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Algorithmic Presentation of the Independent Work of the Students of the Vocational Pedagogical University in the Conditions of the Synchronous Pedagogical Control

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ABSTRACT

The topicality of the investigated problem is stipulated by the demand for specialists able to develop algorithmic preparedness to perform professional activities, the level of which corresponds to modern level of technological production. The purpose of the article is to diagnose the influence of the synchronous pedagogical control on the development of preparedness for the algorithmic presentation of the independent work of the students of professional and pedagogical university. The leading approach to the study of this problem is the method of algorithmic presentation of the synchronous pedagogical control of the process of assimilation by the students of the professional knowledge and skills, enabling them to develop in algorithmic preparedness corresponding to the level of complexity of the implemented educational and professional activities. The article deals with the psychological and pedagogical approaches in the study of algorithmic preparedness to work independently as well as with the arrangements for the synchronous type of the pedagogical control in the discipline of profile preparation of students of the Russian State Vocational Pedagogical University and with the results achieved during experimental search of work indicating the effectiveness and efficiency of this type of control. The materials of the article may be useful to teachers of vocational training in the organization of practical training in the disciplines of profile preparation containing procedural knowledge and skills and, consequently, an algorithmic nature.

KEYWORDS
Algorithmic preparedness; algorithmic presentation; independent work; self-control; synchronous control

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Introduction

From the standpoint of the personal approach to the work, the preparedness is characterized by the willingness of individual expression of personality traits, abilities, and professionalism, competence based on the conscious pursuit of

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highly productive activities in a specific field of work or social life. Preparedness for the activities is determined by factors characterizing different sides, and depending on the conditions or characteristics of performance of activities, one of the sides of preparedness turns out to be the leading. For the future teachers of vocational training the development of algorithmic preparedness to perform independent work on mastering the professional knowledge and skills is crucial. The importance of the development of algorithmic preparedness to work independently in professional-pedagogical education is determined by its feature – with the presence of not only teacher training, but also the industry that requires the development of the technological level of professional pedagogical consciousness. It is characterized by a focus on the acquisition of the predetermined outcome of pedagogical activity (Dneprov, 2000; Kalimullin, Vlasova & Sakhieva, 2016). This level of consciousness is necessary for the future teachers of vocational training for the preparation of secondary vocational education specialists to carry out high-tech production activities. Especially important is the development of the algorithmic presentation of the independent work in the initial training courses in high school, when educational and cognitive activity becomes an independent, professionally oriented and therefore more algorithmically complexity.

Algorithmic preparedness to work independently is defined by us as a special personal status that presupposes the existence of a clear image of the structure of educational activity (or model), and a constant focus of consciousness, a special focus on its implementation with a view to the successful (quality) of the educational activity. The main factor as we believe, that influences the development of the algorithmic presentation of the independent work is the continuous growth of informative independence of students. The basis for this growth is the development of reflective teaching and professional work carried out by the students in the role of subject-object and the upcoming professional activities, when they become its full-fledged subjects. Reflection promotes the formation of conscious control over mental activity (Akhmetova, 2009) and "volitional control" of cognitive activity (Khalin, 2003) as a teacher and students, which in turn contributes to the development of self-control, in which the structure of implemented self-test function, self-esteem, self-diagnosis and self-correction.

In our study the algorithmic preparedness for self-study, we hypothesized that its development becomes possible and achievable in terms of organization of continuous and synchronous process of assimilation of subject knowledge and skills corresponding to a certain level of complexity of the professional activity, pedagogical control. This type of control is similar to the synchronous type of education, in general, is a system of activities, defined in terms of purpose or reason, and connecting these activities to the specific point in time (Dneprov & Valiev, 2008; 2009). Through the mechanism of rapid feedback, it provides relevant diagnostic information about the results of the training necessary for their objective evaluation and surgical correction.

Systematic and consistent implementation of the phases of the synchronous control, which are in relationship to each other, reproducing the logic of learning material provides the continuous (uninterrupted) time-tracking process of the results of independent activity of students by the educator. The continuous nature of the synchronous control is one of its most important essential characteristics. The increase in significance in the synchronous control of diagnosis and correction functions and their regular implementation focus on the analysis of the learning situation, the explanation of mistakes in training, including those one with the deficiencies in the organization of educational process, typical for pedagogical orientation control on the continuous improvement of the educational process. With the ability to present the learning process algorithmically, the teacher in the process of continuous and synchronous control involuntarily as the baton passes down to future teachers of vocational training and enhance their preparedness for self-algorithmization of professional-pedagogical activity as a basis for future algorithmic presentation of the activities of students.

Today, the quality of education level is mainly determined by the results of a subjective teacher control. The inspection results are subjective because of the disconnected views of teachers on the content of education as well as due to the individual ideas, concepts, teachers, styles, as well as existing quantitative "unmeasured" requirements of the federal state educational standards (Zvonnikov, 2009). Subjectivity in pedagogical control often occurs because of its asynchrony for example dissociation, postpone or incongruity in time with the learning stage. The more "asynchronous" is the pedagogical control, – the "weaker" is the feedback, which is carried out the verification procedure in order to identify the learning outcomes. Studies show that the educational needs of synchronous education, and, consequently, in the synchronous form of pedagogical control are in demand by students of pedagogical universities (Dneprov & Valiev, 2008; 2009).

