Technology of Managed Self-Education: Construction of an Educational Trajectory

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Abstract: The article presents the basic provisions of the proposed technology for constructing a student's educational trajectory. The key idea of this technology is the idea of controlled self-learning. The methodological guidelines of technology are a set of approaches: personal, competence–based, activity–based and competence. The content of training in line with the technology under discussion is based on the idea proposed by the author of the inertial development of the level of knowledge of an individual as a component of a generalized assessment of his professional and social competence.

1 INTRODUCTION

In the conditions of intensive development of communication IT–technologies, technologies focused on independent work of students are gaining more and more importance. The professional e–learning platforms that have been formed to date make it possible to implement training programs at a high educational level in a remote format. What allows you to implement technologies of managed self-learning.

Recently, much attention has been paid to the problem of developing new effective pedagogical technologies. Researchers (Dr. Ajay Kumar Attri; 2019; Margo McNeil et al. 2019; Sylvia Encheva 2019; Maria Enriqueta Ponce Ponce 2019) propose distance learning methods, strategies and technologies.

2 GUIDED SELF-LEARNING TECHNOLOGY: METHODOLOGICAL GUIDELINES FOR TECHNOLOGY

One of the key ideas that form the basis of the modern stage of modernization of the system of professional training of a specialist in higher education is to provide students with academic freedom, which implies their active and autonomous activity in the conditions of individual educational routes. In this regard, the development of educational technologies aimed at increasing students' responsibility for learning outcomes, developing self-learning and self-control skills, stimulating independent learning and research activities, is becoming an important pedagogical task of higher education.

The technology that meets the above characteristics can be based on the idea of controlled self-learning. Its essence lies in the fact that the educational process is a thorough and detailed planning, organization and control of the student's activities by providing the most favorable conditions for the social and professional development of his personality, development and manifestation of creative individuality. Guided self-learning is characterized by:

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– focus of education on personal development;

– the development of students' psychological attitude to independent systematic replenishment of knowledge;

– using a variety of techniques and means of motivating educational activities;

– creating conditions for self-organization and self-discipline of the student in mastering the methods of professional and cognitive activity;

– taking into account the interests of the trainees and the peculiarities of mastering the educational material by them;

– setting a didactic goal in each specific learning situation;

– the modular structure of the content of training in order to track the level of his competence by the trainee in the process of moving from module to module;

– determination of the required amount of knowledge, skills, abilities at each stage of the student's cognitive activity;

– the presence of effective feedback that supports the trainees' confidence in the correctness of their progress along the path from ignorance to knowledge;

– expansion of available information sources and methods of access to them.

The methodological guidelines of technology are a set of approaches: personal, competency–based, activity–based and contextual.

The content of training in line with the technology under discussion is based on the idea proposed by the author of the inertial development of the level of knowledge of an individual, as a component of a generalized assessment of his professional and social competence. At the same time, the process of mastering new knowledge is considered as a continuous non–linear change in the level of competence of the student, which characterizes the qualitative transition from one level of competence to another.

To characterize the level of professional competence of a future specialist, we introduce the concept of "Basis". The basis is a set of certain knowledge, skills, and experience of activity that are vital for the implementation of the professional activity of the individual and his productive life within the framework of a given social society. Thus, the process of changing the level of competence is a process of transition from one Basis either to the next one, or to the initial one, if the accumulated knowledge at the time of its formation has lost its relevance.

If we imagine the Basis as a plane, then each point of this plane will be some professionally significant knowledge. In connection with the development of science, production, social relations, etc. growth points (beams of knowledge space vectors) begin to appear on the Basis plane.

This acquired knowledge (Superstructure) can either be developed further or be lost. If any new knowledge acquires a professionally significant status, then its transformation takes place, which means a transition to a new Basis. The transition from one Basis, as a change in the position of the plane in space, means the transformation of the structure of the accumulated Knowledge – part of the accumulated knowledge, due to uselessness / lack of demand, is forgotten and, on the contrary, a number of areas receive additional positive dynamics.

To characterize the level of students' mastery of educational material, three criterial characteristics can be set: actual, dynamic and potential.

The current characteristic determines the level of mastering the educational programs by the student within the framework of the system for assessing the level of professional competence adopted in the educational institution.

