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The Problem of Developing Professional Expertise of Vocational College Students

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ABSTRACT

The goal of the paper is to study the problem of developing the professional expertise of vocational college students, future technicians of the road transport industry. The nature and content of the concept "the professional expertise of a technician of road transport industry" has been defined. This concept is considered as a set of skills, knowledge and experience of professional activities in the following directions: cargo and passenger transfer; road transportation service; transport and logistics activities. The content and structure of the contextual approach contributing to the effective development of the professional expertise have been determined. Its structural components - cognitive, value, activity, informational and communicative, adaptive – have been revealed. The pedagogical experiment involved students of the Ufa Road Transport College (Ufa, Russia). The pedagogical conditions ensuring the effective development of future technicians' professional expertise have been formulated. The latter includes using the forms, tools and techniques of active learning within the contextual approach; the implementation of the automated control systems for road transport in the educational process; the orientation of the educational process on realizing the potential of students, enabling them to display creativity through the project method. After the experimental work the number of the students with a high level of professional expertise increased by 30%. The results of the experiment proving the efficiency of the suggested complex of pedagogical conditions for developing the professional expertise have been presented.

KEYWORDS
Professional education, professional expertise, specialists of the road transport industry

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Introduction

In the modern conditions according to the Conception of Long Term Socio-Economic Development of the Russian Federation up to 2020 and in accordance with the Federal Target Program for the Development of Education in Russia for the period of 2016-2020, the teaching process is expected to provide to each future specialist both fundamental theoretical knowledge and a wide range of practical professional skills alongside with developing professionally significant qualities of a person.

The structural element of the previous educational standards was represented by *a subject*. According to the new generation educational standards based on the competence approach, its structural element is *an educational area*. The latter presents itself in the form of professional modules designed to develop specific types of professional activity. In its turn, the structural elements of the vocational modules are the professional and generic competences which are regarded as an integral indicator of the quality of its development (Benin, 2011). The terms "expertise", "competence", "qualification", "individual curriculum" are included in the basic concepts used in the Federal Act of Education of the Russian Federation and the Federal state educational standard of secondary vocational education (2015).

The current state of the road transport sector is characterized as ambiguous: on the one hand, there is the increase of its amount in Russia as compared to the volume of the air, rail and water transports. Besides, the shipping and trucking companies are in crisis. The crisis phenomena observed in the road transport industry have led to production decline, reduction in traffic volumes, vehicle production line, and rolling stock and also to a shortage of highly skilled

professionals. In the city of Ufa and in the Ural region as a whole, remains a high demand for qualified, competent technicians engaged in the organization of transportations and management of motor transport operating and maintaining vehicles in service networks. At the same time there is an imbalance of supply and demand in the labour market, decline in the prestige of technical education.

The stated problem leads to the search for new forms of organizing the educational system that will ensure qualified training of relevant personnel potential with the developed professional expertise and eventually all that will make the workers competitive (Asadullin, 2014). The importance of this issue is also noted by some foreign authors (Crawley et al. 2014; Kimberly and Todd, 2013).

The basis of the content of modern education is determined by the competence-based approach developed by J. Raven (2002) etc. In this regard, one of the key concepts becomes "an expertise". We proceed from the generally accepted interpretation of expertise as personality traits involving a specific set of knowledge, skills and abilities to apply them in all situations. This interpretation contains an important statement that the expertise manifests itself only in practice. Following scholars E.F. Zeer (2013) and N.V. Kuzmina (1990), due to the component analysis of the concept "expertise" we review it as a result of certain areas of training expressed in the acquisition level of

corresponding competences (common cultural and professional) including professional experience, skills, knowledge and personal integral characteristics.

According to G. N. Akhmetzyanova (2010), E. A. Demina (2015), O. I. Volenko the peculiarities of the educational environment in which future technicians are trained, are considered during the development of the main types of their professional activities. In accordance with this, we clarified the essence of the concept "the professional expertise of future road industry technicians". We define it as a set of integrated skills, knowledge and experience of the major professional activities in the field of freight and passenger traffic, the organization of service on a vehicle, transport and logistics activities. All that will let a future specialist design his\her professional work and acquire professionally significant qualities in order to employ them in the working sphere and get adapted to the changing technical and economic conditions.