Methodological framework

Research methods

During the research, the following methods were used: theoretical (analysis and synthesis, comparison, generalization, ranking); diagnostic (scientific observation, study performance); empirical (quantitative measurement and evaluation results, modeling); experimental (notes forming and supervising the experiments); methods of mathematical statistics and graphic results.

Experimental research base

Experimental research base was Russian State Vocational Pedagogical University.

Stages of research

The study was conducted in 3 stages:

– at the first stage the input control of the baselines of algorithmic preparedness among students of experimental and control groups was implemented;

– the second stage was the formative level, which included the organization of synchronous pedagogical control and conducting practical classes in the chosen discipline;

– the third final stage realized the control of the algorithmic preparedness levels among students of the experimental groups achieved in the course of the experiment their comparison with the results of input control.

Results

Psychological and pedagogical approaches in the study of algorithmic preparedness

In the study, we have focused on approaches that were the basis for pedagogical hermeneutics of the internal mechanisms of formation of the various properties of the tested groups. Above all, we reckon to them the personal approach, subject-activity approach and problematic approach to the organization of learning activities based on synchronous pedagogical control.

Considering the *personal approach* in the formation of algorithmic preparedness in terms of organization of the continuous pedagogical control, we understand that the changes in the personal qualities of students in active learning and cognitive activity are responsible for the continuous subject-subject relationship. As a result, the students form their own subjectivity have the ability to be active initiators of teaching and learning activities. Thus, the *subject-activity approach* to learning had been identified, which was based on the concept of the formation of the essence of the human mind in the course of social practice.

Both personal and subjective-activity approaches in teaching are organically linked with the personalization of pedagogical interaction. On the one hand this is the level of interpersonal relations arising in the process of continuous collaborative learning and cognitive activity and lead to the emergence of representation or an objective reflection of one person (a teacher) - its subjectivity, to another person (a student). On the other hand it is a process that realizes the need to be a person providing the "active inclusion of the individuality in the system of social relations" (Petrovskiy, 1987), thereby forming its subjectivity. Through the process of personalization in a continuous and synchronous pedagogical control, in which the personality of the teacher, their subjectivity, affects the changes in the teaching, the responsibility for education results - the quality is shared between a teacher and a learner. In addition, continuous pedagogical control inevitably entails a manifestation of the level of subjectivity teaching when the student begins to assess themselves with the "eyes of the teacher".

The implemented analysis of the concepts of subjectivity and subjectivity within the meaning of "prejudice" allows us to say that they determine each other in a continuous pedagogical control. This subjectivity in the evaluation of knowledge and skills is a dual opposition of subjectivity of the teacher. The high level of subjectivity of the teacher acts as a condition of its low subjectivity – impartiality in pedagogical control, and vice versa, a low level of subjectivity of the teacher acts as a condition of its high subjectivity.

No less important in the formation of algorithmic preparedness is the *problematic approach* to cognitive training and professional activity, which is based on the principles of developing training and requires a high level of cognitive motivation. In the educational activity based on synchronous pedagogical control, highlighting as the main indicator of the level of cognitive motivation of intellectual abilities, we identified the cognitive activity of students with successful implementation of *intellectual* activity. It manifested itself in the process of solving the educational and cognitive tasks, and in the process of self-overcoming of difficulties in the implementation of diagnostics and correction functions, leading to the complete educational actions assimilation.

Referring to the opinion of A.V Gubanov (1990) which marks the importance of the role of the "emotional-motivational component of activity" in relation to the conversion of intellectual activity, the development of which in turn leads to increase in intensity of the process of solving the problem we can say that it is an appropriate level of intellectual activity in favor of motivation for cognitive activity. If the intellectual development level is low, you cannot expect the development of motivation of cognitive activity. If the intellectual development is of a high level (independent interpretation of goals, algorithmic activities), respectively, then educational and cognitive motivation will be high.

The above-mentioned approaches being implemented in the training activities and carried out on the basis of synchronous pedagogical control, allow achieving high performance and efficiency of the process of development of algorithmic preparedness of future teachers of vocational training. However, the main approach that distinguishes this study is an algorithmic approach to the development of the qualities of the person. It suggests algorithmic presentation of the synchronous pedagogical control, with which there is an orderly process of assimilation of knowledge and shaping.

The algorithm of the synchronous control and independent work

Algorithms for training are divided into algorithms associated with the studied object, allowing to solve problems specifically to this subject, and – the algorithms teachings (assimilation). Algorithms related to the subject studied, determine the sequence of elementary operations to solve any of the tasks that belong to a certain class. Algorithms for teaching or learning algorithms according to L. S. Tlyusten (2008) appear to be the model of the correct construction of reasoning, and "are a means of education, showing what actions and in what order a student should perform to learn the relevant knowledge".

The development of algorithmic preparedness among students of the pedagogical university along with vocational algorithmic presentation requires from all the learning process to take into account the peculiarities of the content of subject knowledge and skills, the conditions of their formation and consolidation of the learning process. It orients the students of professional-pedagogical high school on self-development, self-operating, self-regulation. In modern society, it is a necessary condition in order to be successful in their professional activities (Zemskova, 2007).

