Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: http://www.science-gate.com/IJAAS.html

Learning Algorithm to promote future specialist

Christopher Anderson *

Department of Mathematics, University of Canberra, Australia

ARTICLE INFO

Article history:
Received 14 March 2015
Received in revised form
27 April 2015
Accepted 30 April 2015

Keywords:
Learning
Informational and technological competence
Integral assessment
Individual trajectory

ABSTRACT

The purpose of the article is to analyse the competence-contextual approach of mathematics learning. In the article there was studied a computer system of analytical processing the results of the educational process, which allows the designing of a discipline. The technological card, proposed by V.M. Monakhov, determines the content of a lesson and its role in students' development. As a result of the technology application, a student obtains skills of rational learning, critical thinking, independent research, and analytical activity, clearly understands his potential abilities, and is able to the further successful implementation of his aims. The considered computer system provides the information about the level of professional competence of the academic teaching staff. In the article there were considered the recommendations concerning the enhancement of the teachers' information-technological competence.

1. Introduction

In recent years we have been witnessing a global process of standardization in our educational space. To ensure that every student reaches the level of academic standard, every educational establishment needs a new pedagogical tool instead of the traditional method.

Consequently with new progressive and adequate pedagogical technologies there comes a need for a new technology as a solution to the problem of transition from traditional to innovative methods.

Educational technology is a procedural category and it represents a certain system of activities. The emergence and dissemination of new technologies is changing the activity itself and the substantial restructuring of targets, values, specific knowledge and skills.

In the article the technology of V.M. Monakhov, aimed at improving the quality of education, creating conditions for level differentiation of the learning process taking into account the personal characteristics of students, is taken as the basis.

2. Methods

The modification of educational technologies of V.M. Monakhov was conducted in the research. There were determined the operating parameters, which allow to approach closer to the optimal regime of functioning of the methodical system of teaching with the beforehand specified properties. It was proved that taking into account the recommendations represented by the computer system, a teacher can correct the studying process project.

The system of pedagogical education constantly requires diagnosing and teachers' aid provision. The particular attention is paid to the development of computer systems of analytical processing of the results. They are a goal statement, content structure, forms of diagnostics, designing of the innovative methodical system of teaching, competent model of a pupil, standardized volumes of knowledge, special metric system for the quantitative estimation of competences and aim of study. The development of these innovative didactic categories and their technological in-building in the model of methodical system of teaching with the beforehand specified properties naturally led to the serious development of the didactic notions and their innovative functions (Monakhov, 2014).

The contribution to the organization and modelling of the diagnostics result at designing of the competent-contextual formation of mathematics teaching was made by Alexandrov (1987) and Bakhusova (2011) "Technology design of the educational process: the preparatory and designing stages", (Collins and Madaj, 2012; Klevakina, 2010) "Group form of teaching as a means of the joint pedagogical activity of a teacher and students in the process of mathematics teaching", (Krajewski, 1969-2000; Ksenzova, 2001; Kudryavtsev, 1985; Kuzmina 1985 and Monakhov, 2012) "Informatization of the

* Corresponding Author.
Email Address: C.Anderson@gmail.com

learning and teaching provision of the integrate process of competence and technological quality management monitoring", (Monakhov, 2014) "IT-education and some issues of evolution of the domestic methodical system of mathematics education, providing the educational process technologization", (Monakhov, 1991-2006 and Sherstnyeva, 2014) "Pedagogical technology: content, essence", (Zhurba, 2014) "Design of a training course on the basis of technological approach".

3. Results and discussion

Taking into account various fixation dynamics models of diagnosis and their application in many educational establishments, it should be noted that in addition to an objective picture of the dynamics of the material learning and mastering a subject successfully (computer system data in processing diagnostics results), a computer system provides the information on the level of professional competence of the teaching staff. Hence, an important task is the improvement of the information technology competence of the faculty at the educational establishments. Apparently, there must be analysed the programme of the development of information technology knowledge, without which the tasks of technologization and informatization of the competence-contextual format of learning cannot be solved. It should be added that a strategy of the university development should be directly linked to the creation and implementation of the *quality* management technology (Kreytsberg, 1982):

– *Quality* of the vocational training of the graduate non-mathematician (as an important factor of the demand for graduates in the labour market);

– *Quality* of the educational process in terms of the competence-contextual format of learning of a bachelor of a nonmathematical specialty;

– *Quality* of the target meaningful component of the educational process of a bachelor;

– *Quality* of the dynamics fixation of the diagnosing component of a bachelor.