A dynamic characteristic is the student's ability to acquire new (positive value) or lose already acquired knowledge (negative value), it characterizes the degree of mastery of knowledge acquisition tools.

A potential characteristic describes the student's opportunities for further learning, depending on his ability and motivation to systematize and store acquired knowledge, that is, personal tools for storing existing knowledge.

Let us explain the mechanism for managing the student's educational trajectory in accordance with the proposed approach. For the progressive increase in the level of student competence, it is necessary, as already noted, to form an optimal system of motivational criteria. Such a system is designed taking into account the initial level of the student's competence and can be represented as a system of micro–goals – a set of sequentially built educational tasks. In the process of solving such problems, the optimal learning trajectory of the student is formed based on the difference between the actual and the level of professional competence required from him (the difference in actual characteristics), the allotted time interval (dynamic characteristic) and the possibility of further development of the student.

So, for example, a significant difference in levels of competence can provoke a loss of interest on the part of the student due to the seemingly unattainable

result and, as a result, inefficient assimilation of new information or its complete loss. On the other hand, a small difference between these levels will lead to the formation of the student, due to the significant predictability of the subsequent educational material, the psychological state of "completion of learning". The latter can provoke a decrease in interest in the material being studied, as a result of the student's negligence in systematizing and storing the information received, which in turn leads to an increase in errors, the loss of tools for obtaining new knowledge and the loss of acquired Knowledge.

In line with the technology under discussion, one of the key points is the issue of structuring the content of training, which is solved by determining the degree of overlap – the repetition of the material of training blocks. Obviously, the degree of overlap of educational blocks will be determined by the nature of the goals or expectations of the student from the educational process, as well as from his personal success and the dynamics of mastering the educational material. So, if the student demonstrates a sufficiently high dynamism of his educational process, then the overlap of educational blocks can be minimal – necessary to organize the logical structure of the course and ensure the continuity of educational blocks. At the same time, the probability of interrupting the learning trajectory due to the loss of one of its links is small.

Determination of the degree (area) of overlapping educational blocks, as well as the formation of their set in the training course, the order of presentation of the educational material of the blocks is the result of comparing the real state of the student – the level of his current training and expected results – learning objectives.

The learning process within the framework of a particular academic discipline begins with the definition of the basic level (Basis) of the student's preparation – his actual characteristics.

The change in the level of competence of the student is determined by a number of factors, two of which are the amount of educational information and the tools (skills) necessary to obtain and assimilate this volume by the student. For example, in the course of mastering a particular academic discipline, the student needs an additional information component. As one of the sources of its receipt, the Internet information resource is possible, however, in order to use it, the student needs to additionally master some skills of working as a user.

However, a high current assessment of the basic level of training does not yet guarantee the success of the further development of the training course. So, in the case of an example of using the Internet, the student may encounter a situation where the user's skills are no longer sufficient to advance in the subject, and there is a need to acquire additional knowledge. Thus, there is a need to use a dynamic characteristic that reflects the student's ability to use the acquired knowledge.

The effectiveness of further training depends on how successfully the acquired knowledge is transferred to the internal level, which requires the introduction of an additional characteristic – potential.

Like any inertial process, the educational process can be conditionally represented by three stages.

The first one is characterized by a high potential indicator – the student learns the tools for working with new information and, as a result, the level of the student's competence begins to increase at an ever faster pace. Further (the second stage), the learning trajectory of the trainee is linearized, that is, the material of the new information blocks is perceived by the trainees equally effectively. This is explained by the fact that the trainee has formed the necessary skills to work with new information (tools have been worked out) and a further increase in the level of his competence is associated only with an increase in the information component. The third stage characterizes the finiteness of the possibilities of the tools mastered by the trainee. The dynamics of the process of obtaining new knowledge is reduced due to the inability of the student to assimilate new information using the "old" methods and the imperfection of his "old" information storage system.

The third stage is indicative. The result of its completion may be either the transition of the individual to a new Basis, that is, the knowledge acquired by him begins to characterize the individual as a person, or the complete rejection of the knowledge he has received, which means a return to the original Basis.

Each of the trainees, as already mentioned, is characterized by a certain basic level of knowledge. When organizing the educational process at a university, a preliminary assessment of these levels allows you to optimally form study groups and give a preliminary forecast about the success of mastering a given training course by one or another individual. In this case, we are talking about the assessment of the actual parameter that characterizes the learning trajectory of the student.