Synchronous control algorithm is continuous and consistent implementation of procedures for *checking the results* of training, *evaluation*, when students focus on *self-test* causes of errors and *self-correction* in case of deviation from the norm. Each time, the newly formed element of knowledge is based on the assimilation of the previous one completely or with a slight deviation from the prescribed norms. The result of the comparison that was supposed to get, and what happened is the basis for further action in the case of coincidence, or correction in the case of a mismatch. The frequency of pedagogical control gradually decreases with increasing qualitative characteristics of the knowledge and skills digestible for a subject, – their generalizations, minimize, conscious and systematic phasing.

Since the pedagogical control is implemented regularly and systematically (coinciding with each stage of solving the problem), the gaps in knowledge will not be as significant as in the conditions of the use of traditional forms of control, when differences in the knowledge accumulated all the time. At the same time, continuous and consistent implementation of all synchronous pedagogical control functions (audit, assessment, diagnosis and correction) in the process of solving problems results in synergy or their summing effect, for example to strengthen each other. Thus, having verified the current process of learning outcomes after any previous diagnosis of the previous result, it becomes more efficient, as the occurrence of errors diagnosed earlier was expected. In addition, the effectiveness and efficiency of the algorithmic presentation educational activity, as practice has shown, increased in the process of assimilation and improvement of substantive action, extended in time, and, accordingly, intensive content.

Due to the transition to the synchronous type of pedagogical control, there is the substantial increase, which is a mechanism of formation of responsibility of students. Students, who are aware of the inevitability of the coming control of the teacher, are appropriately formed in a good preparation for classes. Just as a strengthening of the functions of the state, it led to its gradual withering, and synchronous control leads eventually to the gradual replacement of the pedagogical control with the self-control students.

Constantly initiating demand of students for self-control stages of self-learning activities, directing them to self-esteem, self-diagnostics and self-correction learning difficulties by analyzing the essential features of the workflow and the conditions for the formation of the true values of the synchronous pedagogical control developed algorithmic preparedness of students to work independently. In other words, synchronous pedagogical control oriented learning activities of students on their constant reflection.

In the process of reflection of the activities students using smart lock operations, comparison, discrimination and generalization of expression in symbolic forms, which constitute the content of "conceptual scheme of reflection" (Alekseev, 2002), realized and assimilated generalized algorithm of self-control self-activity phases, repeatedly "testing" it in a synchronous pedagogical control. In the structure of the generalized algorithm of self-control stages of the activities self-test function, self-esteem, self-diagnostics and self-correction are implemented.

The research of the possibilities of continuous and synchronous with the process of assimilation of subject knowledge, pedagogical skills and control skills allowed us to highlight the structure of preparedness of students for algorithmic presentation of the independent work. It provides for the development of three interrelated components – motivational-value, reflective and activity, as well as their levels of development: from the poor – to low, and then – to a satisfactory, adequate and high.

Motivational-value component contributes to the development of cognitive activity of students based on a translation of an external stimulus in the form of a synchronous control of the teacher in the sense-internal motives for independence and professional self-development. It is necessary to conduct systematic work on the development of cognitive activity within the personality-oriented education (Dneprov & Manturova, 2015). The main indicator of the level of cognitive activity development in favor of the success of the intellectual activity is the mechanism that develops in the activity itself through its reflection.

The reflective component in conditions of the compliance of the control algorithm of the synchronous teaching promotes continuous reflexive self-digestible educational and professional activities. It includes both results of the self-control that has already taken place, and current activities, as well as analysis and algorithms for the upcoming educational and professional activities.

The activity component ensures the development of subjectivity of students on the basis of the growth of algorithmic complexity of teaching and learning and intellectual development. As a result of timely overcoming difficulties (first with the help of a teacher, and then independently) the implementation of diagnostics and correction functions synchronically became an iterative process, analysis of the conditions of the current phase of the synthesis algorithm for its implementation and self-control of the results obtained, leading eventually to the formation of the true algorithm digestible for educational and professional activities.

Achieving a high level of preparedness of each component in the algorithmic process of assimilation of subject knowledge and skills at this stage of training laid the foundation for the transition to the next stage, as a rule providing for the absorption of algorithmically more complex professional activity. All this is possible and achievable only in specially organized pedagogical synchronous control.

Diagnosis of the synchronous control influence on the development of algorithmic preparedness

Experimental research to identify the impact of synchronous control on the development of algorithmic preparedness for the independent work included three main steps: *ascertaining, forming and control*. The study involved 121 students enrolled in the specialty "Computer Engineering" and profiling "Computer automation and control technology" on the issuing department Russian State Vocational Pedagogical University. The subjects were divided into experimental (60) and control groups (61) people.

To organize synchronous pedagogical control the academic discipline "Arithmetic and logical bases of computing" was chosen for students who have the profiling for "Computer automation and control technology" of the first training course, and students enrolled in the specialty "Computer Engineering" at second training course. Selection of subjects was determined on the basis of the process (procedural) nature of the digestible substantive knowledge and skills (Shabaldin & Smolin, 2012), disclosing information presentation and processing algorithms in digital computing devices. This allows the algorithmic presentation process of assimilation to be effectively applied with the synchronous algorithmic control.

The ascertaining stage of the study

At the ascertaining stage by incoming control, the progress of the previous stages of training level of preparedness of the future teachers of vocational training to the algorithmic presentation of the mastered professional activity was assessed. Incoming inspection was based on the performance of the students of the first practical assignment on "Notation and representation of numbers in different number systems". Students relied on the knowledge and skills obtained after passing the discipline "Computer Science", but taken into depth with the consideration of the mastered professional activity.

