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LEARNING PROCESS MODELING WHILE TEACHING ENGINEERING GRAPHICS

Abstract: Matters connected with arisen problem situation while teaching graphic disciplines are considered in this article. Sharp reduction of academic hours for graphic disciplinesstudy and increased requirements for education quality causednecessity to develop new ways of teaching this discipline. One of the possible approaches to improve the situation is redefining the content and forms of teaching engineering graphics.

To determine the qualimetric estimate of students used method for constructing the tree of properties. The qualimetric estimation of a student is offered on the basis of internal factors. Positive and negative factors influencing successful training are investigated. M*anagement of the learning process is achieved by the continuous monitoring of students' knowledge. For each academic group calculated integral indicator of progress. Identified the most of significant factors among positive and negative ones.*

Analytical dependencies are determined allowing to manage the educational process.

Keywords: graphic disciplines, modeling of educational process, qualimetric estimation, positive and negative factors, interrelation between factors.

Problem statement. Academic discipline “Descriptive geometry and engineering graphics” (Engineering geometry and computer graphics”, “Computer Graphics”) is the basic one and included into academic curricula of the most higher education technical institutions, oriented for training both engineers and artists for the 1st and 2nd semesters.

It is this discipline that is directly and indirectly associated with all graphic disciplines, architecture, design that lays down the foundation for becoming professional specialist training (spatial thinking, the ability to see the problem as a whole, produce a decomposition of the whole into its component parts, or the synthesis of a variety of parts etc).

The level of specialist competence directly depends on his/her knowledge of engineering graphics, the ability to operate graphic images and skills to handle computer graphic packages.

However, this discipline traditionally has been difficult for perceiving by students.

Chronic poor progress on graphic disciplines remains the long-term phenomenon.

The situation is being aggravated by sharp reduction of training time provided for engineering graphic disciplines, by discrepancy between increasing requirements for professional training ofspecialists and new information technologies introduction into all spheres of activity and also by shortcomings in training methods and insufficient preparation of students themselves and by irrational organisation of educational process as well.

This has stipulated the problem of working out the ways of rethinking and improving engineering and graphic grounding contents as well as learning process technique.

Training disciplines modelling structure involves the following components:

1. Academic programme containing the necessary structural learning information to be mastered by students

2. Control programme for cognitive activity of students

3. Programme for controlling and correction of student learning activity.

4. Carefully thought-out structure for training arrangement.

There may be two variants for detection of targeted professional specialists training.

5. Analysis of existing practice in activity types and choice of problem situations, necessary tasks and controlling types on this basis.

6. Working out of a model for learning process on the basis of specialist activity analysis.

The first way is focused on experience and intuition of a teacher (lecturer). The second way is based on the method of programme-oriented planning, advanced mathematical and statistical methods and new technologies [1–3].

Analysis of the recent researches. Component analysis of academic discipline content named "Descriptive geometry and engineering graphics" allows to make a conclusion that academic information to be mastered by students has not been changed for many years.

Attempts have been made by Russian scientists to rethink the contents and methodology of teaching graphic disciplines [4, 5].

Theprogramme of cognitive activity management, the programme of correction and control of educational activity of students have evolved under the influence of systematically active approach to learning and using new technologies.

The basis of the new pedagogical approach is the technique of modular training according to which the priority is to acquire self-education and self-control [6].

Some characteristics of this technique are: the predominance of independent student work due to system-designed assignments to ensure self-knowledge, the prevalence of the advisory activity of the teacher.

When applied to graphic disciplines such technique means redistribution of teacher efforts from lecture part of the course to the seminars and workshops, as well as to individual consulting work and strengthening the role of student independent work [7].

The usage of such study scheme reveals the following situation: poor student preparation for perception of graphic disciplines and for their self-work require from the teacher/lecturer much more time for consulting and advisory work in comparison with the standards designed in the training load. Teachers are not generally ready for this.

Way out is seen in the identification of the relationships between the factors influencing the success of the engineering graphics teachingas well as in the definition of mathematical

relationships between them. This will create a model of management of educational process.

Article purposes. Article purposes are to consider possible ways for managing the teaching process and the modeling an example of graphic disciplines; to identify the internal and external factors affecting the success of training; to determine the prerequisites for the development of educational process management model.

