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Вопросы динамического хаоса в технических дисциплинах

Описывается опыт введения в содержание технических дисциплин достижений современной физики на примере понятия динамического хаоса. Рассматривается методика формирования у студентов в ходе изучения дисциплин специальности понимания роли неустойчивых, критических состояний в эволюции материи. Приведены примеры изучения динамического хаоса в курсе «Электромагнитные колебания и волны». Рассмотрена роль нелинейного ограничения в динамических–автоколебательных системах на примере классического лампового генератора Ван-дер-Поля и при изложении принципов работы лазеров. Приведены примеры применения хаоса в коммуникационных системах.

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The impact of self-regulation of students' educational activity on success in learning process

In this article the authors investigate the problem of self-regulation of students as a factor influencing on success in leaning process. The work shows the theoretical part of the research: hypothesis, goal, objectives, methods, scientific novelty and significance stages, methodological and theoretical basis of the research. In this work the authors presents possibilities, methods and means of the development of self-regulation of pupils and the impact of self-regulation of students' educational activity on success in learning process. In research they studied and considered three components of self-regulation: self-control in educational work, social self-control and ability to strong-willed efforts in intellectual work as self-regulation means. The results of pedagogical experiment are presented in the following publication.

Key words: student, self-regulation, self-control, self-estimation, reflection, self-correction.

Introduction. In concepts of the Kazakhstan education modernization for the period to 2020 [1] the stress is made on the necessity of the education orientation on the personality development of a pupil. The highest level of a person's development is his ability for independent activity, self-cognition and self-

regulation. Therefore today the centre of attention of teachers is the necessity of development of self-regulation of educational activity in pupils.

Transition from traditional teaching to constructive one requires a search of new approaches of training providing the development of self-regulation of educational activity of pupils in the course of their training. Self-regulation of educational activity based on the general ability to learning (L.S.Vygotsky, Z.I.Kalmykova, N.A.Menchinskaya, S.L. Rubinstein) is a necessary condition for the formation of this ability. There are some evidences that self-regulation effectively influences the use of such regulation processes as training strategy (Schunk and Swartz, 1993) [2]; Zimmerman, Bandura and Martinez-Pons, 1992) [3], management of learning hours (Britton and Tesser, 1991) [4], self-regulation (Bouffard-Bouchard, Parent and Larivee, 1991) [5], self-evaluation and statement of purposes (Zimmerman and Bandura, 1994) [6]. Self-regulation was an object of many researches in relation to preschool children, schoolboys and students. A.K.Osnitsky [7] was engaged in studying of the structure, the content and functions of a person's regulation, the connection of educational progress of pupils with individually-typological features of their self-regulation was studied by O.A.Konopkin [8, 9] and G.S.Prygin [10].

Studying and analyzing the researches connected with an estimation of self-regulation in children of different ages, led us to the conclusion that unpurposeful formation of self-regulation does not guarantee successful development of the general ability for learning. Frequently the low level of self-regulation underlies poor progress, various barriers arising in cognitive-and-learning activity. Recognizing the scientific value of the works specified above, we decided to research possibilities, methods and means of development of self-regulation of pupils and its influence on the success of learning, in particular on the success of learning physics and the English language. The choice of these school subjects was purposeful, i.e. one is from the physical and mathematical cycle, and the second one is from social-humanitarian.

The urgency of the theme of our research in our opinion consists in the fact that a self-regulation problem as a factor influencing the success of training at teenage school age is insufficiently considered in the practice of school teachers. Ability to self-regulation plays an important role in organizing difficult forms of educational activity. Its realization requires skills to concentrate attention, to perceive and remember information actively, to be oriented in advance in the conditions of the task and to think over a solution course, to verify the received result with the set sample and the given conditions that is for successful realization of educational activity a certain development of ability of self-regulation is necessary. On this basis, we assumed that the success of learning depends on the level of a self-regulation development. The hypothesis of our research consists in the fact that the level of a self-regulation development defines the success of teaching pupils at school.

The purpose of our research is comparing the level of the self-regulation development of pupils with the success of their learning at school. To check the hypothesis we posed the following problems: studying the theoretical bases of self-regulation: possibilities, methods and means of the development of self-regulation of pupils; the definition of self-regulation level of pupils of teenage age; the comparison of the self-regulation level of pupils with the success of their learning; working out the recommendations for the development of self-regulation in pupils and the consideration of the further research prospects.