To assess the levels achieved algorithmic preparedness was developed tier structure development and evaluation of students' preparedness for the algorithmic presentation of the independent work. Qualitative characteristics and key figures in this structure for each alert level was characterized by the degree of development of cognitive motivation, reflection and self-teaching and professional activities, as well as the level of development of intellectual abilities of students. The main, unifying factor was the increasing of the cognitive activity of students. To generate quantitative criteria of the algorithmic preparedness alerted levels, we referred to the commonly used in teaching practice performance indicators of educational activity, such as:

1) *the intensity of the interaction* of students with the teacher that has characterized the development of motivational-value component and the amount of calls to the teacher at the initiative of the student assistance or supervision activities performed;

2) *the accuracy of the solution* of problems that characterized the development of reflective component and measures with the amount of mistakes made by the student in the process of solving problems;

3) *efficiency,* which characterizes the development of the activity component and the measured ratio of the number of correctly solved problems of students in the classroom to the total number of tasks scheduled for the teacher in class.

Pedagogical control at the ascertaining stage of the study was carried out in the process of solving problems on the initiative of the students of the control and experimental groups. Final pedagogical supervision was carried out on the results of the entire job. As a result, the individual values were found for each of the three ones discussed above the defined and quantitative levels achieved the algorithmic preparedness formed according to the quantitative criteria values.

In order to identify differences in the distribution of students of the control and experimental groups by levels of components of algorithmic preparedness the structures the comparison of the results obtained by the criterion χ^2 were conducted. These empirical values of χ^2 criterion for the chosen level of significance equal to 0.05, and the two signs were valued less than the threshold value χ^2, equal to 3.84 (Dubina, 2006), which indicated no difference in the distribution of student control and experimental groups. The diagram in Figure 1 shows the characteristics of this distribution.

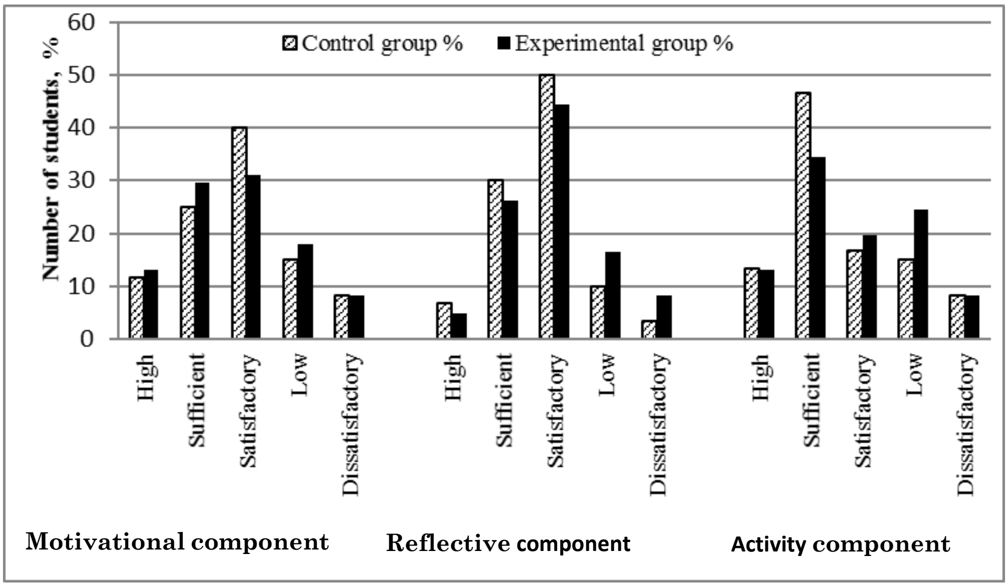

Figure 1. Distribution of students into groups to identify the level algorithmic preparedness

It turned out that a high and sufficient level of the motivational component was developed more among the students of the experimental group (from 13.1% and 29.5% of students, respectively), and they lagged behind in the development of the same levels of reflexive and active components. However, with the satisfactory level of development there were more students in the control group: respectively 40%, 50% and 22% of students for each component of the algorithmic presentation preparedness. Such a difference in the results of the control and experimental groups could be due to the different quality of specialists and bachelors respectively. Students who receive a specialist qualification could be more focused on the effectiveness of the training, as this depended on their continued employment (they have already chosen the profession). At the same time bachelor qualification does not imply selection of specialty immediately.

A considerable number of students of the control and experimental groups was identified as with the sufficient level of development of the activity component of the algorithmic presentation preparedness of students for the independent work. It estimated the number of solved by students. It corresponded to 46.7% of the students in the control group and 41% of students in the experimental group. The relatively high efficiency of solving problems at the ascertaining stage of the study can be explained with their low algorithmic complexity and partial repetition of earlier learning.

Overall, ascertaining stage of development of search works showed that the experimental and control groups in terms of preparedness for independent work algorithmic presentation was almost completely identical. However, in both groups numerically dominated the students who demonstrate a satisfactory level of development of each component. In the context of the further growth of algorithmic complexity of the digestible educational and professional activities, of course, there was a need for a substantial development of all components of the structure of algorithmic preparedness to work independently.