The main part. Material and methods. The necessity has arisen to work out new good reasonable approaches for solving this situationproblem. One of these approaches is to identify factors affecting successful training and to create automatic system to manage learning process on this basis. Numerous factors influencing the learning process can be divided into essential and less essential factors. The essential factors arethose ones, that are having higher probability in comparison with other factors and those whichacquire significance in a particular situation. To internal factors are referred student personal characteristics which are affecting his/her qualimetric estimation as of a main participant of the educational process.

One of the methods of qualimetrics (quality control) is to build up a tree of properties [8].

Let us consider a particular student having a different set of properties, both simple and complex, belonging to different scales

	Purposefulness
	Communicability
	Maturity of knowledge
	Motivation
Student's quality	Diligence
	Discipline
	Reaction speed
	Spatial thinking
	Ambition
	Perseverance

Fig.1. Student's quality

The authors have chosen 10 of numerous properties as much more related to the final appreciation. For each property a numerical value is assigned.

In this approach, some academic group turns out pareto-optimal set, where each member is better than another one according to one ofthe properties, but worse according to another property (Table 1).

Table 1.

Quantitative values of studentsproperties

q_1	q_2	q_3	q_4	q_5	q_6	q_7	q_8	q_9	q_{10}	Σ
q_{11}	q_{12}	q_{13}	…	…	…	…	…	…	…	$\sum_{1}^{10} q_i$
…	…	…	…	…	…	…	…	…	…	…
q_{n1}	q_{n2}	q_{n3}	…	…	…	…	…	…	…	$\sum_{1}^{10} q_i$

$0 \leq q_i \leq 1$where a numerical value of property determined by expert assessments.

n- general number for each student

It is assumed that all properties can be projected onto a unified scale and evaluate a certain number. The next step is forming a “perfect” student, to which all 10 properties are set to 1 and the sum of properties is 10.

For each student is calculated Euclidean distance to the “ideal” student

$$r = \pm\left[\left(10 - \sum q_i\right)^2\right]^{\frac{1}{2}}$$

which determines their qualimetric assessment. In this case, the assessment indicates the status of the student's properties at a certain interval and is static in nature.

It is clear, however, that all the properties are not invariants and change over time, and then the estimate $\underline{r}$ acquires a dynamic character and serves as a basis for determining the student's educational trajectory.

The success of training the graphic disciplines is also influenced by the following factors, which can be divided into positive and negative.

Among positive factors were identified following:

– the use of innovative computer technology during lectures and practical classes

– professional experience and skills of the teacher

– the ability of students to the perception of graphical information

– the overall preparation of students for training

– motivation

– intellectual perseverance

– Among the negative factors noted:

– weak motivation

– lack ofpreparation for study at university

– inability to perceive graphics

– poor living conditions

– the absence of control by parents

– strained relationship with teacher

– adverse psychological atmosphere in the group

– non-attendance

Results of the research.

Monitoring of educational process is carried out throughout the academic year. During semesters students are under continuous assessment: written assignment delivery, oral questioning, problem solving, protection of essay and computer testing.

Rating for each student is determined according to assessment.

Let's note an interesting fact – regardless the type of control, distribution of student rating consistently obeys the normal pattern. [9] (Fig.2)

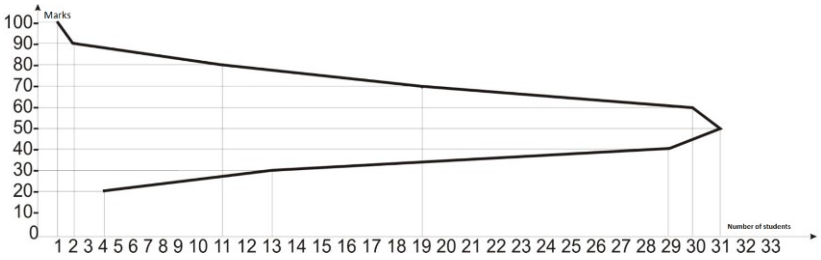

Fig.2. Graphic of results of computer testing
(Faculty of Hydromelioration, 2014y, 130 students)

Processing of the assessment results of more than 2300 students since 2011 by methods of mathematical statistics allowed us to make some conclusions.

