further strategy of current design activity realization;

6. Realization of dialogue between students and the teacher in the form of a forum within of each project activity that essentially raises clearness of discussed problem borders in forums, for the purpose of problem allocation of areas and their further decision.

Interactive environment of programming realizing of algorithm

Generating of project's demo versions

Generating of initial data values

Generating of results values

Generating of reports with opportunity of interactive view

Generating of project's execution

Generating of initial data values

Generating of execution results values

Comparative analysis of scenariji results and execution

Generating of projects reports (verification)

Structure Generating of projects reports (edition)

Development of algorithm programming implementation

Development of didactical contents

TUTOR

Monitoring of students project activity

Discussion of project results with student

Monitoring System of Remote Educational Projects Using ICT

Results Display of students project activity

Implementation of forum for project discussion

Calculation of project results

Getting of initial data values and projects results

STUDENT

Analysis of current project activity

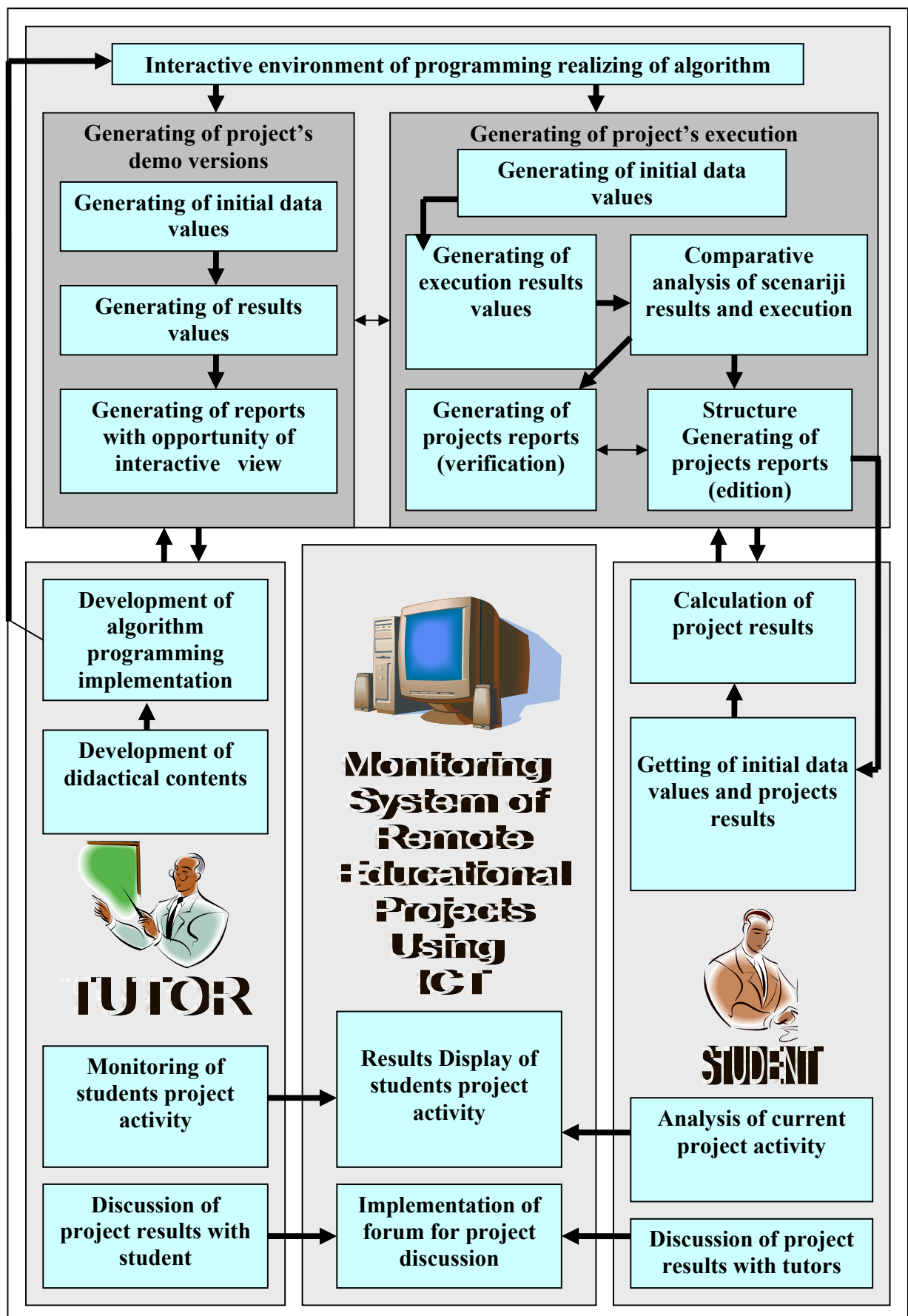**Discussion of project results with tutors**