The scientific novelty and significance of results of research:

- self-regulation of learning activities of students considered as a system, including as components of self-control, self-evaluation, self-correction and reflection;
- rationale for the approach to the organization of training activities with a focus on the development of self-regulation of learning activities of students on the basis of self-development, reflection, self-evaluation and self-correction;
- the selection and description of criterion-oriented levels of development of self-regulation of learning activities of students, for use in training and further theoretical researches;
- development of diagnostic tasks, allows us to trace the dynamics of self-regulation of learning activities of students at a specially organized experiential learning;
- the use of the developed methods and diagnostic tools and the formation of self-regulation of learning activities of students by practicing teachers in secondary school.

Methods. To achieve the object in view and to check the hypothesis we used methods of the theoretical analysis and the generalization of literature on the problem under research, pedagogical experiment, methods of mathematical statistics and a graphic method and the following techniques: a modified variant of a teenage personal questionnaire by R. Cattell; a technique “problem which cannot be solved” (N.I.Aleksandrova, T.I.Shulga) [11] and “technique of amendments” (L.K.Markova, T.A.Matis) [12], the quantitative and quali-

tative analysis of its results. The methodological and theoretical basis of the research was: systematic and active approaches in learning (L.S.Vygotsky [13], S.L.Rubinstein [14], etc.); theoretical bases of formation and development of the general educational abilities (Z.I.Kalmykova [15], V.V. Repkin [16], D.B.Elkonin [17], etc.) and the theory of stage-by-stage formation of intellectual actions (N.F.Talyzina [18], P.J.Galperin [19], results of researches of Schunk and Swartz [2], Zimmerman, Bandura and Martinez-Pons [3, 5], Britton and Tesser [4], Bouffard-Bouchard, Parent and Larivee [6] and others). The research was made by in three stages: studying of self-regulation theoretical bases, the selection of techniques and experiment carrying out; the formation of didactic materials, the elaboration of the methodical ways providing the development of self-control, self-estimation, reflection and self-correction of pupils at lessons of physics and the English language in 7 classes and carrying out the pedagogical reflection and a control-estimating stage, the definition of the self-regulation level of pupils and comparison to the success of their learning, making practical recommendations and forward planning. The approbation and introduction of the research results were carried out in the course of giving lessons of physics and the English language in 7 classes of school # 1 of Kokshetau (Kazakhstan).

Main part. The condition of the domestic Kazakhstani educational system is characterized now by a number of transformations of a conceptual character. One of the major innovative approaches is mutual integration of authentic results of modern scientific researches and best teaching practices. The evaluation of priorities of the Program of development of education in the Republic of Kazakhstan [1], comparable to modern values, characteristic for the progressive countries, leads to the change of the educational process content. In the centre of teachers' attention there is a necessity of training the self-organizing of activity, the realization of reflective actions in pupils. The statement that the development of pupils depends on the character of teaching is already an axiom today. Thus priorities are given to the training involving the development of self-cognition, to self-activity, self-regulation. The task of the modern education is to teach the child to learn, i.e. to generate and develop the self-regulation of an educational activity [18]. However, self-regulation is possible only on the basis of the own activity management, so it is necessary to teach pupils in a special way. The solution of the chosen problems on the modern level is caused by the organization of the teaching process capable to provide the process of a person's self-development. It required attention to studying the concept of self-regulation, the structure of the self-regulation of educational activity and the description of components of the self-regulation structure of pupils' educational activity.

Studying and the analysis of the pedagogical, philosophical and psychological literature (2–10) showed that: the self-regulation of educational activity underlies the general ability to learning and it is a necessary condition for the development of this ability; self-regulation is the major condition for the success of the course of educational activity; a self-regulation level is a dynamical formation depending on the experience of inclusion in educational activity, on a grade level; the regulation of educational activity should be "appropriated" by each separate pupil; the teenage age is most appropriate for the development of the self-regulation of educational activity.

In the process of thinking over the theoretical bases of self-regulation we revealed that the self-regulation of educational activity has its structure, an activity purpose, a model of significant conditions, a program of actions, an estimation of results and correction. Having comprehended theoretically the self-regulation structure, we understood that components on which basis the self-regulation of educational activity is formed are self-control, a self-estimation, a reflection and self-correction, where self-control is a necessary condition of the self-regulation development; a self-estimation is a self-regulation basis; a reflection is a self-regulation initial stage, a direction to it; self-correction is connected with a self-regulation level of development.

Analyzing the content of a school course, in particular of physics and the English language of 7 classes, we made a conclusion, that they as school subjects have large possibilities for the development of the self-regulation of educational activity of pupils. So, the problem of a theoretical substantiation and practical elaboration of receptions and diagnostic aids and formation of self-regulation of educational activity of pupils in the process of studying physics and the English language was staticized.