The estimation parameters which define the *quality* are objectivity, consistency, transparency and openness of the information about the learning process. It seems reasonable to treat quality management as a *management process*.

This approach allows using a methodologically innovative design of modified flow charts of V.M. Monakhov as a management process, and a methodical system of teaching mathematics to specialists of a nonmathematical specialty, providing and maintaining the specified quality of the educational process.

The main idea of the message is the *thesis of modifications* of the pedagogical technology by V. M. Monakhov, already functioning in practice. It serves for the design of the learning process at the educational establishments in terms of the competence-contextual format of learning (Kremyansky, 1969).

The aim of this pedagogical technology is to determine the reasonable norm of the tasks (according to the volume, difficulty and complexity), the content of the extracurricular work that leads to the achievement of the aim with the teacher's help. Any changes, based on the obtained results, could be implemented into the technology, for example, through the block "Diagnostics". It should be noted that the technology of V.M. Monakhov includes a goal statement, diagnostics of the extracurricular tasks, and also the possibility to fill in the specifications and changes based upon the results, obtained from different stages.

The technology of V.M. Monakhov makes the emphasis on the students' development, to which the biggest share of time is devoted. The aims and tasks of a student's development are accurately and understandably arranged in a student's development information card.

This technology includes a logically substantiated system of stages and aims of teaching; a diagnostics system for quick achievement of the goals; described ways of the educational process of the participants' interaction on each stage; elements of motivation; possibility of transference into new conditions; guarantee of the pedagogical results.

For the achievement of the purpose of this research we try to compile a scheme of the educational process. For this task *a problem situation* (PS) is taken as a unit of designing the content of the discipline. The content of each discipline will be translated into the language of problematic situations.

The methodical system of teaching mathematics to the bachelors of a nonmathematical specialty in terms of the competence-contextual format of learning is then designed to solve the problematic situations of the discipline consistently (sometimes simultaneously) with the assimilation of the traditional content of the discipline. For this purpose the learning process in the discipline is divided into the problematic situations PS1, PS2, ..., PSm. Then, for each PSi a system of micro-purposes of the discipline is formed – micro-purposes B1, B2, … Bn, sufficient to solve the PSi (Kuzmina, 1980).

The modification of the pedagogical techniques by V.M. Monakhov for implementing the competence-contextual type of learning has led to the following procedural scheme of the design of the educational process, shown in Table 1.

This scheme allows to systematically monitoring the process of studying the content of the discipline either by a separate bachelor or a group as a whole. The created computer system of the analytical processing results of the diagnostics provides not only the efficient information on the process of the discipline learning, but also the estimated parameters for the formation of the key competencies within the boundaries of the discipline.

The computer system of the analytical processing of the diagnostics results forms and analyses "The individual trajectories of the discipline learning" (via

the diagnostic results D1, D2, ..., Dp) (as shown in Fig. 1) and "The individual trajectories of the formation of the competences in students" (through the assessment of the solution diagnostics of PS1, PS2, ... PSn) (Ksenzova, 2001). Of the greatest methodological interest is a rate graph of the dynamics of assimilation of the entire group of students, shown in Fig. 2.

Table 1: The design of the educational process

N	Procedure
1	To distribute the professional competences, laid down in the SES of HPE of the third generation, in the academic disciplines, i.e. to indicate in the context of which disciplines one or the other competence is formed.
2	To formulate the problematic situations PS1, PS2, ... PSm for a discipline (or a group of disciplines, responsible for the same competence). The contents of the problematic situations should reflect the connection between the academic discipline and the future professional activities of a student, and to foster the competences.
3	To design a sequence of micro-purposes B1, B2, ..., Bn (in the sense of V.M. Monakhov's technology) for each discipline, aimed at solving the PS. The technological document at this stage is the project card of the educational process in the discipline, which includes the competence formation, a list of the problematic situations (PS1, PS2, ... PSm) and a sequence of micro-purposes for solution of each PS. Project card in the discipline "..." Professional competences (C) — Problematic situations (PS) — Micro-purposes
4	To design the technological cards (TC) of the training topics. The logical structure of the learning process, besides the traditional diagnostics D1, D2, ..., Dn, should include the time limits of the PSi solutions and PSi diagnostics by students. Thus, the logical structure has two levels. For example: Academic hours: 1 pair, 2 pair, 3 pair, 4 pair, 5 pair, 6 pair, 7 pair, 8 pair, 9 pair, 10 pair, 11 pair, 12 pair Formation of the subject knowledge and skills: B1, D1, B2, D2, B3, D3, B4 Formation of the key competencies (C1): PS1, Diagnostics of PS1, PS2

a. If in the context of the discipline there are two formed competences, then the logical structure will have three levels