At present, the current system of education, as a rule, assumes a linear supply of educational

information with an intensity predetermined by the curriculum, and allows variation of the current level of competence of trainees, defined as satisfactory, only in a strictly limited range. It is easy to see that, having different dynamic characteristics of their educational trajectory (that is, different skills in obtaining and processing information methods), a number of students will be ahead of the "supply" of new material, looking for the educational material they need on their own, and will soon lose interest in ongoing group classes, and some simply will not have time to learn new material, which will also lead to a loss of learning interest. This drawback can be minimized either by changing the intensity of the "feed" of the material, or by violating the linearity of its presentation.

In the first case, a significant expansion of such a range will lead to a decrease in the intensity of presentation of the course material. And since there are restrictions on the time resource allocated for the study of a particular training course, a number of training topics of its components will either be “skipped” due to low intensity, or “unplanned” offered to students for independent work. Both lead to a violation of the integrity of the provision of educational material and a decrease in the effectiveness of the educational process as a whole.

3 GUIDED LEARNING TECHNOLOGY: THE ART OF MANAGEMENT STRUGGLE

The most productive pedagogical technique that allows the teacher to maintain the attention of the group, thereby increasing the effectiveness of training sessions, is the violation of the linearity of the presentation of information blocks of the training course. In many ways, the success of applying this technique depends not only on the high degree of competence of the teacher in his professional field, but also on the ability of the teacher to “work” with the group.

Taking into account the idea of the inertia of the process of knowledge accumulation proposed by the author, let us single out the main points that the teacher should take into account during the educational process. Recall that the physical meaning of inertia is a measure of conservation of motion by an object or system. A feature of inertial motion is that the object retains the initial characteristics of its motion. “... Any management technique consists of three parts:

– capture – placing yourself and your partner in a situation where this technique gives the desired result.

– reception body – a pattern of behavior or pseudo–behavior (used role), which leads to the acquisition of a new role or to the retention of an existing role (blocking an attempt to change the role).

– fixation – fixing the result of obtaining a new role or retaining an existing one by creating a precedent for interaction in the desired role ratio (beginning to play a new desired role or continuing to use the previous desired role) ... "

A similar structure is applicable to the management of the educational process. Similarly, the following steps can be distinguished:

– analysis of the initial characteristics (actual, dynamic and potential indicators of the student's learning trajectory) – capturing the situation;

– changing the characteristics of the movement of the object to the desired ones (forming the student's interest in the subject of training) – the body of the reception;

– fixation – blocking the unwanted movement of the object, that is, the newly formed characteristics of the movement of the object become its own personal characteristics (the process of assimilation by the trainee of new educational material).

Such a structure for managing the educational process can be implemented both at the level of specialist training, that is, provide for interdisciplinary connections, and at more specialized levels – at the level of the curriculum of a separate course, as well as during the training session.

We single out the following stages:

Stage 1 – updating the basic knowledge and methods of action. Supporting knowledge is singled out, the connection with past lessons is clarified, the type of independent work (reproductive, productive, partially exploratory) and the form of training (individual, group, frontal) are selected, ways of solving problems of motivational support for the lesson are outlined, forms of control over the course of work, the names of students are noted to assess their development and academic performance.

Stage 2 – the formation of new concepts and methods of action. New concepts and methods of their formation are singled out, the main and secondary problems are formulated, the type and form of independent work are selected, the content of educational material is selected, problematic and non–problem (information) questions are prepared,

options for solving educational problems are outlined, possible tips for solving them.

Stage 3 – the application of knowledge, the formation of skills. The type and form of independent work is planned, its kept woman is being prepared (assignments, exercises, instructions, etc.), specific skills are outlined for practicing (for example, the ability to plan, control, solve typical and other tasks), methods of obtaining feedback (information).

As an example of the proposed structure for managing the educational process, let us consider in more detail its first stage – the capture (updating of basic knowledge): its goals, objectives and possible implementation options.