The experimental work was carried out on the basis of the State budgetary educational institution of secondary vocational education (Ufa, Bashkortostan). The pedagogical experiment involved first-year students (55 respondents), second-year students (44 respondents), third-year students (103 respondents) and fourth-year students (103 respondents) of the Ufa Road Transport college, as well as the Professional lyceum in the settlement of Maloyaz of the republic of Bashkortostan (35 respondents), students of the Bashkir State Pedagogical university named after M. Akmulla (26 respondents). The direct participants of the pedagogical experiment were 60 third-year students of the Ufa Road Transport College. All of them are acquiring the specialty "The organization and management of road transport". 30 students made up a control group, an experimental group also comprised 30 students.

Methodology

The research is based on the combination of the following approaches: 1) the competence approach (White and Robert, 1959; Raven, 2002; Dautova, 2013), 2) the context approach (Verbitsky, 2010; Gilmiyarova, 2011). The professional expertise is a competence implemented in the activities, an integral characteristic of a person expressed in a situation of professional activity which determines the success and responsibility for its results (Raven, 2002; Zeer, 2013; Krasnikh and Samoilenko, 2014).

Our analysis of the component composition of professional expertise revealed that it consists of the value, cognitive, activity, information and communication, adaptive components.

We consider the result of the professional expertise in the light generated by the generic and professional competences, professional fulfillment, as well as the dynamics of the value orientations of an individual (Zanin and Fatikhova, 2013). We have identified levels (low, medium, high) and indicators of formation of the professional expertise of future technicians of the road transport industry.

The cognitive criterion of the professional expertise represented by professional literacy was assessed by the level of the students' performance, results of their course papers, practical training, qualification examination, besides psychological and pedagogical techniques for evaluating an individual were used (Karelin, 2003). The value criterion of the professional expertise was determined on the basis of the methods of J. Atkinson, M. Rokich and B. Bass (Karelin, 2003). The activity criterion of the professional expertise was expressed

due to the students' work in laboratory classes, grading for defending their projects, their performance at conferences and specialty competitions. The activity criterion was also evaluated according to V.M. Rusalov's technique (Karelin, 2003) for measuring the professional expertise. A multifactor questionnaire was prepared and used during the experiment to reveal the students' ability to employ the information and communication technologies in the educational activity of the academic type, their future professional activities; also the ability to use the automated control systems to generate new skills and knowledge in the learning setting with the use of the techniques of S.D. Reznik and I.A. Igoshina (2003).

The multi-factor questionnaire contained questions for the students aimed at clarifying concepts concerning professionally significant qualities of a road transport technician. It was done to determine the quantitative characteristics of the adaptive criterion.

We have developed a model based on the works by V.E. Shteinberg and R.V. Gurina (2014). We have also theoretically determined a complex of pedagogical conditions in which the formation of the professional expertise of future technicians of the road transport industry will be effective.

The first pedagogical condition is the development of the professional expertise which is conducted using forms, means and methods of active learning within the contextual approach. The first pedagogical condition in this study is aimed at modeling a language of symbolic means of the subject and social content of their future professional activity, an important factor here is the interdisciplinary nature of teaching. We believe that the contextual approach is the fundamental conception of developing the professional expertise when transforming the students' learning into the professional activity of the future technicians. A.A. Verbitsky (2010), S.G. Gilmiyarova (2011), O.B. Dautova (2013) emphasized that thesis (see above).

A.A. Verbitsky (2010) suggests the use of the integrated approach in teaching, according to which various forms, methods and means for active learning should be combined with traditional methods. At the institutions of secondary vocational education instructors use a wide range of organizational forms of teaching. Nowadays the innovative lecture-seminar system is being widely used. This system makes it possible to raise the level of teaching, make the students' cognitive activities more effective, and develop their skills of independent work.

The second pedagogical condition of developing the future technicians' professional expertise is the use and implementing in the educational process the practice-oriented information and communication capacity of the automated control systems (ACS) on road transport. The ACS are a collection of information, methods, models, hardware, software, technology tools and solutions, as well as a set of professionals who perform information processing and take management decisions within the enterprise. From the view point of a technician's professional activity, the ACS provide an opportunity to use the modern computer technologies to process primary statements of manufacturing and commercial operations, the release of fuel and lubricants, accounting spare parts, labor norms of drivers, the organization of maintenance and repair of rolling stock and to make appropriate decisions et al. (Nikolayev, 2012; Tikhonova, 2014). Accordingly, of great importance are ways of processing and

the use of information, as well as the technical means by which it became possible to convert the information into an important production resource (Drucker, 1993).