The formative stage of the study

At the formative stage of experimental and searching operation for the organization of the synchronous pedagogical control, it was necessary to carry out the following activities:

1) to form a structure of practical training, increasing algorithmic complexity which would lead to a qualitative mastery of knowledge, skills and abilities and influence on the development of components of the structure of algorithmic preparedness to work independently;

2) to carry out computer simulations of the functions of the synchronous control, the decision on which was a consequence of the lack of detection of the primary organization of the pedagogical control of traditional means and methods of quality control of training – it "is not universal".

In order to calculate the algorithmic complexity of the practical exercises the standard algorithmic complexity of each task was designed such as the ratio of the number of transactions in terms of the total number of computational procedures involved in solving the problem. As a result, seven practice sessions were formed that implemented conditionally consistent dynamic growth of algorithmic complexity of the educational activity. Each practice session provides a solution from one (with a high level of complexity) to five (with a low level of difficulty), educational and cognitive tasks. The subject of each task (data source and sought) is a numerical code that operate on digital computing devices (binary, hexadecimal, binary-coded decimal machine code), logic functions and timing diagrams of combinational devices.

Events on *computer modeling* were about to form a software control modules performing practical tasks, implementing automated synchronous control of independent work of students. Programming implementation of practical tasks and the results of testing and evaluation functions are carried out on the basis of information models of the solutions. It is a sequence of actions to transform the raw data values and getting the right results. Referring to the conclusions regarding the diagnosis and correction functions – mainly on non-algorithmic methods of their implementation, the organization of a program of support is based on the results of previous training data. These data contain information about the most probable (typical) for each stage of the problem solving errors.

Software control modules possessing the property of interactivity or the ability to actively respond to the actions of students provide algorithmic, information and educational simulation training activities. If during the usage of an algorithmic simulation of the consistently reproducible steps in the process of learning of subject knowledge, the information is necessary for the simulation filing of the relevant information, without which it was impossible to perform further actions of students. These included the following: the original data on the conditions of tasks, the teacher reported the results of problem solving, information about possible errors, etc., pedagogical situation simulation was the most accurate reproduction of whole work of the teacher in the conditions of synchronous pedagogical control. It determined the activity of the experimental group students in different educational situations.

As a result of computer modeling of synchronous control functions for the considered discipline using algorithmic language programming, four program control unit have been developed (Telepova, 2013). Each of them can meet the challenges of one or more practical tasks to perform synchronous control of the results, implemented in the educational support function, to form the results of solving problems. Thus, future teachers of vocational training have the opportunity for the algorithmic presentation of the personal learning process.

Since the practical tasks were performed in a classroom, the organization of the synchronous control based on software modules did not exclude the participation of the teacher in the current and final control of activity of students of the experimental group, influencing the formation of their professional-significant qualities of the person.

At *the stage of development* of the algorithmic presentation of the independent work forming part of the experimental searching work for students, the control in experimental groups was conducted in the form of practical exercises with increasing complexity of algorithmic formed earlier. Evaluation of the students who achieved levels of the algorithmic presentation preparedness for the independent work for each component of its structure was carried out in accordance with the values of the above criteria – the number of accesses to the pedagogical control, the number of errors committed, the number of correctly solved problems per practice session. Table 1 shows the change in the quantitative performance indicators performing practical exercises during the formative stage of development of the experimental and search work.

Table 1. Quantitative indicators of the efficiency of the performance practice sessions

Sessions	Number of appeals to pedagogical control, %		Number of errors done, %		Number of correctly solved tasks, %	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Practice session № 1	71,3%	77,3%	75,9%	77,9%	68%	66%
Practice session № 2	91,8%	**100,0%[2]**	93,4%	**100,00%[4]**	54%	64%
Practice session № 3	**100,0%[1]**	86,2%	**100,00%[3]**	91,6%	55%	68%
Practice session № 4	97,1%	79,6%	86,8%	76,7%	61%	76%
Practice session № 5	93,0%	74,0%	81,4%	62,5%	63%	77%
Practice session № 6	89,5%	69,1%	80,6%	51,1%	67%	83%
Practice session № 7	88,3%	65,7%	77,9%	49,2%	70%	88%

100 % - maximal indicator of the results of all practice sessions. In control group 100,0%[1]= 171, 100,0%[2]= 258. In the experimental group 100,0%[3]= 181, 100,0%[4]= 309.

The maximums of the first two indicators for the control and experimental groups was calculated according to their maximums revealed in the process of implementation of all the practical tasks by the students. According to the data in the table the diagrams were created (figure 2) that obviously demonstrate the alterations of the numerous maximums of the efficiency in both groups.

