LOOK ACADEMIC PUBLISHERS
OPEN ACCESS

INTERNATIONAL JOURNAL OF ENVIRONMENTAL & SCIENCE EDUCATION
2016, VOL. 11, NO. 8, 2113-2122
DOI: 10.12973/ijese.2016.582a

Using the Technology of Critical Thinking Development (CTD) as a Means of Forming Competencies of Students Majoring in "Life Safety"

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ABSTRACT

The relevance of the research problem is caused by the need to use various teaching methods and techniques in training students majoring in pedagogical specialties while implementing the competency approach in education. Information about the technology of critical thinking development (CTD) in future teachers training is limited, and the conclusions about its effectiveness are contradictory. The article aims at justifying the application of this technology in training future Life Safety teachers for development of their general cultural and pedagogical competencies. The article describes the experience of the educational program actualization in accordance with the Federal State Education Standard (FSES) to enhance the formation of professional competence of future teachers. The article analyses the results of implementing active education elements and techniques of CTD in different types of contact and independent work within a single module for bachelors' training (44.03.01 Pedagogical Education, Life Safety profile). Graduates use these techniques and methods successfully in their in their professional activity. The article is of practical value to educational activities managers, teachers of higher and secondary education, and Life Safety teachers.

KEYWORDS
college education, competence-based approach, technologies of critical thinking development, life safety, educational program

ARTICLE HISTORY
Received 17 January 2016
Revised 15 April 2016
Accepted 24 May 2016

Introduction

The realization of the competence-based approach in secondary schools and higher educational institutions leads to the need for continuous improvement of educational programs and teaching materials and the organization of educational process. The analysis of theoretical and teaching materials reveals the growing interest in using CTD technology (Ospanova, 2010; Shakirova, 2006; Zair-Bek, 2011; Klimova, 2012), as well as lack of information about the implementation of this technology in the school course of Life Safety and in training future Life Safety

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teachers. It should be noted that this course requires logic and analytical thinking abilities as the basic factor of safe behavior and first aid organization is to identify causal relationships and eliminate life- and economy-threatening consequences (Kuznetsova, 2011). So CTD technology is promising in terms of formation of students' competencies of all types.

Literature Review

The Federal State Education Standard presupposes the realization of a competence-based approach. A competence-based approach concept became widely known at the beginning of the XXI century in connection with the problem of the Russian education modernization (Khutorsky, 2003; Dolgusheva and Bekker, 2011). To implement this approach high proficiency in technologies forming competencies is required from university teachers, and especially those training future teachers. It is extremely important now when the contact work with students is reduced (Mansurova and Fomin, 2014). Techniques and methods used in the study of educational program disciplines reflect the qualification of a higher school teacher. This, in turn, is the basis of critical thinking development of students (Klimova, 2012). However, most higher school teachers of Russia (57%) mainly use traditional forms of education, and 14% of students have never met active methods in teaching. Most teachers are critical of their own awareness and readiness for the introduction of new methods in training (Burkhanova and Rodionova, 2012). The literature mostly contains information about either the possibilities of the individual components of the CTD technology for certain disciplines (Varlakova, 2012; Yeltsova, 2013; Yeremina, Nagornov and Nagornova, 2013; Lazyrina, 2015), or describes the process and conditions of critical thinking formation in students (Ovcharenko and Repina, 2014; Ozbey and Saricam, 2016; Makarova and Sharshov, 2015). The article shows the possibility and effectiveness of active methods and techniques of CTD technology in training future teachers aiming at both developing their intellectual potential and forming their skills and abilities to use these methods in their future professional activity.

Aim of the Study

The aim of this study was to explore the possibility of the systematic application of techniques CTD technology to improve the competence of students "Life Safety"

Research questions

The overarching research question of this study was as follows:

Which can be used in the study of CTD technology and how they affect the performance and motivation of students?

Method

Theoretical methods of our research include the analysis of literature (legal and teaching documents); studying and generalization of innovative pedagogical experience; development of the training model within a single module to improve the efficiency of formation of students' pedagogical competence; selection of

techniques and methods of CTD technology, formation of the system for their using in students' contact and independent work.

The empirical methods include observation, ascertaining and forming pedagogical experiment, the study of the results of students' curriculum and extracurricular activities, methods of mathematical statistics for processing the research results.

The experiment was carried out at the Physical Education and Sports Department of Vyatka State University (former Vyatka State University of Humanities).

The study was carried out in three stages:

The first stage actualized the educational program of training students majoring in Life Safety (Pedagogical education) and the curriculum based on State Educational Standards 3 and 3+. It also included the actualization of educational systems and discipline programs forming the content of Life Safety school subject. To implement pedagogical competencies within these disciplines we suggested the distribution scheme of contact work with students in accordance with State Educational Standards 3 and 3+.