The third pedagogical condition represents the orientation of the educational process to revealing its participants' potential enabling them to display creativity as a factor of a future specialist's personal, professional and social self-realization through the project method. We see the specifics of this method in the following:

- consolidating the system of interdisciplinary knowledge on general subjects and professional modules (interdisciplinary contextual knowledge can be used for decision-making, thinking over ergonomic factors, economic-mathematical and spatial skills and knowledge are developed when the students plan and evaluate their ideas, develop schemes and models, etc.)., providing the relevant situations in which this knowledge can be applied, the formation of professional thinking;

- the development of cognitive skills (for planning, research, analysis and remediation of the data), skills of divergent thinking (which are very important for creativity), skills of convergent thinking (that are necessary for decision making, search for the right strategy to solve a certain professional problem, developing professional literacy);

- the focus on the success in the future careers (the ideological aspect, value orientations, interest in the acquired profession, getting professional experience, skills, knowledge);

- the integrated use of the Activity theory and active learning (the development of interest to all forms and types of the educational activity), the integration of the teaching, research and professional activities);

- the bi-directed use of the information and communication technologies in the professional work (first the study of the technologies themselves, then the development of new skills, knowledge and professional experience through the application of the former;

- the focus on a person's self-development, forming his/her professionally important qualities (autonomous determining the tasks of professional and personal development, self-education).

As seen from our experimental research work, the implemented pedagogical conditions discussed above provide the development of future technicians' professional expertise.

Results

When carrying out an ascertaining experiment we revealed the baseline indicators of professional expertise that let us identify the factors and conditions affecting its level in the following types of activities: learning or academic, quasi-professional, educational and professional, both in an ordinary and specially organized process.

To conduct our experiment, we prepared a multi-factor questionnaire to diagnose the level of professional expertise of the future road transport technicians who major in the organization of transport and traffic management in road transport. The offered questions included indicators of professional expertise. In our study we used the statistic method (mean values rank method,

correlation analysis, ANOVA, two-sample t-test): interval estimation of parameters of distributions and statistical hypothesis testing (Hermelin et al., 2007).

The ascertaining experiment showed insufficient professional expertise of the future technicians: the cognitive, value, activity, the information and communication, adaptive components. 94.3% the first year students experienced difficulties in studying general professional subjects. The second year students having the same problem were 78.9%, the third year students – 78.6%. Only 12.1% fourth year students experienced difficulties in learning general professional subjects. The profession of a road transport technician was selected by the students for the following reasons: the attractiveness of the future work (35.1%); the parents' recommendation (31.8%); corresponding to the students' abilities (28.9%); easy employment in the future (25.4%); an opportunity of getting a high salary (10%); the prestige of the college (9.2%).

These data indicate that the professional motivation and propensity for the profession were decisive in at least half of the enrolled students (45.5%), 54.5% of the students experience the impact of external factors (family, amount of earnings, the prestige of the college, etc.).

The results of the survey show that the college students generally focus on their education for future success in their life: getting a diploma, having a decent-paying job, a high social status, but at the same time they have not sufficiently mastered an effective professional expertise that is a prerequisite for achieving these goals. This in turn determines the necessity to activate the potential of the educational environment for the successful formation of the professional competence of the future technicians, developing their personal qualities, their inclusion in the various joint activities.

The objective of the control stage of the study was to determine the effectiveness of the complex of pedagogical conditions aimed at the formation of professional expertise of the future vehicle technicians. The problem was solved by means of statistical processing of the data offered by W. Gossett, namely using the Student t-test, aimed at identifying the shift that occurred after the provision of the formative influence of the studied parameters of professional expertise in the experimental group. In our case we compared the data in terms of professional expertise of the future technicians on the ascertaining the control stages of the research.

On the basis of the experimental data, the Student t-criterion for the experimental group is 2.591. The obtained value of the Student t-test 2,591 is more than the critical value (2.002) with $p < 0,05$ value specified in the table of critical values. Therefore, we conclude that the observed differences are statistically significant (p-value <0.05), the significance is confirmed in the experimental group. For the control group these values are not statistically significant (t-Student test for the control group $0.514 < 2.002$ critical values at a significance level of $p < 0.05$).

