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Distance Education for Biology Teachers - Two Educational Technologies

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Abstract. The aim of this study is an application of two pedagogical technologies in distance education and the analysis of their effectiveness. The methods that were used are theoretical analysis and synthesis and pedagogical experiment. The development of distance education courses under the behaviorist conception (including neo-behaviorist ideas) is traditional in the area of distance education. As an alternative to this technology an application of the psychological theory for activity (theory about the formation of intellectual activities) is considered. In view of the results of this study the conclusion is that the psychological theory for activity is more suitable and effective in reaching high levels of operating with knowledge. At the lower levels no significant difference was detected between two theories and technologies. It is supposed that this is a result of the way of communication applied (guided didactic conversation) with these two technologies.

Key Words: Biology teachers, distance education, educational technology, teaching skills, psychological learning theories.

Özet. Bu araştırmanın amacı uzaktan eğitimde iki farklı eğitim teknolojisini uygulamak ve etkililiğini analiz etmektir. Araştırmada teorik analiz, sentez ve deneysel çalışma yapılmıştır. Davranışçı anlayışla uzaktan eğitim derslerinin geliştirilmesi geleneksel bir anlayış olup, bu anlayışa bir alternatif olarak aktif bir psikolojik teorinin uygulanması düşünülmüştür. Bu araştırmanın sonucunda aktif psikolojik teorinin yüksek düzeyde bilgilerin elde edilmesinde etkili olup olmadığı tartışılmıştır. Bu iki teori ve iki teknoloji arasında anlamlı bir farklılık bulunmamıştır. Bu durumun nedeninin bu iki teknolojinin uygulanmasında kullanılan iletişim şeklinin bir sonucu olduğu düşünülmektedir.

Anahtar Kelimeler: Biyoloji öğretmenleri, uzaktan eğitim, eğitim teknolojisi, öğretim becerileri, psikolojik öğrenme teorileri.

INTRODUCTION

One of the greatest challenges in the education is the problem of life long learning. Recently the rates of development and changing in social area pose questions about person's adaptation in conditions of globalization and mass-communication. In this circumstances person looks for opportunities to get higher qualification. Parallel with this the offering of forms of organization for pre- qualification after graduating a definite educational level is increasing too. In keeping conformity with development in information technologies and their application in education the offered opportunities for pre- qualification become more modern and perfect. Distance education is among the widespread and suitable forms to realize the life-long learning. The great number of offered courses in this field differs mainly in the technical quality of used media. Researches in the area are concentrated on the influence of technical advantages of the course under the effectiveness too. In the same time few authors pay attention to psychological and pedagogical aspects of distance education.

METHODS

The aim of this study is an application of two pedagogical technologies in distance education and the analysis of their effectiveness. The methods that were used are pedagogical modeling and pedagogical experiment.

An application of educational technology based on psychological learning theories in distance education could lead to higher quality of student's

qualification. Here the term ‘technology’ is used in the broad sense as: ”application of scientific knowledge to the practical aims of human life...” (Encyclopedia Britannica). Psychological learning theories can find a defined implementation in optimization of distance learning courses. The specific approach in creation of educational program under the requirements of one or another learning theory can be understood like educational technology. It gives the answers of main pedagogical questions how to learn and therefore how to teach. The construction of distance course under the behaviorist conception (including neo-behaviorist ideas) is traditional in the area of distance education. A definite dose of information is in the role of stimulus, which has to provoke a reaction like reproduction of a part of knowledge or the application of it. The reinforcement is a type of teacher’s behavior depending on students’ achievement. This theory, in the classical variant, declares that giving a hint is a way of reinforcement. The quantity of hint in the beginning has to be higher than at the end of the educational process. The last tasks can be creative and with problem character. The control and feedback are only with regard to the answer. Therefore the type of management of learning activity is on the principal of “the black box “. According to the requirements of this theory it was constructed an educational program for preparing biology teachers. It consists of five themes:

- * Objects and activities of the subjects: student and teacher,
- * Models in biology education,
- * Educational aims and motivation,
- * Educational activities in biology laboratory lessons,
- * Educational process in biology laboratory lessons.

Each of them includes:

1. General introduction of information that will be an object of learning;
2. Skills that have to be acquired;
3. Theoretical information;
4. Tasks for training.

At the end of the program are the answers of the tasks. This structure realizes a feedback with regard to the result on two main levels:

1. About the answer of every task, and
2. About new skills in general for every theme, that are defined at the beginning of it.

In this way a student can realize self-control and therefore self- management of educational process. The last one can be considered as a motivational factor, too.

First four tasks for training are under the type “true or false” and the answer is connected with reproduction of concrete dose information. The other four tasks are connected with creative transfer of knowledge and get higher intellectual effort. For example, a task from this type for theme № 3 is:

“Create a system of aims for laboratory lesson about chosen of you theme!” This task provokes imagination of students and takes them in a real situation where they can expose their professional qualities.