The second stage analyzed the used techniques and methods of CTD technology. We developed the system of seminars and lectures for disciplines within the module "Dangerous natural situations" including techniques and methods of CTD which could be used later by students in their work as Life Safety teachers.

During the third stage we tested and evaluated the effectiveness of the proposed training scheme; summarized the results of the pedagogical experiment aimed at assessing the effectiveness of CTD methods for students; the discipline "Theoretical basis of the natural dangers and protection from them. Methods of teaching".

Motivational, intellectual, and activity-related criteria were performance indicators (Morochenkova, 2004); and we projected them on the competence groups in accordance with the State Educational Standards. To assess the competencies, the dynamics of the following indicators was analyzed:

- results of evaluation tests on sections of discipline with the inclusion of tasks on logical and analytical thinking – the indicator of general cultural and pedagogical competence;

- possession of skills of using CTD methods based on the results of teaching practice – the indicator of professional competence;

- GPA of a students' group per semester according to the score-rating system – the indicator of general professional competence;

- activity and attendance – the indicator of students' motivation (based on pedagogical observation and analysis of documents). Students' activity was assessed at the average percentage (of those present in the classroom) of the students taking part in group work during lectures and seminars. The evaluation was carried out six times during the final session for every section of the discipline.

52 full time and correspondence second and third-year students took part in the pedagogical experiment which was carried out in 2014-2015 and 2015-2016 school years at the Physical Education and Sports Department of Vyatka State University (former Vyatka State University of Humanities). The students' major

was Life Safety (Pedagogical Education). A preliminary survey of students revealed that most of them (74.4%) did not know much about methods of critical thinking technology; they had no experience with them in relation to themselves while studying at university, and did not see its systematic use by teachers during teaching practice in schools of Kirov and Kirov region at life safety lessons. The pedagogical experiment was carried out over 3 semesters in accordance with the curriculum and the program in the course of studying the discipline "Theoretical basis of the natural dangers and protection from them. Methods of teaching" (432 hours of training). Students were divided into two groups, and they studied the discipline using different methods. The control group (CG) included students (n=28) taught mainly with traditional methods. In the experimental group (EG) (n=24) active forms, techniques and methods of the CTD technology were used in class and independent work.

Data, Analysis, and Results

Actualization of an Educational Program to Raise the Level of Graduates' Pedagogical Competence

A methodological component was introduced into disciplines of the variable part of the curriculum in the educational program in 2015 to form professional pedagogical competencies during training of Life Safety Bachelors (teacher education). It led to both getting theoretical knowledge of the studied discipline and forming skills and experience in various teaching techniques. Hence, the content component of the disciplines included in school Life Safety course was changed. New names of some disciplines reflect this process. For example, the discipline name "Dangerous situations and protection from them" was replaced with "Theoretical basis of the natural dangers and protection from them. Methods of teaching"; "Theoretical basis of man-made hazards and protection from them. Methods of teaching", etc. Distribution of educational work forms is in accordance with the State Education Standard – contact work is 40% of the total labor input. The study of teaching methods of these disciplines' basics takes 40% of contact work held in the form of practical classes and seminars. Students under the guidance of a teacher develop lesson models on relevant topics; form a teaching bank and funds of evaluating tools for testing pupils' knowledge of some unit of the school Life Safety course. This approach allows students to use their experience in some methods and techniques of Life Safety learning during their teaching practice.

Implementation of CTD Technology in the Organization of Students' Classroom Work in the Discipline "Theoretical Basis of the Natural Dangers and Protection from Them. Methods of Teaching"

Using the CTD technology is based on the concept of "critical thinking". We assume that it is not the ability to think critically about the reality but rather the combination of analytical, creative, and logic thinking; the ability to act intelligently, assess objectively, and act logically in accordance with common sense; the ability to look at the phenomenon from different perspectives and give up their own prejudices (Shakirova, 2006; Kukina, 2010). It should be noted that we did not use the technology as a whole, but its specific techniques and methods. The selection depended on their effectiveness for developing different aspects of thinking and their use in Life Safety lessons.

We divided all methods into the following groups (Table 1):

1) used mainly during lectures

2) used during seminars for studying theory;

3) used during seminars for studying methodology of the discipline and recommended for teaching Life Safety.