By the end of the experimental work in the experimental group the number of the students with a high level of professional expertise increased by 30%, the number of the students in the same group with a low level of professional expertise decreased by 26.6%. In the control group these indices are shown below - an increase of 6.7% and a decrease is 6.7%, respectively.

The statistical processing of the data revealed the significant changes in the level of the development of professional expertise (see Figure 1).

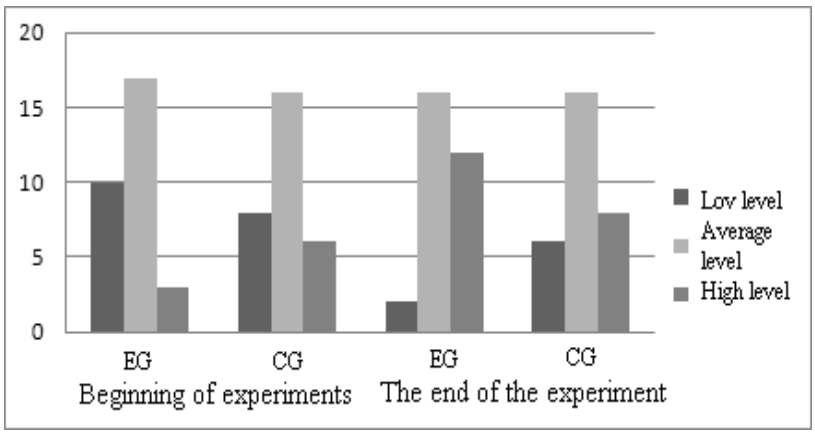

Figure 1. The levels of professional expertise (EG – experimental group, CG – control group)

We have proved the significance of the changes in the experimental group compared to those in the control group through testing the hypothesis of equality of the mathematical expectations of 2 normal distributions of the populations (Voskoboynikov and Timoshenko, 2006).

We formulate the following hypotheses (H_0 and H_1):H_0: the percentage of the people who have shown the effect of increasing the level of professional expertise in the experimental group is no greater than that in the control group. H1: the percentage of the people who have increased the level of professional expertise in the experimental group is greater than that in the control group.

The result of the two-sample t-test in the control group is K = -0.80 that enters the critical range [2.00; -2.00], $-0{,}8 < |-2{,}0|$ All that indicates that the null hypothesis with a significance level of 0.05 is adopted, and the percentage of the people who have achieved the effect of increasing the level of their professional expertise in the control group is not significant.

The result of the regime of two-sample t-test in the experimental group showed that the t-statistics being the observed value of the criterion K = -3.08 enters the critical range. Indeed, $|-3{,}08| > |2{,}00|$. Therefore, the null hypothesis with the significance level of 0.05 for the experimental group is rejected and the alternative hypothesis is accepted, which proves the importance of the research. Thus, the analysis of the results processed by the methods of mathematical statistics confirms the conclusion about the effectiveness of the developed model and the proposed pedagogical conditions of developing professional expertise of the future technicians of the trucking industry.

Discussion

When conducting the formative experiment, the pedagogical conditions leading to developing technicians' professional expertise were implemented. The characteristics and specifics of the college were taken into account. The formative experiment let us carry out a specially organized experimental

exposure using the contextual approach in terms of preparation for the real professional work as technicians of the trucking industry.

The first pedagogical condition - the development of professional expertise - was realized due to the use of forms, means and methods of the contextual approach. That provided a gradual transition from the students' educational activities of the academic type to their quasi-professional activities. The latter was achieved through modeling the content and conditions of technicians' professional work and making up a certain professional context.

The professional context of the educational content was systematized that contributed to the successful formation of professional expertise of the future road transport technicians. The curriculum was structured in the way that various sections of the subjects provided developing the future specialists' general and professional competences. Besides, the structure of the curriculum made it possible to identify experience, skills, knowledge acquired by the students.

We made an attempt to resolve the contradiction between the system of professional knowledge and the way it is reflected and arranged in various academic disciplines and modules. The existing "mosaic" of knowledge can hardly promote the interest of the students to their future careers. To improve that we suggest the following: establishing interdisciplinary relationships, the development of structural and logical schemes and cross-cutting problematic professional situations, mainstreaming cross-cutting issues in the contents of innovative lectures, developing themes for the students' diploma and course papers on the basis of projects requiring the complex application of knowledge adapting the entire syllabus for mid-level profile of the specialty.