Fig. 1. The scheme of implementation of REP monitoring

2. On the base of development network and Internet technologies in educational process there is almost completely unresolved a problem of ICT mobilization for the purpose of small resources of information using. Practically at all stages of educational process realization (classroom activity without dependence from possibility of their carrying out in a display class, in house conditions, library, in the open air etc.) the requirement for integration of subject and information knowledge is obvious. The given problem reflects the essence of ICT development designated above the second direction for today, consisting in necessity of ICT transition from the level of local user on mobile level of an information technology realization.

Now practically within of small resources of information there is no possibility for monitoring of students educational activity, not to mention of design activity realization. If to track all available achievements on ICT mobilization for today it is possible to allocate only one class of small resources of information as graphic calculators which are rational for using in educational process with restriction of a scope within of reception and visualization decisions of necessary educational problems. Possibility of graphic calculators using in educational process speaks a primary orientation of given mobile devices from the point of view of hardware and program maintenance. However primary possibilities on using in educational process of other classes of representatives of small resources of information (cellular telephones, smart phones, communicators, a handheld computer etc.) are simply absent as those [11]. The matter is that the given mobile devices have initially been focused on especially applied problems a little connected with educational process that is for realization of telecommunication, access to the network the Internet as user and use of additional user functions, for example, application of the device as the camera, a player, an alarm clock etc.

On the same level with the essential lacks generated above modern REP, applied in high schools of the Russia, it is possible to allocate real *problem areas* which arise at realization of educational process with use of small means of information:

1. Practically a total absence of the concept and techniques using of small resources of information in educational process that directly reflects small volumes of studies support of similar mobile devices;
2. Primary absence of the software for small resources of information, directed on using of given devices in educational process in all its displays. This in itself is unacceptable as on the studies spent without attraction of display class, mobile devices are the unique alternative of personal computers replacement on realization of computing projects and problems;
3. Absence of direct application of small resources of information within of REP that is strange enough circumstance as the majority of modern mobile phones, smart phones and communicators give possibility of access to a network the Internet under HTTP report and some other reports with application of technology GPRS.

Now authors actively develop and approve the concept using of small resources of information in teaching mathematics [2, 3, 5]. As a didactic material the methodical complex of graphic calculator CASIO ALGEBRA FX 2.0 PLUS using is developed. Thus various graphic calculators of Texas Instrument corporations and CASIO as one of the representative of small resources of information in the course of teacher training can be applied. Research includes the description of necessary methodical and didactic making various studies (a laboratory practical work, a practical training and an open classroom), the design problems focused on active using of educational activity realization.

The basic lack of graphic calculators as well as all representatives of small resources class of information is the total absence of interaction with Internet environment as directly or through of local networks. Thus also there is no a necessary software for work in Internet network (browser), therefore to unite graphic calculators in the uniform environment of remote training from the point of view of pupils access to educational projects for the purpose of subsequent monitoring of educational activity of students by the teacher is impossible. Unique possibility of graphic calculators using in educational process is presence of powerful built in mathematical software realized on the level of computer mathematical systems and directed on realization and visualization of mathematical calculations connected with research of difficult phenomena and processes.