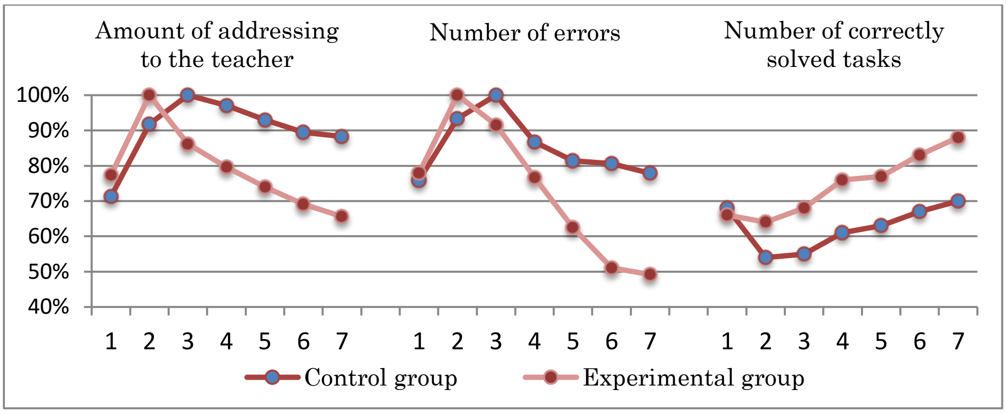

Figure 2. Changes in quantitative algorithmic preparedness

Analysis of the data in Table 1 and Figure 2 shows that after the second class due to the growth of its algorithmic complexity it has not yet generated the majority of continuous self-monitoring group activities of students, and there was a growth in the number of appeals to the teacher and the increase in the number committed in solving the error task, showing maximum values for all the classes conducted in the experimental group. Also in the group there was a decrease of efficiency of employment, namely the number of tasks solved by students decreased. In the control group, this reduction was significant and was 14%. However, after the third class a trend towards a significant reduction in the number of inspections carried out by means of software modules, control was revealed in the experimental group, and the number of errors made in solving problems reduced, as well as in the number of solved also increased. In the control group, these changes have been identified since the fourth practice session.

The control stage of the study

In the control stage of the study to confirm the effectiveness of the synchronous control in the development of algorithmic presentation of the independent work we carried out the final inspection for the purpose of comparison made since the formative stage of development and search operation level algorithmic willingness students control and experimental groups, with the results of entrance control, conducted prior to the development of search works. The comparison results are presented in Table 2.

Table 2. Distribution of students of the control and experimental groups on the algorithmic level of preparedness before and after the forming stage

Components of the algorithmic	Levels of algorithmic presentation	Control group		Experimental group	
		Types of control, %	Criterion x^2	Types of control, %	Criterion x^2

preparedness		Input	Final		Input	Final	
Motivational Indicator - amount of addressing to the teacher	High	11,7	21,7	1,70	13,1	39,3	7,74*
	Sufficient	25,0	21,7	0,18	29,5	34,4	0,90
	Satisfactory	40,0	36,7	0,12	31,1	19,7	3,11**
	Low	15,0	11,7	0,28	18,0	6,6	3,38**
	Dissatisfactory	8,3	8,3	0,00	8,2	0,0	5,08*
Reflexive Indicator - number of errors revealed	High	6,7	18,3	3,15	4,9	40,0	15,99*
	Sufficient	30,0	26,7	0,15	26,2	30,0	0,28
	Satisfactory	50,0	38,3	1,04	44,3	18,3	7,00*
	Low	10,0	10,0	0,00	16,4	11,7	3,04**
	Dissatisfactory	3,3	6,7	0,63	8,2	1,7	2,73**
Pragmatic Indicator - number of solved tasks	High	13,3	21,7	1,23	13,1	40,0	7,74*
	Sufficient	46,7	21,7	5,48*	34,4	36,7	0,34
	Satisfactory	16,7	28,3	1,70	19,7	11,7	3,04**
	Low	15	20,0	0,38	24,6	11,7	3,04**
	Dissatisfactory	8,3	8,3	0,00	8,2	1,7	2,73**

* - maximums differ; ** - maximums significant with the statistical tendency; limit value x2 =3,84 for the level of significance 0,05 of 2 evaluated indicators.

In the control group after the experimental search of work, we observed an increase of 10% of the number of students with a high level of development of the motivational component, and about the same number of students with a high level of reflexive and activity components. However, a comparison with the results of the experimental group convinced us that the students in the control group for the development of algorithmic preparedness to perform increasingly complex educational and professional activities under consideration did not have the discipline of pedagogical monitoring results of solving problems, and especially its synchronicity with the learning process.

Lack of efficiency of the motivational component in the control group had an influence on the development of the activity of algorithmic component of preparedness structure. It became apparent significant differences in the number of students in this group who are at a sufficient level of the activity of algorithmic component of preparedness. As a result, the input control of the students was 46.7%, and after the final control – 21.7%. There has been a regression in the level of formation of preparedness of the algorithmic part of the students in the control group due to increased complexity and difficulty of tasks. This fact indicates that the traditional pedagogical control, implemented in a professionally-pedagogical high school, in modern conditions with the reduction of classroom teaching and growth of the independent work of respectively tends to reduce the role of the practical training in the educational process.

Analysis of the data in Table 2 reveals significant differences in the results of input and final control of the experimental group at high levels of preparedness for the algorithmic structure components. This fact testifies to the influence of directional synchronous control on the development of a high level of cognitive motivation, continuous self-reflexive activity – on the formation of high-quality subject of the specific competences. However, due to the rather large number of students who with the input control were diagnosed with a sufficient level of preparedness for algorithmic components (respectively 25%, 30% and 46.7%), we found no difference in the results of input and total control at this level of development.

During the development of the reflective component of students of the experimental group, significant differences were found at a satisfactory level of algorithmic preparedness development. The number of students who are at this level was reduced after the experimental and search operation by 26% – from 44.3% to 18.3%. In other cases, differences were found in the statistical trend level, indicating the dynamic process of development of the algorithmic presentation of the independent work.