Table 1. Using active techniques and methods of the CTD technology in classes of different types for studying "Theoretical basis of the natural dangers and protection from them. Methods of teaching"

Training sessions	Type of classes		
	Lectures	Practical classes (seminars)	
		The study of the theoretical foundations	The study of teaching methods
Techniques and methods	Problem lecture	Brain storm	
	Lecture together	Tables «What? Where? When? Why?» in the form of "Diary of emergencies"	
	Lecture with pre-planned errors	Cross debate	
	Elements of cross debate (the reflection stage)	Thick and thin questions	
		Clusters	
		INSERT	Fish boat
	Analysis of audios and visuals at the reflection stage	Business game	"My own game"

Techniques were selected in accordance with the studied material. As for recommended techniques and methods they were tested experimentally and described in literature; they also match the age factor (Life Safety is studied in 5-7 grades of secondary schools). It should be noted that students did not like some recommended techniques (Zair-Bek, 2011; Gruzdeva & Bakhtiyarova, 2014); so we did not use them any more (SWOT-analysis, RAFT-technology, "basket of ideas").

The presented techniques and methods were further integrated with the procedures of the problem and interactive education and systematically used in class for studying every unit of the discipline "Theoretical basis of the natural dangers and protection from them. Methods of teaching". We followed the three-staged algorithm: evocation stage → realization of meaning → reflection. Implementation of this scheme is time-consuming which limits the information content of lectures; so it was mainly used during seminars. Some techniques were partially transformed in accordance with the discipline content and the school Life Safety course. For instance, tables "What? Where? When? Why?" were used in the form of "Diary of emergencies" during the calendar year. These data were further used to determine the frequency and probability of emergencies in the world and in Russia.

Using Active Education Techniques in Students' Independent Work for Studying "Theoretical Basis of the Natural Dangers and Protection from Them. Methods of Teaching"

Active teaching methods are aimed at developing the trainees' independent creative thinking and ability to solve non-standard problems (Yeremina, 2013).

The need to use active learning methods in the organization of students' independent work is determined by the possibility to stimulate the development of thinking and creative abilities of the future Life Safety teachers outside the classroom. For this purpose, the students were given tasks requiring both independence of thinking and interactive cooperation. While studying "Theoretical basis of the natural dangers and protection from them. Methods of teaching" students were given the following tasks: 1) essays on the films, the plot of which is built on the natural emergencies; in essays students are to determine parts of a film which may be used as fragments in the classroom with their subsequent analysis; 2) the collection of movies and cartoons, where the authors used the misconceptions about safe behavior of their characters; 3) the development of a virtual travel or tourist route in Russia and the world with the "visit" of interesting natural objects; 4) a creative task "Natural hazards and emergencies in literature and art"; 5) development of technological mapping of volcano and geyser models, etc. The results of this creative activity are analyzed and assessed by students themselves in subsequent seminars in the form of review highlighting both positive aspects and shortcomings. We believe that the review may be considered as one the methods of the CTD technology which should be used in training future teachers.

It is worth noting that students' independent work based on active methods increases significantly their activity in class; has a positive effect on attendance of classroom and extracurricular activities (the average attendance of classroom activities during the experiment was 87.3±4.2% in the experimental group and 62.5%±6.2 in the control group).

The Results of the Pedagogical Experiment

The analysis of students' performance in basic disciplines studied during the first academic year in the control and experimental groups did not reveal any significant differences in the development of their thinking. The average result in the CП was 3.92±0.26 and in the EG it was 4.02±0.56. The groups were considered relatively homogeneous; and we initiated the pedagogical experiment.

To evaluate the effectiveness of this technology the following criteria were used. The level of general cultural and pedagogical competencies was assessed with tests developed for all six units of the discipline program. The test results gave the opportunity to assess the level of logic and analytical thinking. The results were evaluated in points (maximum 30 points); the test included the tasks like reproduction, understanding the causes of the process, compiling a logical chain, sequence of actions, comparison and identification of errors.

The average points differ significantly in the control and experimental groups (fig. 1). In the control group the dynamics of the test results is relatively constant; the obtained results were not significantly different and the points for every controlled stage were 16.8±1.02; 18.8±2.06; 22.6±3.5; 20.6±1.25; 23.8±2.56; 22.8±0.36 correspondingly. In the experimental group there was significant increase of performance ($p<0.01$; Figure 1) shown in the third test (26.2±3.12 points during the third test and 16,3±1,24 points during the first test); then the results were stable (25.8±4.2; 28.3±2.84; 27.9±4.52 points correspondingly).