The technique of graphic calculator using offered by authors in the course of teacher training is characterized by following aspects (fig. 2):

1. Revealing and statement of the didactic problem consisting in necessity of using of graphic calculator on certain stages of problem decision connected with application of visualization, algorithmization and difficult computing procedures and variability of initial data values;
2. Allocation from didactic problem designated above, mathematical, science and applied problems and problems deducing on realization of difficult computing and logic operations, connected with visualization and also variability of initial data values;
3. Realization of conceptual, mathematical and information modeling for the decision of problems;
4. Working out of algorithm of problem decision on the basis of received mathematical and information models and its realization on programming level within of graphic environment of calculator;
5. Using of applied software developed on graphic calculator within of realization of task decision for the purpose of hypothesis formulation. After checking it on the basis of carrying out of comparative analysis of intermediate and total results in the course of a variation of initial data values. It is expedient to organize in this case some process of training in small groups of pupils that allows to revealing of various personal psychological features of students.

Authors on an example of developed laboratory work using of graphic calculator as integration tools of mathematical and information knowledge is offered at performance of numerical algorithms which essence consists in construction and visualization of iterative processes converging to required decision.

The technique of laboratory works using of communications principle in small groups is carried out on following stages:

1. The actualization of knowledge and the control of theoretical aspects and practical skills on using of graphic calculator;
2. The formulation of the name, the purpose and the plan of laboratory work carrying out;
3. The consideration of mathematical problem decision on an indicative example;
4. The distribution of students on small groups (on 3-4 persons) for the purpose of the various variants analysis of initial data;
5. Evident modeling and the decision of an offered mathematical problem with application of three numerical methods on the basis of mathematical and information knowledge integration with using of graphic calculator;
6. The reflection and carrying out of comparative analysis of received results for the purpose of conclusions formulation and checking out of hypotheses;
7. The registration of laboratory work with subsequent representation to the teacher;
8. The presentation of results;
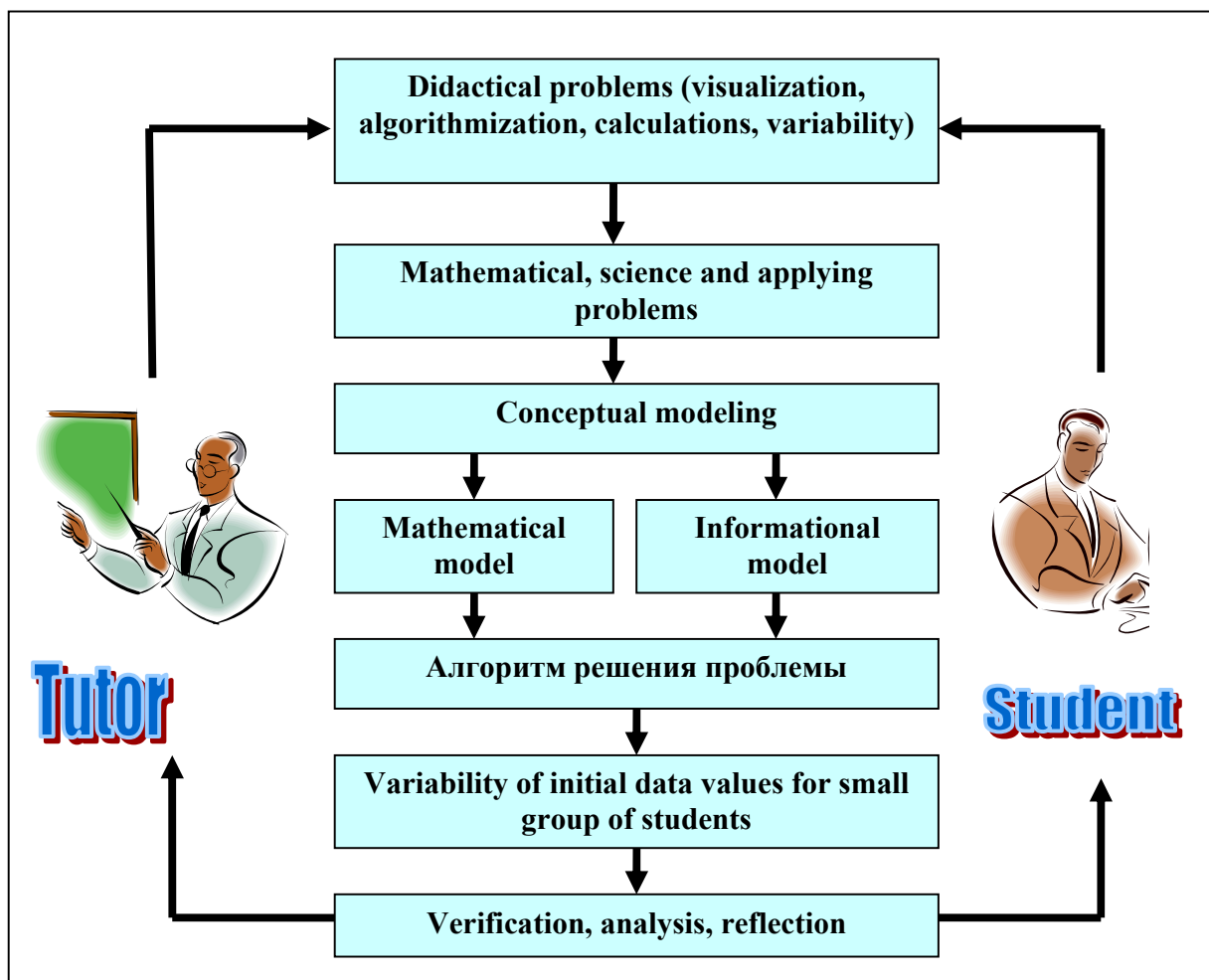9. Individual interviews or verifying testing.