During our experimental work with the students, in the study of educational cycles, sections and modules we were solving tasks connected with professional issues in the context of industrial processes and situations. On the one hand, they could be implemented in the experimental group. On the other hand, the ways to solve the tasks let us transform the educational activity of the academic type into the quasi-professional and vocational activities. In the experimental work we developed samples of problem and binary lectures; made up the course design support at the level of general subjects and in the modules of interdisciplinary training courses; organized an introduction training course taught by specialists working at the places of practice.

The second pedagogical condition meant implementing in the educational process the practice-oriented information and communication capacity of the automated control systems of driving the road transport. It was aimed at training the effective behavior of the students in the professional environment. Therefore, it is necessary to use demonstration training options and the complete automation of enterprise software, means of information systems and technologies at all stages of the management of the motor transportation enterprise (Khamitov, 2013). It is also important to use the software for the following: the customer relationship management, the management of inventory and personnel, developing a line of business problem situations that all in all make up the content for an interdisciplinary practicum. It provides a solution to the cross-cutting problem – to train specialists in the field of automated control systems for road transport enterprise.

In the Republic of Bashkortostan the software product "1C Vehicles" (the State standard, GOST 24.103-84) is used at the motor transport enterprises for training technicians in the trucking industry. This software product makes it possible to implement a comprehensive management automation technology for a transportation company, which promotes the planning and management of the rolling stock, the financial management, etc. The modular structure simplifies its study and use. In addition, there is an opportunity to consider each module separately for the training of professionals: mechanics, HR managers, warehouse workers and others.

Another software named “Avtotransport” (“Road Transport”) contains assignments for laboratory and practical works that are developed in the shape of a cross-cutting task. The latter involves assignments forming the professional expertise corresponding to the requirements of the Federal State Educational standard of high vocational education. The professional expertise embraces the implementation of the transportation process with the use of modern information technologies in transportation management; the organization of the personnel to ensure the safety of transport and the choice of optimal solutions when working in non-standard situations; the execution of documents; the organization of the transportation process.

Throughout a semester each student is working with an individual database in his/her own section, which allows an instructor to check the students’ prepared assignments and has an opportunity to correct their mistakes. Later the students present a report on the basis of the data obtained as a result of all the assignments. Performing these tasks lets create a virtually complete model of the company.

The development of "1C Avtotransport" allows the students not only to get experience in the basic model conditions of professional activities, but also to improve their competitiveness in the labor market. The college is aimed at training qualified technicians for modern road transport enterprises. Training on the real software tools is effective and efficient; it contributes to the well-known didactic principles of the educational process. The teachers’ work is filled with an entirely new content, allowing them to focus on their main educational and developmental functions.

When implementing the third pedagogical condition of developing the professional expertise of future vehicle engineers, we proceeded from the position that the method of projects represents the organization of the educational process which realizes students’ potential enabling them to display creativity as a factor in personal, professional and social self-realization. The method of projects can stimulate a student’s personal growth, his/her experience, skills, knowledge, interests, abilities to apply them all in practice. Therefore, when carrying out research work in the experimental group we chose the method of projects.

The students were proposed themes to work on within project groups on the following adjacent professions: the professiograms of a driver, a taxi park dispatcher, a car mechanic, a dispatcher, a motor company dispatcher, etc. The issues discussed at seminars in the experimental group included the topics touching upon the ideological aspects: "The situation in transport companies due to the financial and economic crisis and challenges to minimize its negative consequences", "The scientific substantiation of functions of a mobile control

center," "Why do not young people work in the sphere of production?", "The marketing peculiarities of demand for the services of freight and passenger traffic", "What does a competitive vehicle technician mean?, etc.

The objective of the control study was to determine the effectiveness of the pedagogical conditions and the programs developed on this basis and aimed at developing the professional expertise of technicians of the trucking industry. The problem was solved by means of statistical processing the data, namely, using the Student t-test, two-sample t-test, the interval estimation of parameters of distributions and statistical hypotheses testing, aimed at identifying the shift occurred after the provision of the formative influence of the studied parameters of professional expertise in the experimental group.