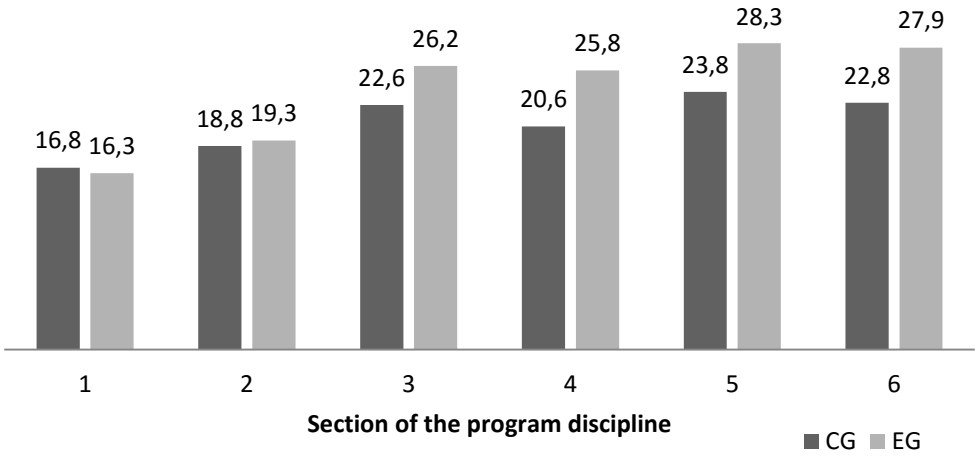

Figure 1. The average results of tests for discipline sections of the control and experimental groups

The analysis of students' performance in "Theoretical basis of the natural dangers and protection from them. Methods of teaching" revealed that development of critical thinking in students contributes to the assimilation of theory; the dynamics of the rating system results in the experimental group proves this statement. As shown in Table 2 in the control group the average results were virtually unchanged at the end of the experiment; and in the experimental group the results were 62.34±4.5 at the beginning and 75.14±3.19 points at the end of the experiment ($p<0.05$).

Table 2. Average values of indicators in the control (CG) and experimental (EG) groups

Indicators:	CG (n=28)	EG (n=24)
Average results of the rating system at the beginning of the experiment (4th semester)	61.83±4.19	62.34±4.5
Average results of the rating system at the middle of the experiment (5th semester)	68.15±3.48	71.54±8.19
Average grade of the rating system at the end of the experiment (6th semester)	65.40±2.74	75.14±3.19
Activity during lectures, %	60.71%	66.67%
Activity during seminars, %	53.57%	91.67%
Students' participation in active forms of the independent work, %	14.28%	77.78%
Using techniques of the CTD by students in teaching practice, %	7.14%	29.16%

Active techniques and methods of the CTD technology contribute to growth of students' motivation to study. The activity in the experimental group was 5 times higher than in the control group, especially in group forms of the independent work. The effectiveness of the techniques of the CTD technology was also assessed on the basis of students' skills to use this technology which reflected in the frequency of implementing these techniques by students during their teaching practice for organizing pupils' work. 29.16% of students in the experimental group

used some techniques of the CTD technology for developing lessons during their practice; in the control group this indicator was 7.14%.

Discussion and Conclusion

The problems of implementing techniques of the CTD technology for students' training are new for Russian and foreign literature. In the last decade the interest in this problem has increased (Arsenyev, 2011; Mzhelskaya, 2014) including the realization of the competence-based (Mansurova and Fomin, 2014) and student-centered approach to teaching, especially in connection with the accession to the Bologna process and the transition of higher school to the multilevel structure of education which puts forward new requirements for the training of students (Stolbnikova, 2006; Ospanova, 2010).

In literature it is stated that using the CTD technology in higher education depends on teachers' personality and pedagogical competence (Morochenkova, 2004). The complexity of the application of this technology and the ambiguity of evaluating its effectiveness in terms of time are indicated in most studies (Mansurova and Fomin, 2014; Ozen, 2016; Burkhanova and Rodionova, 2012).

The results of our study do not contradict this information. In this paper we summarize the experience of the systematic use of different techniques and methods of the CTD technology for training students majoring in Life Safety (Pedagogical Education); one discipline of the module "Dangerous situations and protection from them" is taken as an example. We assessed the effectiveness with motivational, intellectual, and activity indicators: evaluating tests, methods of critical thinking development in teaching practice, students' activity and performance indicators. The study showed a significant increase in these parameters in the experimental group compared with the control group during the experiment. Thus, systematic use of active methods of the CTD technology contributes to students' activity and performance. The analysis of the CTD techniques presented by various authors allowed us to select and transform some methods and tools of this technology. The experiment has shown that using a methodological aspect in the content of professional block disciplines is justified and can be recommended for teaching students majoring in Pedagogical Education.