Fig. 2. The scheme of graphic calculator using in teacher training

Within of laboratory work with the decision of following design problems from calculus [2, 12] is carried out:

1. The calculation of minimum numbers values on approach to a limit of numerical sequences $x_n = \dfrac{a_2 n^2 + a_1 n + a_0}{b_2 n^2 + b_1 n + b_0}$ (for $\varepsilon > 0$ $a_2 \neq 0$ $b_2 \neq 0$, $\left| x_n - \dfrac{a_2}{b_2} \right| < \varepsilon$) with using methods of a gold proportion, Fibonacci, a dichotomy and their comparative analysis (section *«Limits and a continuity»*) [4];

2. Decisions of algebraic and transcendental equations with using of dichotomy method, combined method of chords and tangents (Newton), iterations method and their comparative analysis (section *"Differential calculus"*);

3. Calculations of certain integrals values under formulas of average rectangles, trapezes, parabolic trapezes (Simpson) and their comparative analysis (section *"Integral calculus"*);

4. Decisions of ordinary differential equations of first order with using of Euler method,

Runge-Kutta of the second, fourth usages of accuracy and their comparative analysis (section *«Differential equations»*).

Further realization of unique integration of above-stated tendencies of ICT development within of educational activity thanks to developed information system of REP monitoring of students Teacher Training Institute using of an access to given environment is offered. Thus interactive activity is possible as from personal computers through Internet global network and from certain representatives of small resources of information (mobile phones, smart phones, коммуникаторы) on the presence of GPRS technology supposing of HTTP report. It finally will allow to realizing the uniform environment of remote training of students in high schools, uniting all participants of educational process without dependence as from the presence of display class and geographical position of educational process participants on realization of independent activity and monitoring of students educational activity by the teacher.

In the conclusion it is necessary to notice that unique possibility of creation of high-grade uniform environment of remote training of students in high schools is organized educational process on the basis of dynamic level realization of settlement educational projects with access possibility to the information through local and global networks and using of small resources of information in forms of cellular telephones, smart phones and communicators.

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