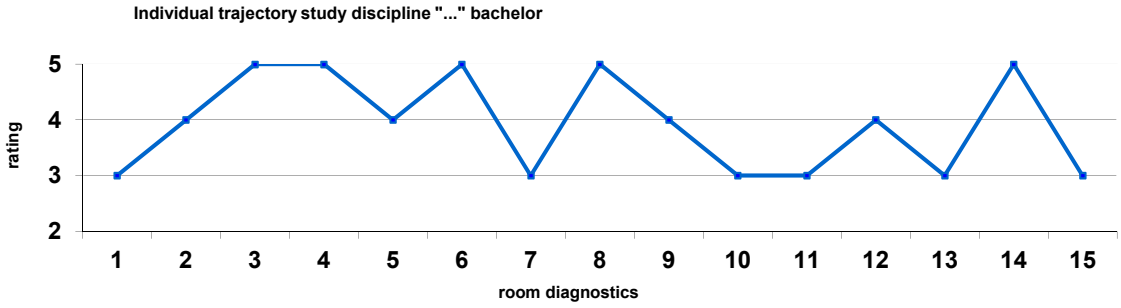

Fig. 1: A student's individual trajectory of the discipline learning

The computer system of the analytical processing of the diagnostics results in accordance with the programme of the spectral analysis of the diagnostics results of a group can issue the recommendations of the following nature to a teacher:

A comment to the curve "excellent"

An average number of the marks "5" equals to 7.88, or 27.16%. In the normal range are the following diagnostics results: D3, D4, D5, D6, D7, D10, D12, D13, D14, and D16. The deviation of the diagnostics results from the mean value towards the maximum is: in D9 to 14.22%, in D11 to 10.78%, and in D15 to 21.12%. The deviation of the diagnostics results from the mean value towards the minimum is: in D1 to 13.36%, in D2 to 13.36%, and in D8 to 27.16%.

The recommendations are as follows: to simplify the tasks for the mark "5" in D1, D2, and D8; to complicate the tasks for the mark "5" in D9, D11, and D15.

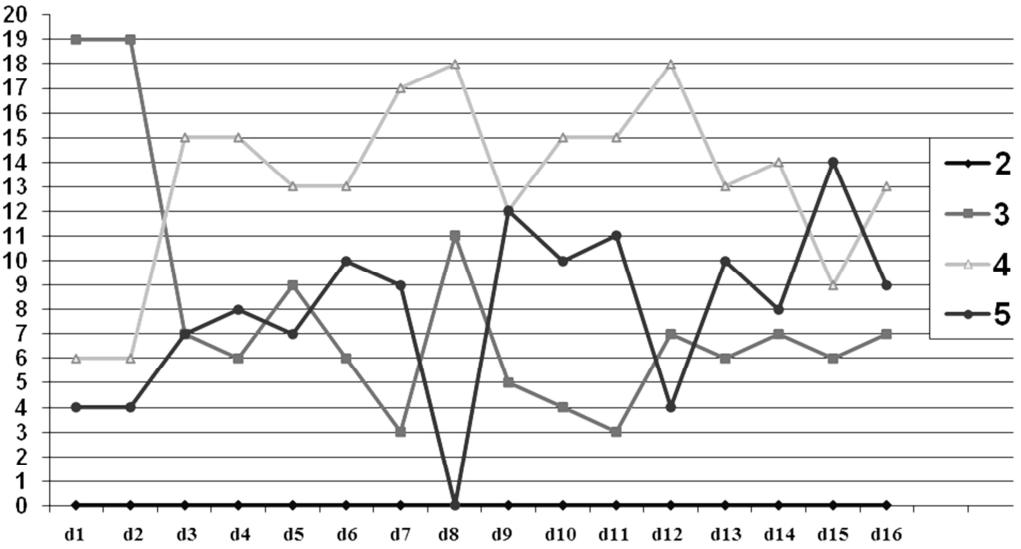

Fig. 2: A rate graph of the dynamics of assimilation by a group of 30 students

A comment to the curve "good"

An average number of the marks "4" equals to 12.69 or 43.75%. In the normal range are the following diagnostics results: D3, D4, D5, D6, D9, D10, D11, D13, D14, and D16. The deviation of the diagnostics results from the mean value towards the maximum is: in D7 to 14.87%, in D8 to 14.87%, and in D12 to 11.42%. The deviation of the diagnostics results from the mean value towards the minimum is: in D1 to 23.06%, in D2 to 23.06%, and in D15 to 19.61%.