The purpose of the first stage, as already mentioned, is to identify the real state of the group, that is, to determine the indicators of changes in the educational trajectory of the group: static, dynamic and bidynamic. To determine the current level of readiness of the group (static indicator), various start control methods can be used that meet the following requirements:

– starting control should not be a stressful (psychologically overloaded) event for the group, otherwise the psychological resource of the group members will be “developed” at the initial stage of the lesson, which means that the group will not be able to perceive further educational material;

– start control should be limited in time. An increase in the duration of the initial control sharply reduces the interest of the group members in the subsequent perception of the educational material;

– openness of the methodology for evaluating the results of the starting control of group members. It is optimal when the group itself participates in the assessment, and the teacher plays the role of "leader";

– timely announcement of the results of the starting control of the group members. Failure to comply with this requirement means the loss of the expediency of starting control in general;

– analysis (assessment) of the starting control should imply the publicity of the results, both for correct solutions to the tasks set, and for erroneous ones, with the obligatory emphasis on errors”;

As a possible method of starting control within the framework of the next training session, the following method can be proposed: conducting an oral survey of group members carried out by the teacher based on the material of the previous lesson. It should be specially noted that the start control, as well as the training session as a whole, is a separate completed training unit. And, therefore, the structure of building a starting control can also be represented by the three stages described above: analysis of the initial characteristics (capture of the situation), controlled change in the characteristics of the learning trajectory (body of the reception) and consolidation of a positive result (fixation).

Let us explain the proposed methodology using the example of constructing an initial survey as an independent educational unit in more detail.

Capturing the situation. The teacher formulates a question and asks any of the group members for clarification. At the initial stage, the formulated questions should concern general ideas, possibly definitions and terms, the explanation of which was given in the information and training block in the previous lessons. The trainees, when answering, are not limited in the possibilities of using any information resources they have, except for the intervention of other members of the group. The only restriction is an informal (not normatively stipulated) restriction on the duration of the preparation of the answer (respondent's reaction). In case of difficulty with the answer of one of the trainees, the question is forwarded to another. If in this case the situation repeats itself, then this question can be asked to any member of the group who is ready to answer it.

For the effective use of this technique, the professional ability of the teacher to create a psychologically uncomfortable and socially unfavorable environment for the respondent in case of his unwillingness to answer is necessary. It is important to maintain a favorable psychological mood common to the group. At the same time, the negative assessment of the “negligent student” does not come from the teacher, but from the group, which is much more significant for the teacher, since it entails a change in his social status. At the same time, this assessment does not become a conflict for further interaction between the teacher and the teacher.

So, the first stage of the initial survey solves the following tasks:

1. forms the psychological attitude of the group to the perception of new educational material;

2. gives the teacher an initial idea of the competence of the group, that is, the readiness of the group to continue to study this or that educational material;

3. allows you to fix the past educational material in the group.

Reception body. The main task of this stage is to develop by the trainees the skills of using the existing (repeated) conceptual apparatus, methods and algorithms for processing specialized educational information. Depending on the time resource, either

an oral survey, similar to the first stage, or a survey in the form of “solving problems at the blackboard” can be recommended. In the latter case, it is supposed to work at the “board” (public problem solving) at the same time for several students. The most effective is the combination of an oral survey with the work at the "board". Depending on the degree of qualification of the teacher, controlled participation in the tasks solved at the “board” of the remaining group members is possible, which eliminates the loss of their attention, and also contributes to the formation of teamwork skills in this study group.

At this stage, the teacher forms a stable tendency in the study group to work with new information, that is, sets a dynamic indicator of the group's learning trajectory. The goal is to develop skills in using already known tools.

Fixation. The main goal of this stage is to prepare the group for the perception of new information by consolidating the previous one. A distinctive feature of the questions or tasks formed by the teacher is their focus on activating the independent search by the group members for additional information and developing methods for its analysis. Here, a fundamentally important psychological aspect is the participation in the discussion of as many group members as possible. The result of this technique is the strengthening of positive rivalry in the group and the emergence, according to the situational theory of leadership, of a long–term or short–term positive leader of the group.

An example of fixation is the formation by the teacher of a question (task) for students, the solution of which involves not so much finding the final answer as the formation of recommendations for its definition. The fixation technique will be successful if, in the process of developing such recommendations, the group offers solutions that are consonant with the subsequent educational and information block.