An alternative to described technology is the application of the psychological theory for an activity. This theory gives opportunity to realize management of the educational process on the principal of the “white box”. This means that the control is with regard to every stage of learning and the students’ activity is an object of formation depending on defined characteristics. The effectiveness of educational process is higher when are taken into account following rules about the control:

1. “In the initial stages of learning, the control has to be on every operation
2. At the beginning of material stage and the external speech stage, the control has to be orderly- for every task
3. At the end of those stages and at the others the control has to be incidental- at the request of a student
4. The way of control does not have an influence under the quality of acquired knowledge”.(Тальзина, 1975; p112)

These conclusions were made in the obligatory education when the control is external from the teacher. In the distance education can be applied implicit control by the full system of operations that form activity. This type of the control has to be at the beginning of the learning process. At the other stages the control turns into internal (a part of subject's mind). This affects on the type of tasks for every stage. ”The tasks can be considered in close connection with activity: the given facts are the object of an activity, the

problem to find is the aim of activity and the operations are the way to turn the object and reach the purpose.”(Талызина, 1975; p. 139). Every task is a model of activity. The specificity is connected with the stage of activity and the form of it (external material, external speech, internal). For example at the first stages of forming the teaching skill ”to create a model of motivation in biology educational process” one of the tasks is:

“For the laboratory lesson a biology teacher makes the following introduction *“You will work with substances which we call biological catalysts. The knowledge about their properties is the first step to solve many problems. It is in the root of elaboration of many medicines. These substances find application in food processing industry and agriculture.”*”

Which way for motivation is chosen?

Operations for work:

1. Take card № 2 and read the information in it
2. Underline in the task where it is given a description about the way of motivation
3. Compare the underlined information with information in card № 2
4. Find which is the chosen way for motivation
5. Check up your answer

The information in card № 2 describes ways of motivation that a teacher can use in the biology educational process. The student is given the rules how to analyze “given” in task, in other words, how to reach the aim - right answer. This task is a part of the external material stage of an activity, because of working with card № 2 and the way of analyzing the “given” in task (Салмина, 1981). On the next stage – external speech, as a part of rules to solve the intellectual problem, is writing a knowledge that is necessary to reach the looking answer. For example, create the task for biology laboratory lesson about photosynthesis. With this task you have to reach the educational aim: every student could list and prove in practice products of photosynthesis.

Operations for work:

1. Write the requirements for tasks about laboratory lessons

2. Create the task in following way:

- * Describe photosynthesis as “given” in the task.
- * Write the aim of the task in accordance with the educational purpose.
- * Write in sequence all of the operations that a student has to realize to reach the answer.
- * Write how a student marks off the answer.”

At the last stage of learning – internal, tasks do not consist of operations for the work. The entire process of deciding passes into a student's mind. At this stage, the task can be phrased in the following way:

“Create a model of motivation for a laboratory lesson about a chosen of your theme by the combination of an influence under the emotional sphere and revealing practical application of knowledge!”

The entire educational program created under the requirements of this theory includes:

1. Introduction - general characteristic of knowledge and purposes;
2. Informational cards- theoretical information that is an object of learning;
3. Tasks for training- ordered in conformity with forms of activity;
4. Feedback card - answers of the tasks.

Two observed technologies give two different ways of communication or a guided didactic conversation. This means that even at a distance there is a communication as an important structural element. “The phrase suggests strongly that the distance education is not simple self-study as it is organized according to the traditional pattern of teaching and learning.” (Peters, 1998; p. 14). There is dependence between distance and communication. When the communication is closer, so that the interaction teacher – student is regular, than the distance is smaller and the efficacy of education is higher (under the M. Moore’s theory for transactional distance). (Moore, 1996; p.200; Mood, 1995, Peters, 1998; p. 28) The communication at the second offered technology is closer, hence the distance is shorter. This fact is because of applied teacher's control in every stage of learning process with regard to every operation that a student has to implement. In this way the student learns parallel special peace of information and principles of activity in solving intellectual problems. (Кискинова, 1992; Панайотов, 1991; Tzanova,1998)

RESULTS

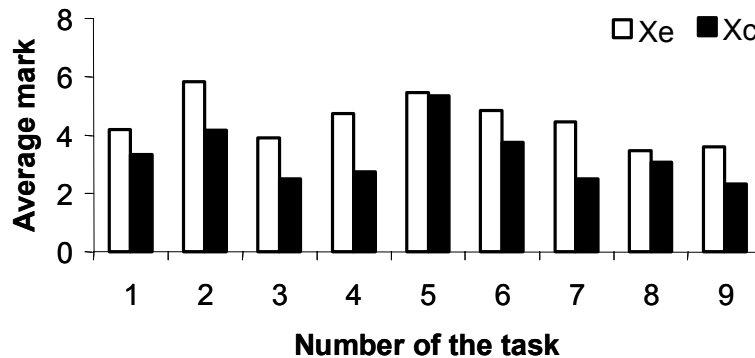
In these two technologies were included an equal quantity of new concepts and skills. The media in two models is printed materials. Two technologies were a part of experiment with students that were preparing for biology teachers at Sofia University. The final control of effectiveness was a test that includes nine tasks. The type of tasks is analogous to the tasks at the end of educational programs.