The recommendations are as follows: to simplify the tasks for the mark "4" in D1, D2, and D15; to increase the time for studying the micro-purposes: B1, B2, and B15; to complicate the tasks for the mark "4" in D7, D8, and D12; to reduce the time for studying the micro-purposes: B7, B8, and B12.

A comment to the curve "satisfactory"

An average number of the marks "3" equals to 8.38, or 28.88%.

In the normal range are the following diagnostics results: D3, D5, D6, D11, D12, D13, D14, D15, and D16. The deviation of the diagnostics results from the mean value towards the maximum is: in D1 to 36.64%, in D2 to 36.64%, and in D8 to 12.50%. The deviation of the diagnostics results from the mean value towards the minimum is: in D4 to 11.64%, in D7 to 18.53%, in D9 to 11.64 %, and in D10 to 11.64%.

In the diagnostics of D1 and D2 there was an increase of the marks "3" at the expense of the marks "4".

The recommendations are as follows: to reduce the time for studying the micro-purposes: B4 B7, B9, and B10; to increase the time for studying the micro-purposes: B1, B2, and B8.

Taking into account these recommendations, a teacher can adjust the project of the educational process (Kuzmina, 1985).

The assessment of the competence development of a future professional within the discipline is integrally formed from the diagnostics assessment of the solutions of the problematic situations PS1, PS2, …, PS*n*. Since the concept of "competence" is multifaceted, and the assessment of the competence development has a vague nature (Alexandrov, 1987), we suggest to make this assessment a main component and to assess its constituents approximately by the 10-point scale. The constituents of the assessment are: theoretical knowledge, future activities of a specialist, and social maturity. These three components of the specialist's professional sphere can be taken as three parts of the assessment for the diagnostics solutions of PSi (and later for the assessment of the competence development within the discipline). Thus, for the solution of each problematic situation PS*i* a bachelor receives a composite approximate assessment in the form of a fuzzy set with the elements: <<assessment of theoretical knowledge – α1i>; <assessment of the future specialist's activity – α2i>; < assessment of the social maturity – α3i>>, wherein αji is a natural number from 1 to 10, j - a number of a problematic situation. The marks are put by a teacher, and the fuzzy marks can be seen on the scale (Table 2).

Table 2: Fuzzy assessment scale

1,2	Insufficient level
3,4	Below the basic level
5,6	Basic level (sufficient)
7,8	Above the basic level
9,10	Advanced level

An example of the trajectory of the bachelor's competence formation within the discipline is shown in Fig. 3.

Each trajectory can be rolled into one fuzzy mark of the competence formation within the discipline with the help of the following formula: the integer

part of the arithmetic mean of the marks of each constituent:

$[\left(\sum_{i=1} \alpha_{j_i}\right)\frac{1}{k}]$, where k – a number of diagnostics (1)

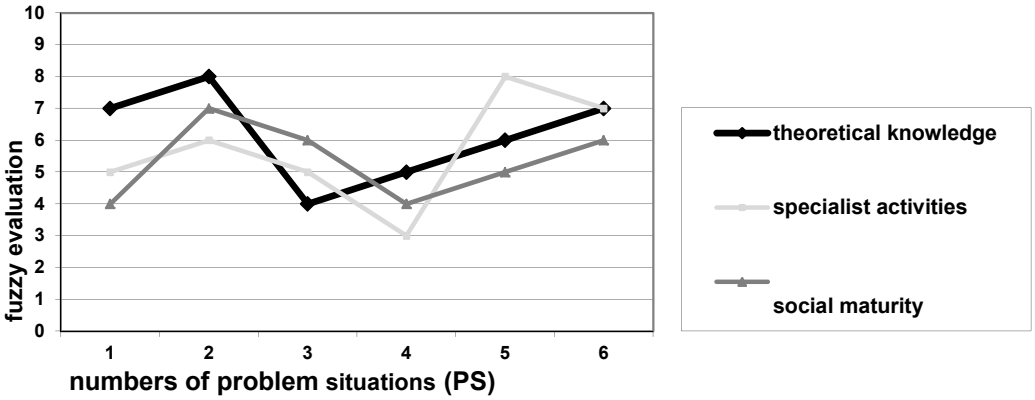

Fig. 3: The trajectory of the bachelor's competence formation within the discipline

For example, for the graph, shown in Fig. 3, the final assessment of the key competencies development is: << assessment of theoretical knowledge – 6>, <assessment of the future specialist's activity – 5>, < assessment of the social maturity – 5 >>.