To identify the features of the development of algorithmic preparedness groups, the number of students, it was determined that the results of the implementation of practical tasks had not increased the level of the algorithmic presentation until the formative stage of development with the experimental and search operation had been implemented. The same is about the determination of the number of students who raised it on the same level, and some of them raised on two levels. Table 3 presents the data for students in the control group.

Table 3. Results of the final control of students in the control group

Number of students of the **control** group with the revealed levels of algorithmic preparedness															Number of students, %			
After final control	High			Sufficient			Satisfactory			Low			Dissatisfactory		Left on the same level	Increased by 1 level	Increased by 2 levels	Decreased by 1 level
Input control	High	Sufficient	Satisfactory	Sufficient	Satisfactory	Low	Sufficient	Satisfactory	Low	Satisfactory	Low	Dissatisfactory	Low	Dissatisfactory				
Motivational	7	5	1	8	4	1	1	18	3	3	4	0	0	5	70,0	20,0	3,3	6,7
Reflective	4	7	0	10	6	0	0	19	4	2	2	2	0	4	65,0	31,7	0,0	3,3
Pragmatic	8	5	0	12	0	1	7	8	2	4	7	1	1	4	65,0	13,3	1,7	20,0
Average number	**6**	**6**	**0**	**10**	**3**	**1**	**3**	**15**	**3**	**3**	**4**	**1**	**1**	**4**	65,0	21,7	1,7	11,7

For the generalized presentation of the data average values in the distribution of students in the control group after the final control over the levels of development of motivational-value were calculated both in reflexive and activity components of the algorithmic structure of preparedness. These data are based on the input of inspection results. For example, a satisfactory level of algorithmic preparedness was identified after an average total control of 21 control group students. At the same time on the input control of the 3 of them were diagnosed with low levels of development, and the same number of students has been identified in a sufficient level of development, namely higher than after the final control. By 15 students the algorithmic level of preparedness has not changed and remained the same as with the input control namely satisfactory.

It should be noted that individual students in the control group after the final control were observed even with the reducing algorithmic preparedness in comparison with the results of input control. For example, in the development of the activity component of the students in this group, we observed a redistribution of the number of students with essential for the formation of a sufficient level of algorithmic preparedness not only to a high level, but also at a satisfactory and underdevelopment. In general, the average number of students in the control group, remaining at the same level of preparedness for algorithmic development, amounted to 65% and – 21.7% of the students have raised it to the level and 1.7% of students have raised it to level 2. In addition, 11.7% of students in the control group decreased level of the algorithmic preparedness.

The same analysis of the final test results was held for students of the experimental group (Table 4).

Table 4. Experimental group input control results

Number of students of the **experimental** group with the revealed levels of algorithmic preparedness												Number of students, %		
After final control	High			Sufficient			Satisfactory		Low		Dissatisfactory	Left on the same level	Increased by 1 level	Increased by 2 levels
Input control	High	Sufficient	Satisfactory	Sufficient	Satisfactory	Low	Satisfactory	Low	Low	Dissatisfactory				
Motivational	8	12	4	3	13	5	6	6	0	4	0	27,9	57,4	14,8
Reflective	3	14	7	3	12	3	8	3	4	3	1	31,1	52,5	16,4
Pragmatic	7	16	1	9	8	5	3	4	3	4	1	37,7	52,5	9,8
Average number	**6**	**14**	**4**	**5**	**11**	**4**	**6**	**4**	**2**	**4**	**1**	32,8	54,1	13,1

In general, it should be noted that if among the students in the control group with the growth of algorithmic complexity of the task we could observe a decrease in the level of algorithmic preparedness in comparison with the results of input control, among the students of the experimental group this reduction was not observed. The average number of students of the experimental group remained at the same level of readiness for the algorithmic development, was 32.8% and – 54.1% of the students have raised it to the level and 13.1% of students have raised it to level 2.

Distribution of students of the control and experimental groups reached after the final control of the levels of development of algorithmic preparedness to work independently is visually represented on the charts in Figure 3.

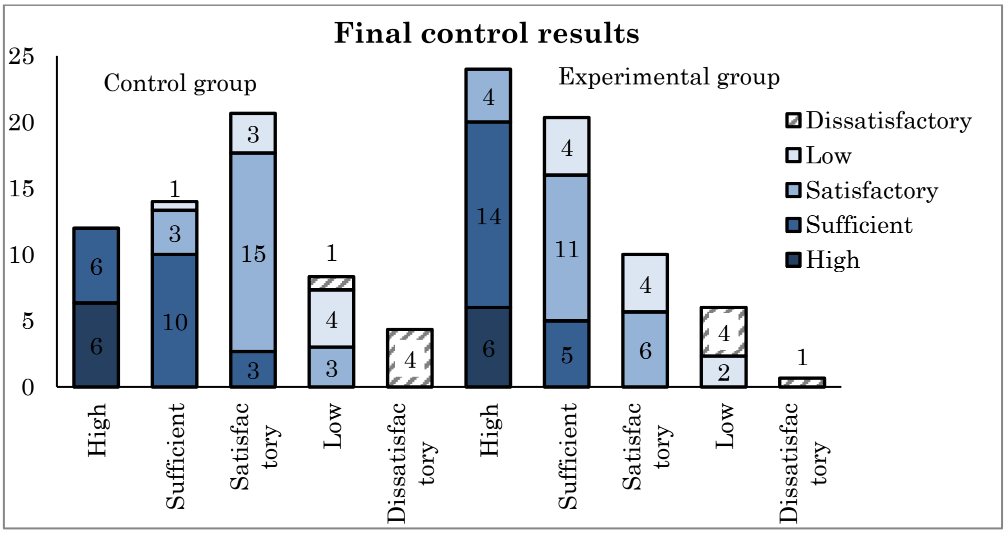

Figure 3. Distribution of the students according to the achieved levels of the algorithmic preparedness development