Another possible option for conducting start–up control is, along with the considered "oral survey", the conduct of written tests – "Express control". The requirements for conducting such work remain the same as for the oral survey: limited time; openness of the methodology for evaluating results; timely announcement of results; openness of the analysis of the results of the start control. Let us explain the proposed method of "Express control" in more detail.

Capturing the situation. The teacher formulates tasks for students, it is more convenient if in writing – cards, tests or, if possible, a software shell. Important – tasks should be individual for each member of the group. The task may contain both theoretical questions: knowledge of special terms, knowledge of laws, and the like, as well as practical tasks. The main condition in the preparation of such individual tasks is the limitation of the complexity of their solution.

The purpose of such examinations is to update the basic knowledge and methods of action. The greatest efficiency of such a technique is achieved with the systematic use of such a technique, which excludes the effect of surprise for students. The student knows for sure that the control survey will definitely take place and knows which information block will be submitted for the upcoming control work. The success of this technique is largely determined by the psychological effect of extending the future lesson into the present, that is, for the student, the stage of capture does not begin at the lesson, but even before it starts.

Reception body. As mentioned earlier, the main task of this stage is to develop the trainees' skills in using the existing conceptual apparatus, methods and algorithms for processing specialized educational information. Since the psychological capture was performed earlier – before the lesson, then the solution of the "Express Control" tasks, in essence, is the development of the trainees' techniques and methods of working with new specialized information (toolkit).

Fixation. Consolidation (or formation) of positive dynamics (dynamic characteristics) of the educational trajectory occurs when analyzing the results of "Express control". The psychological strengthening of the fixation stage is achieved by a certain time delay in the announcement of the results of the test relative to the moment the trainees complete the independent solution of tasks. This temporary pause contributes to the continuation of the work of students, namely the further targeted search (notebooks, workbooks, textbooks, manuals, and so on) for the correct solution of the tasks of their already completed tests, in order to develop an individual forecast regarding the results of their verification.

The announcement of the results of the test requires the teacher to have a professional ability to systematize the mistakes made by the trainees, to single out a number of successful and a number of "weak" works. To achieve maximum efficiency of this stage, the teacher needs to create a psychologically comfortable environment in the group that does not interfere with the process of comparing the results of the test.

Similarly, each of the subsequent stages of the training can be detailed: the presentation of the main material of the training session (the body of the reception) and the final control (fixation).

When organizing the educational process, taking into account the principles of controlled self-learning, the construction of a control and measuring system undergoes a serious transformation. We single out two main tasks that such a system should solve:

– identifying the prerequisites for managing the learning trajectory of the student: the content, sequence and intensity of training blocks;

– formation of a system of long–term and short–term motivational criteria that allow to strengthen the self-organization of educational activities on the part of the student.

4 ORGANIZATION OF THE EDUCATIONAL PROCESS BASED ON GUIDED SELF-LEARNING

The organization of the educational process based on controlled self-learning involves three forms of control:

1) current control by deviations;
2) proactive control;
3) resulting control.

Each of these forms has a certain time resource for correcting a "failure" in the controlled system. Proactive control has the greatest potential in this regard. However, for its implementation, a process model is needed, according to deviations from which the real process is judged on the emerging trends in the loss of its quality. The resulting control has a stating function and allows only assessing the degree of deviation of the result from the expectation and formulating recommendations for optimizing the process, however, the relevance of such recommendations that do not take into account the changed (changing) conditions (real conditions) is insignificant.

Current control can be a component of proactive control, making it possible to judge the degree of compliance of the current process with its expected model. For the implementation of current control, it is necessary: 1) objective and subjective controllable indicators; 2) the presence of rejection criteria (the severity of the violation of the process: dangerous, significant, insignificant and acceptable); 3) the presence of an organizational system and control procedures.

In the proposed technology of supervised learning, the controlled indicators for the current control can be defined as the control of mastering the educational material by the trainee, which is the areas of overlap of educational blocks. Since for a training course the areas of overlap are determined by the outputs and determine its input parameters, then the analysis of quantitative assessments of controlled indicators in the educational process can be used to assess the readiness of the student to perceive the proposed material, to predict the results of the resulting control and to promptly adjust the educational trajectory.