Only 20% of selected students had direct correlation and linear relationship estimation obtained for different types of control. The rest of students did not show linear relationship between estimations, and in 15% percent there was an inverse correlation [9]. (Fig.3)

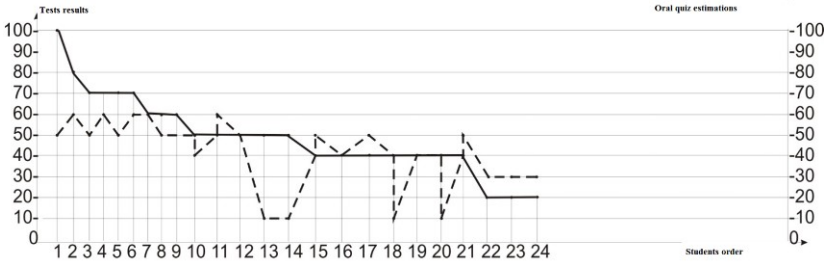

Fig.3. Comparison between computer test results and oral quiz
(Faculty of Hydromelioration, 2014y)

The integral indicator for each group of students in a particular kind of control was calculated:

$$G = \sqrt{\frac{\sum (x_i - x)^2}{n-1}}$$

Where x – a middle arithmetic estimation value

x_i– a particular student score

n – a number of students.

In case where the indicator is below the threshold, i.e. minimal satisfactory estimation, we had to admit the fact of the poor quality of student knowledge

The interrelation between the factors mentioned above, was also determined by well-known methods Q- criteria of Rosenbaum, U- Mann-Whitney criteria test, and others [10].

The "weight" of each factor was determined applying the expert estimation method where experts were students themselves and teachers

According to this survey among the positive factors the most significant were "motivation" (67%) and professional experience, skills of the teacher (57%), and among the negative factors – "lack of motivation" (71%), "lack of preparation for study at the university" (55%).

Conclusions. In accordance with preliminary research results the conclusion has been made that experimental results can be used in further modeling of educational process in high educational institutions.

Proposed assessment qualimetric estimate of the student is not a statistical performance but it's dynamic performance, which will allow to predict the trajectory of learning for each student. The relationship between the factors, the results of all types of control are a prerequisite for creating a learning management model.

Research perspectivesrelated to the determination of the best ways of using the results – improving techniques as data storage and its correction, depending on the implementation of the results in the practice of teaching.

References

1. Subetto A. I. Noosfernoye obrazovaniye kak mehanizm noosfernoy chelovecheskoy revolyutsii v XXI veke I proriva chelovechestva k kosmonoosfernoy paradigm budushey Istorii. *Obshestvo. Sreda Razvitiye*. 2012, №2. S.177–181

2. Azgaldov G. G., Kostin A. V. Innovatsii v netehnicheskoy sfere – neobhodimost' I vozmojnost'. *Nauchnoye, exspertno-analiticheskoye I informatsionnoye obespecheniye natsional'nogo strategicheskogo proektirovaniya, innovatsionnogo I tehnologicheskogo razvitiya Rossii*. Tez. Dokl. 5-oy Vseross.nauch-praktich. konf / 28-29 may 2009. (INION RAN). Moskva, 2009

3. Prohorov Yu. K. Upravleniye kachestvom [Quality control] : uchebnoye posobiye. SPb. : SPbGUITMO, 2007. 144 p.

4. Kaygorodtseva N. V. Innovatsionnaya metodologiya nachertatel'noy geometrii. Omsk. : OmGTU, 2013, 184 p.

5. Volkov V. Ya., Yurkov V. Yu., Panchuk K. L., Kaygorodtseva N. V. Kurs nachertatel'noy geometrii na osnove geometricheskogo modelirovaniya. Omsk : SibADI, 2010. 252 p.

6. Rotkov S. I. Tendentsii razvitiya ingenernoy geometrii i komputernoy grafiki. *Materialy Ukraino-Rossiyskoy nauchno-prakticheskoy konferentsii*. Ukrain-Russia scientific-practical conferenses proceedings], Har'kov, 2006. S. 46–50

7. Lupandin V. I. Matematicheskiye metodi v psihologii : Uchebnoye posobiye. Ekaterinburg : Izd-vo Ural. Un-ta, 2009. 252 p.

8. Garry G. Azgaldov, Alexander V. Kostin. Applied Qualimetry: Its Origins, Errors and Misconceptions. *Benchmarking : An International Journal*.Vol. 18, Iss. 3, 2011, S. 428–444.

9. Kuchkarova D. F., Achilova D. A. Metodi statisticheskogo analiza pri obuchenii injenernoy grafike. Pedagogika, Tashkent. 2014 №5, S. 68–71

10. Sidorenko Ye. V. Metody matematicheskoy obrabotki dannykh v psikhologii. Sankt-Peterburg : Rech', 2007, 320

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