Discussions

Analysis of the psychological and pedagogical literature shows that teachers often use an algorithmic approach to the organization of training activities or in the formation of the different qualities of students. For example, algorithms or algorithmic orders (Landa, 1966) are used in the education process with a view to the efficient organization of the educational process (Bespalko & Tatur, 1989), the operating side of thinking development (Lund, 1966), the intensification of the process of assimilation of knowledge and skills (Ovchinnikov, 2008) or enhance the cognitive activity (Shchukin, 1979). In the case where the algorithmic presentation is used to develop the operating side of thinking algorithm is understood exactly as the comprehensible description of a sequence of intellectual operations, necessary and sufficient for the independent decision of any of the tasks that belong to a certain class. During execution the algorithm typically does not provide a direct teaching control. It is replaced by self-examination and self-learning situation choice course of the forthcoming operation, as a rule, dichotomous or polytomous types of regulations.

In the case where algorithmic presentation is used to intensification of training, the general educational and informative and subject specific actions become algorithmic that reflect the characteristics of the studied subject. They are used for strictly defined rules for successful solutions that formulated teacher training task (Cherdyntseva, 2002) algorithm in this case, it organizes the learning process through a clear description of the "steps" in the application of rules or training actions implemented in relation to the elementary portion of educational material (Tlyusten, 2008). According to V.N. Zemskova (2007) algorithmic presentation training allows several times to reduce the time to study the phenomena that in order to familiarize with traditional methods it requires significant costs. In addition, the formulation of problem situations both with the use of algorithms in the learning process helps to develop the cognitive activity of the students, the ability to self-employment, the decision of certain logic and algorithmic problems. Thus, algorithmic presentation training being used in educational practice mainly focuses on the development of self-reliance, self-regulation and self-organization (Zemskova, 2007; Ustinova, 2000), and we agree with V.N. Zemskova (2007), that in modern society there should be necessary conditions in order to be successful in any professional activity.

However, achieving educational goals by algorithmic presentation of the learning process, teachers almost do not consider the problem of improvement in students algorithmic preparedness activities which, we believe, necessarily develop algorithmic activities and are the basis for the quality of growth and the intensity of the training process, as well as self-development , self-regulation and self-organization. These are all the personality traits that the above mentioned authors consider in their work. In addition, they are not paying attention to the importance of the pedagogical control in the formation of professionally significant qualities of the person of students.

In our study, we consider the synchronous control of knowledge and skills as the basis for the development of skills for the algorithmic presentation of the independent work. Due to the transition to the synchronous type of pedagogical control here comes its substantial increase, which is a mechanism of formation of responsibility of students and forms necessarily in a good preparation for classes. Just as a strengthening of the functions of the state leads to its gradual wither, and synchronous control leads eventually to the gradual replacement of the pedagogical control self-control students as well as to a significant development of abilities of the algorithmic presentation of the professional activity.

Conclusion

The development of algorithmic preparedness for independent work must be the future teachers of vocational training to prepare professionals to carry out high-tech production activities. Its development is possible and achievable in terms of organization of continuous and synchronous with the process of assimilation of subject knowledge and skills. Due to the transition to the synchronous control it there is a significant gain, which is a mechanism for timely and objective of establishing learning outcomes. During synchronous control teacher involuntarily as the baton passes the algorithmic presentation skill activities for students, developing their commitment to their personal future algorithmic presentation of the professional pedagogical activity.

In the development of algorithmic preparedness to work independently on the basis of synchronous pedagogical control implemented personal, subjective-activity and the problem of psycho-pedagogical approaches, as well as the algorithmic approach. It suggests algorithmic presentation of the synchronous pedagogical control, with which there is an orderly process of assimilation of knowledge, shaping, and synchronous control algorithm is continuous and consistent implementation of procedures for checking the results of training, evaluation, students focus on self-test causes of errors and self-correction in case of deviation from the norm. Each time, the newly formed element of knowledge is based on the assimilation of the previous full or having a slight deviation from the prescribed norms. Constantly initiating students' need for self-control stages of self-learning activities, synchronous pedagogical control develops algorithmic preparedness of students to work independently.

For the diagnosis of the impact of the synchronous control on the development of algorithmic experimental and search operation of the preparedness the experimental work was carried out. The study involved students of the Russian State Professional Pedagogical University. Experimental research operation included three main steps: ascertaining, forming and control. In the process of their implementation there were the development levels of the three interrelated components of preparedness for the algorithmic structure - motivational-value, reflexive and activity. Analysis of the results obtained after the final control as well as the results of ascertaining phase of the study revealed the students of the experimental group with the significant positive results in the development of algorithmic preparedness to perform independent work. There was more significance compared to the control group, the growth of the number of students who have reached in the process of solving problems and high levels are sufficient for its development. This is indicative of the efficiency of the synchronous control in the development of all components of the algorithmic structure of preparedness.

Disclosure statement

No potential conflict of interest was reported by the authors.

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