If the constituents of the assessment have different importance for the formation of key competencies, then the weighting coefficients can be entered to show the importance of the component parts of the assessment (Kudryavtsev, 1985). We can come to a single final mark β, using the formula:

β = min {α1, α2, α3} = min {6, 5, 5} = 5 (competence is formed at the basic level) (2)

The integral assessment of the competence formation of the future specialist non-mathematician derives from the final marks of the competence development in the context of each discipline, responsible for this competence by the formula:

Min {β1, β2, ..., βn}, where n - a number of disciplines in the context of which competence was formed (Collins, K. & Madaj, Z. 2012) (3)

As a result, for each graduate there will be applied a system of assessments that show the degree of formation of all the key competencies of a professional non-mathematician. In addition, the results will be obtained, for the modified educational technology by V.M. Monakhov.

When designing the educational system with the predetermined properties, the dynamics fixation model of evaluation of all current operating parameters of the educational system, their relevance and the degree of approximation to the specified properties, is particularly important. When preparing a strategy of the building of a methodical system of teaching mathematics to the students of a nonmathematical specialty, the following factors are gaining in importance: the semantic transparency of the formulations, technological possibility of their assessment, and a well-proven technology of the operational control and quality functioning management of the educational system itself (Monakhov, 2006).

4. Conclusion

The organization of the educational process provides diagnostics of the component of the methodical system of teaching mathematics, taking into account the information about the internal assessment and specifying, if possible, the results. If to ignore the fact of the competent substrate, the diagnostics teaches communication, being a means of the self-expression and self-realization, didactic at the external level and competent at the domestic one, and a mechanism of the self-discovery of the bachelor's individuality and development of their unique features. The "incompetent" rhetoric is considered to be the competent intentions of the bachelors, orientations on the manifestation of their values, personal and competency positions.

At this time the labour market requires the specialists, highly qualified and competent in different situations, arising in any field. On the basis of the competent approach there was given the analysis of the development of the future professional non-mathimaticians, and for this task their core competences were assessed with the help of the technological card by V.M. Monakhov. In this research we also gave an explanation why this technique, which had been in great demand for many years, was modernised.

References

Alexandrov PM (1987). Science plus Mathematics. Interpenetration problems. Math in school, 3.

Bakhusova EV (2011). Technology design of the educational process: the preparatory and designing stages. Problems of modern education, 2, 111-122.

Collins K and Madaj Z (2012). Main Stage at Muskegon Summer Celebration: A Statistical Consulting Experience, April 11, Student Scholars Day.

Klevakina VP (2010). Group form of teaching as a means of the joint pedagogical activity of a teacher and students in the process of mathematics teaching. Experiment and innovations in school, 4, 63-68.

Krajewski VV (1971). On the problem of the relationship of pedagogy and teaching practice. New research pedagogical sciences, 4, 5-68.

Krajewski VV (2000). The content of education - running in place. Pedagogy, 7, 3-12.

Kremyansky VI (1969). Structural levels of living matter. Moscow, Russia: Nauka.

Kreytsberg PU (1982). The notion of learning objectives. Classification of learning objectives for concreteness – abstractness. Soviet pedagogy and school, 1, 11-39.

Ksenzova GY (2001). Prospective school technology: Study guide. Moscow, Russia: Pedagogical Society of Russia.

Kudryavtsev, L. D. Modern mathematics and its teaching, 1985. Moscow, Russia: Nauka.

Kuzmina NV (1980). The concept of "educational system" and its evaluation criteria. Methods of system of pedagogical research, 1, 16-17.

Kuzmina NV (1985). Ability, talent, talent teacher. Leningrad, Russia: Knowledge.

Monakhov VM (2012). Informatization of the learning and teaching provision of the integrate process of competence and technological quality management monitoring. Vestnik of M. A. Sholokhov Moscow State Humanitarian University, 4, 46-59.

Monakhov VM (2014). IT-education and some issues of evolution of the domestic methodical system of mathematics education, providing the educational process technologization. Modern information technologies and IT-education, 1 (9), 100-106.

Monakhov VM (1991). The concept and implementation of new information technology training. Design of new information technology training. Moscow, Russia: Nauka.

Monakhov VM (2006). Introduction to the theory of pedagogical techniques. Volgograd, Russia: Classroom.

Sherstnyeva NA (2014). Pedagogical technology: content, essence. International journal of fundamental and applied research, 10-3, 114-117.

Zhurba AY (2014). Design of a training course on the basis of technological approach. Vestnik of Adyghe State University. Series 3: Pedagogy and psychology, 2 (136), 101-106.