Implications and Recommendations

Systematic use of techniques and methods of the critical thinking development technology even within one professional discipline is effective in training future Life Safety teachers. In our study we selected, transformed, and integrated techniques of the CTD corresponding the content of the studied discipline and forms of educational work. Using active teaching and the critical thinking development technology contributes to generation of students' general cultural and pedagogical competencies developing their cognitive ability, motivation development, formation of skills and abilities in the professional sphere.

It should be noted that the inclusion in the process of training future teachers of certain methods and CTD technology stimulates motivational sphere, the ability to effectively perform tasks, increases the effectiveness of their training at the university.

It is shown that the use CTD technology in the classroom to develop students' skills to use these technologies in their future profession. It is possible to

recommend the use of these methods in an article in the training of future teachers.

The article may be useful in practical terms for teachers of higher and secondary education, experts in the field of education.

Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

Disclosure statement

No potential conflict of interest was reported by the authors

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References

Arsenyev, K. S. (2011). On the problem of critical thinking formation in students of the university. *Education and Science, 10,* 68-69.

Burkhanova, F. B. & Rodionova, S. E. (2012). Introduction of innovative active and interactive teaching methods and educational technologies in Russian universities: modern state and problems. *Vestnik of Bashkirsky University, 4,* 1862-1863.

Dolgusheva, I. E. & Bekker, I. L. (2011). Competence-based approach as a theoretical and organization basis of modern education. *Izvestia of Belinsky PGPU, 24,* 626-630.

Gruzdeva, M. L. & Bakhtiyarova, L. N. (2014). Pedagogical techniques and methods of work of higher school teachers in the conditions of the information educational environment. *Theory and practice of Social Development, 1,* 166 -167.

Khutorsky, A. V. (2003). Key competencies as the component of a student-centered education. *Popular Education, 2,* 58-64.

Klimova, T. V. (2012). Methods of forming student's critical thinking. *Vestnik OGU, 2*, 114-138.

Kukina, E. N. (2010). Basics of the pedagogical technology of critical thinking development in students with reading and writing. *Izvestia VolgGTU, 7 (8)*, 114-116.

Kuznetsova, N. V. (2011). Development of creative potential of pupils during Life Safety lessons. *Theory and techniques of training and education, 7,* 225-226.

Lazyrina, O. M. (2015). Techniques of critical thinking technology in teaching practice of higher education. *Theory and practice of social development, 5,* 156-157.

Makarova, L. N. & Sharshov, I. A. (2015). Individual trajectories technology of critical thinking development in teacher and student. *Gaudeamus, 1 (25),* 73-74.

Mansurova, I. A. & Fomin, S. V. (2014). Technology of critical thinking development in teaching engineering disciplines in higher education. Direct access: http://www.science-education.ru/ru/article/view?id=13588

Morochenkova, I. A. (2004). Formation of critical thinking of students in educational process of university. *Dissertation abstract for the degree of candidate of Pedagogy*, *6*, 22.

Mzhelskaya, T. V. (2014). Techniques of critical thinking development technology in teaching the discipline "Technology of independent work". *Siberian Pedagogical Journal, 2*, 93-95.

Ospanova, N. T. (2010). *Pedagogical conditions of formation of critical thinking in senior pupils*: PhD Thesis, Almaty, 243 p.

Ovcharenko, V. A. & Repina I. A. (2014). Critical thinking development technology. *Problems and prospects of education development in Russia, 27,* 125-126.

Ozen, H. (2016). Determining the Factors of Social Phobia Levels of University Students: A Logistic Regression Analysis. *Educational Process: International Process, 5*(1), 38-53.

Ozbey, A., & Saricam, H. (2016). Human Values and Compassionate Love in Highly Gifted Students and Normal Student. *Educational Process: International Process, 5*(2), 116-127.

Shakirova, D. M. (2006). Formation of critical thinking of pupils and students: model and technology. *Educational Technology & Society, 4,* 284-289.

Stolbnikova, E. A. (2006). *Development of critical thinking of pedagogical higher educational establishment students in media education*. Taganrog: Kuchma, 160 p.

Varlakova, M. L. (2012). Development of critical thinking at physics lessons. *Omsk Scientific Vestnik, 2(106),* 243-245.

Yeltsova, O. V. (2013). Realization of the competence-based approach in the discipline "Life Safety" using some techniques of the critical thinking development technology through reading and writing. *Sience Vector TGU, 4 (26),* 225-226.

Yeremina, L. I., Nagornov, Yu. S., Nagornova, A. Yu. (2013). Creative development technologies for students of engineering specialties. *Fundamental research, 1(1),* 79-80.

Zair-Bek, S. I. (2011). *Development of critical thinking in class: manual for teachers of educational institutions*. Moscow: Prosveshcheniye, 223 p.