In the experimental group where we conducted the formative experiment we compared the indicators of professional expertise of the future technicians on the ascertaining and control stages of our study. In order to confirm the hypothesis of our research on the effectiveness of our formative impact we made a check cut of the indicators of professional expertise in the experimental and control groups. In order to confirm statistically the effectiveness of our

Impact during the formative experiment exposure aimed at developing the professional competence of the future technicians we used the Student t-test, which allows us to see differences in the analyzed parameters in the two groups of the students. The statistical processing of the data revealed significant changes in the level of the development of their professional expertise.

Thus, the implementation of the first pedagogical condition of our study, i.e. the use of forms and methods of active learning within the contextual approach was confirmed. The quasi-professional activities as a form of the context technology of teaching lets us simulate various situations taking place in the professional activities of a driver, a dispatcher, an operator-logistician in the form of business games which promote in-advance experience of various work situations close to real ones. The implementation of the second pedagogical condition presupposing the use of the system automated control in the educational process also found its acknowledgement.

Implementing the third pedagogical condition, i.e. the focus of the educational process on the students' potential, enabling them to display creativity as a factor in personal, professional and social self-realization through the use of the method of projects also received confirmation. We could get the students' positive feedback, their analysis of their activities after the presentation of the projects.

Conclusion

Thus, we can conclude the following:

1. The theoretical analysis of the problem of our research as well as our personal pedagogical experience have revealed the contradictions between the following groups of factors: firstly, between objectives, content, forms of organization, conditions of the students' educational activities in institutions of vocational education, on the one hand, and training of future road transport technicians, on the other hand; secondly, between the active development of the infrastructure, road transport and the insufficient development of the information technology support of the educational process in educational institutions; thirdly, the need to use innovative teaching methods (problem

lectures, simulation situations, through tasks, project method, etc.) and the insufficient methodological elaboration of this process.

As a result of our research we determined the nature of professional expertise which is considered as a set of integrated skills, knowledge and professional experience in the major professional activities in the field of freight and passenger traffic, the organization of service on a vehicle, transport and logistics activities that allow future specialists not only to efficiently design and implement professional activities but also acquire professionally significant qualities for effective inclusion in the working sphere and successful adaptation to the dynamic technical and economic conditions.

2. The potential of the college educational environment as a system of social, material and spiritual factors ensuring the development of professional expertise, self-realization and self-development of the subject of the educational process have been revealed. In the professional context it is implemented in the following areas: improving the quality of training future vehicle technicians on the basis of the interdisciplinary integration of subjects and modules, the introduction of modern educational technologies, forms and methods of instruction in the educational setting of the college; a wide attraction of students to participate in research activities (making projects, using problem professional situations, conferences, etc.); the participation of students in self-government bodies of the college, students' volunteer activities; the introduction of various forms of vocational education with the involvement of experienced professionals; building up a model of cooperation and partnership in the relationship teacher - student - employer and finally, functioning the college as a professional adapting centre.

3. The pedagogical conditions ensuring the effective development of future technicians' professional expertise have been formulated. The latter includes using the forms, tools and techniques of active learning within the contextual approach; the implementation of the automated control systems for road transport in the educational process; the orientation of the educational process on realizing the potential of students, enabling them to display creativity through the project method.

4. The experimental work has proved that the integration of the pedagogical conditions in developing the professional expertise contributes to training a competent specialist acquiring professionally significant qualities that let him/her operate in a constantly changing environment of the trucking industry. The criteria and indicators of the professional expertise of the road transportation college students have been substantiated. The three level evaluation system for assessing the levels of professional expertise - high, medium, low- has been suggested.

The efficiency of developing the future specialists' professional expertise was expressed in the rise of its indicators in the experimental group during the formative stage of the experiment when the pedagogical conditions were being realized. All that made it possible to confirm the verity of the theoretical positions of the hypothesis.

However, the study does not reflect all the issues of developing the professional expertise of road transport technicians and does not purport to be an exhaustive solution to the whole problem. The present survey means the existence of broad prospects for further research problems due to the ideas of

continuous education, the development of the road transport industry and the formation of a new type of training centers.

The work can be continued in the following areas: developing the students' creative abilities within developing their professional expertise in the future work; monitoring the professional expertise; the development of new ways of organizing the learning process in the secondary vocational education; the development of forms and methods of organizing a closer cooperation of the educational institution with prospective employers.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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