Control group includes students that worked with program under behavioristical conception. The results from experiment are summarized in table №1:

Table № 1.

	Task№\ Mark	Excellent (%)	Very good (%)	Good (%)	Satisfactory (%)	Poor (%)
Experimental group	1	9.09	36.36	18.18	36.36	0
Control group		0	0	41.67	50	8.33
Experimental group	2	81.82	18.18	0	0	0
Control group		8.33	33.33	25	33.33	0
Experimental group	3	27.27	18.18	9.09	9.09	36.36
Control group		0	0	16.67	16.67	66.67
Experimental group	4	36.36	0	63.64	0	0
Control group		0	0	25	25	50
Experimental group	5	72.73	0	27.27	0	0
Control group		66.67	0	33.33	0	0
Experimental group	6	36.36	9.09	54.55	0	0
Control group		0	0	83.33	8.33	8.33
Experimental group	7	9.09	36.36	45.45	9.09	0
Control group		0	0	8.33	33.33	58.33
Experimental group	8	9.09	9.09	18.18	45.45	18.18
Control group		0	8.33	0	83.33	8.33
Experimental group	9	20	20	10	0	50
Control group		0	8.33	0	8.33	83.33

Correlation between average marks (“Xe” for the experimental group and “Xc” for the control group) for every task is shown on the following column chart:



The difference between average marks of two groups is more than one point for tasks № 2, 3, 4, 6, 7 and 9. These tasks require a creative application of acquired knowledge. In the same time the difference between marks of tasks № 5 and 8 is insignificant. These two tasks examine the skill to recognize. The difference about task № 1 is 0.85 i.e. lower but very close to one point. This task has two problems to find: to recognize and to argue.

Therefore; the conclusion is that the psychological theory for an activity is more suitable and effective in reaching high levels of operating with knowledge. On the lower levels it is not detected a significant distinction between two examined theories and technologies. It can be supposed that this fact is a result of applied way of communication with these two technologies. The behaviorist theory gives freedom how to learn the piece of information, so that the intellectual effort to learn it is higher and the distance is larger. That's why the needed time to reach creative levels is more than in other observed learning situation. The second theory gives the way of learning step by step and the intellectual effort is higher in solving creative tasks. The student doesn't lose many hours looking for the way to learn the information and has more time to reach the level that requires using the piece of knowledge into the creative process. Further experiments and data collection is needed to confirm or deny this conclusion.

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Summary

One of the greatest challenges in the education is the problem of life long learning. Distance education is among the widespread and suitable forms to realize it. The great number of offered courses in this field differs mainly in the technical quality of used media. Researches in the area are concentrated on the influence of technical advantages of the course under the effectiveness too. In the same time few authors pay attention to psychological and pedagogical aspects of distance education

The aim of this study is an application of two pedagogical technologies in distance education and the analysis of their effectiveness.

The methods that were used are theoretical analysis and synthesis and pedagogical experiment.

The hypothesis of study is: an application of educational technology based on psychological learning theories in distance education could lead to higher quality of student's qualification.

The specific approach in creation of educational program under the requirements of one or another learning theory can be used like educational technology. It gives the answers of main pedagogical questions how to learn and therefore how to teach. The construction of distance course under the behaviorist conception (including neo-behaviorist ideas) is traditional in the area of distance education. A definite dose of information is in the role of stimulus, which has to provoke a reaction like reproduction of a part of knowledge or the application of it. The reinforcement is a type of teacher's behavior depending on students' achievement. As an alternative to this technology it is considered an application of the psychological theory for activity (theory about the formation of intellectual activities). This theory gives opportunity to realize a control with regard to every stage of learning and the students' activity is an object of formation depending on defined characteristics. In distance education can be applied implicit control by full system of operations that form activity. This type of control has to be at the beginning of the learning process. At the other stages the control turns into internal (a part of subject's mind). Two observed technologies give two different ways of communication or guided didactic conversation. This means that even at a distance there is a communication as an important structural element of educational process.

Under results of this study conclusion is that the psychological theory for activity is more suitable and effective in reaching high levels of operating with knowledge. On the lower levels it is not detected a significant distinction between two examined theories and technologies. It is supposed that this fact is a result of applied way of communication in conformity with these two technologies. The behaviorist theory gives freedom how to learn the piece of information. So that the intellectual effort to learn it is higher and the distance is larger. That's why the needed time to reach creative levels is more than in other observed learning situation. The second theory gives the way of learning step by step and the intellectual effort is higher in solving creative tasks. The student doesn't lose many hours looking for the way to learn the information and has more time to reach the level that requires using the piece of knowledge into the creative process.