When adjusting the learning trajectory of a student, in addition to monitoring his level of competence in the proposed educational material, it is necessary to analyze possible learning trajectories for further learning. At this stage, the student can be given the opportunity to self-manage, that is, the possibility of independent choice of educational blocks or academic disciplines (courses) is the greater, the more the student has the ability to form the goals of his learning. Thus, at this stage, the control and measuring system must solve two main tasks: the first is to substantiate the set of changes in the student's educational trajectory proposed by the teacher (training system); the second is to assess the degree of readiness of the trainee to implement the adjustments he makes.

To solve the indicated tasks, a model of “fan control” can be proposed. This model is based on the principle of a trial assessment of the student's readiness to master one or another educational material, the study of which is only planned for a given educational trajectory. At the same time, the depth of the forecast – the delay in the start of learning, is determined by the required detail of the learning trajectory.

The result of such control is a fairly complete picture of the "gaps" in the level of training of the student. Therefore, the material of the identified sections should be studied in more detail and, on the contrary, the educational material, in which the trainee has a high competence, can be used as a binder for various educational blocks.

The latter directly depends both on the degree of motivation, the interest of the student in the final result of his training, namely the achievement of a certain level of knowledge and skills, and on his ability to perceive new knowledge. In turn, the ability to perceive new material is largely determined not so

much by the student's personal capabilities, since these capabilities are assessed at the initial stage of training – entrance tests, entrance control, but by the ability of the educational process, that is, the sequence of providing the student with educational material, its portioning, degree of repetition. to carry out high–quality training of the student.

One of the didactic possibilities of guided self-learning is the individualization of the learning trajectory. Its implementation requires the formation of an individual structure of the training course, that is, depending on the individual success of the student, not only the sequence of presentation of the material (blocks) is determined, but also the degree of overlap or sequential repetition of the educational material of certain training blocks at the next lesson.

Like any controlled system, the educational process presupposes the presence of a master influence, methods for converting the input signal, a control and measuring system and correction methods, that is, the presence of a control signal. The refraction of the above construction of a controlled system in the educational process is one of the debatable topics. Since it implies the existence of disagreements in the choice of the object of control, the control system, and, consequently, the methods of control.

The object of control is the educational process, that is, a set of methods for transferring educational information to a student and forming certain knowledge and skills in him. At the same time, the controlled coordinates are the very construction of the training course, as a structured system for the transmission of educational information from the teacher to the student, and the methods for transmitting this information. The control system assumes the variability of educational trajectories of trainees.

The input parameters of the educational process is the required amount of knowledge and skills that the student must master after its completion. Taking into account the individual orientation of training, the rigidity of requirements is reduced when determining the student's ability to study this training course. The latter becomes possible due to the variability of the structure of the training course, depending on the actual level of training of the student.

The current control of knowledge is a measuring system, the main task of which is to identify control criteria for the transformation of the structure of the training course or factors that characterize the impossibility, for various reasons, of further education.

Final control has a dual function. One of them is the adjustment of the entire educational process in order to improve the quality of student training.

Thus, to develop the structure of the training course: the presence of types of training sessions, the content and interaction of training blocks, the sequence of their presentation and the control system, it is necessary to determine:

– the necessary amount of knowledge and skills – the knowledge and skills that a student must master in order to successfully continue studying related courses;

– the required (sufficient) amount of knowledge offered for studying, characterizing the student as a specialist.

The result of developing the structure of the training course is a sequence of training sessions, characterized by the volume of repeated and new training material.

5 CONCLUSIONS

The main conclusions of the article:

– the process of mastering the educational material by the trainee is inertial, that is, the process of accumulating knowledge is a continuous process, each subsequent state of which is determined by the characteristics of the present and previous educational situation;

– the nature of the learning trajectory can be determined through a system of characteristics: actual, dynamic and potential;

– the educational process is considered as a set of management techniques aimed at the formation of an individualized educational trajectory;

– the construction of an individualized educational trajectory is considered as a set of sequentially built educational microgoals, transformed into a system of personal motivational criteria;

– the structure of an individualized learning trajectory is considered as a set of mutually agreed learning blocks, the degree of overlap of which (the repeatability of educational material) determines the final set of professional competencies that a student must satisfy after mastering a given training course;

– the structure of an individualized educational trajectory involves the construction of a personal motivational system that stimulates the student's desire for further self-learning, self-improvement.

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