After thinking about such concepts as «self-esteem», «self-control», «reflection» and «correction», we investigated their implications for the formation of self-learning activities. During research we have identified what the reflexive control is the start time of an arbitrary self-regulation; self-evaluation is the foundation of any self-regulation and internal learning motivation; reflection is a means of self-regulation (reflection helps students formulate the results, identify targets for further action and adjust their educational path).

An important point of the psychological concept of educational activity is the allocation of reflection which is understood as a skill of a person to allocate, analyze and correlate his or her own ways of activity to the subject situation. In a person's cogitative activity the reflection performs, in our opinion, the following important functions: the regulation of a search process of solving a problem, the stimulation of posing hypotheses, ensuring the correctness of their estimation. According to the psychological concept of educational activity, the reflection is one of the basic psychological mechanisms providing the functioning of thinking as a self-regulated system [13]. A condition of a reflection creation is the formation of actions of a control and estimation which take a special place in the structure of educational activity and have specific functions: the orientation on activity itself, fixing of the a pupil's relation to himself or herself as an entity, a mediated character of an orientation on the solution of an educational problem.

The control function in educational activity as it is specified by D.B.Elkonin [17], consists in the definition of correctness and completeness of the performance of operations by pupils being a part of their actions. The control allows to reveal their connection with the features of a problem conditions and properties of a received result, and an estimation allows to define: whether the educational problem is solved and whether the transition to performing concrete actions is possible or it is necessary to create its new variants for the purpose achievement. Control and estimation actions are closely connected with each other. Their performance assumes the direction of a schoolchild's attention to his or her own actions, to the consideration of their features from the point of view of the result demanded by a problem, i.e. to a reflection.

Authorizing the performance of activity or its correction, control actions are the basic means of self-regulation which is carried out by pupils at all stages of activity — planning, performance and summarizing. Self-control is distinguished by the following criteria: total self-control; per-operational self-control assuming a pupil's accurate understanding of what he is doing now, what will be after that action; perspective self-control, i.e. an activity prediction for some operations forward which is possible with a sufficiently high level of an internal plan of actions and reflection.

In our research we studied and considered three components of self-regulation: self-control in educational work, social self-control and ability to strong-willed efforts in intellectual work as self-regulation means.

The modified variant of a teenage personal questionnaire used by us, is intended for children of 12–18 years, includes 14 factors (scales) reflecting the characteristics of some qualities of a person. We analyzed only the factor Q_3 which gives the possibility to estimate children's self-control (Figure 1).

Подростковый вариант теста Кеттелла, 12-18 лет

19. Ты часто меняешь одно увлечение другим?
а) да б) нет в) среднее
39. Принимая решения, ты стараешься учесть все до мельчайшей детали:
а) да б) нет в) может быть.
59. Если родители осуждают тебя за что-то, ты втайне все-таки думаешь, что прав:
а) да, как правило;
б) нет, почти никогда;
в) может быть.
79. Бывает ли так, что нередко ты затрачиваешь на приготовление домашних заданий больше времени, чем требуется?
а) да б) нет в) может быть.
80. Ты получил бы большее удовольствие от спортивного состязания /например, от бокса или футбольного матча/:
а) если бы поспорил с кем-то о том "кто победит";
б) если бы не спорил, а просто следил за матчем;
в) не уверен.
99. Тебе говорили когда-нибудь, что ты делаешь вещи, которых нельзя ожидать от такого человека, как ты?
а) да б) нет в) не уверен.
100. Если ты должен сделать какую-то работу, то ты обычно:
а) работаешь без остановки, пока не закончишь;
б) некоторое время напряженно работаешь, потом отдыхаешь и снова работаешь;
в) среднее между а) и б)
119. Как ты думаешь, тебя считают человеком, который в любых обстоятельствах остается хладнокровным и сохраняет самообладание?
а) да б) нет в) не уверен.
120. Часто ли бывает так, что ты делал то, что не следовало бы делать?
а) да б) нет в) не уверен.
140. Читая о великих подвигах или героях, испытываешь:
а) как правило, желание самому совершать их;
б) нередко считаешь, что такие дела не для тебя;
в) может быть.

Figure 1. A modified variant of a teenage personal questionnaire by R. Cattell

Self-regulation assumes a certain development of pupils' ability to strong-willed efforts. This ability was measured by us by means of a technique "problem which cannot be solved" offered by N.I.Aleksandrova and T.I.Shulga (Figure 2).

Задания по методике «Нерешаемая задача»

Ученик _____

1 вариант

1. К водному транспорту относятся:

2. Закон Архимеда: на тело погруженное в жидкость действует равная жидкости в объеме погруженной части тела.

3. В воду погружено тело. Определите значение выталкивающей силы, действующее на это тело. Плотность воды 1000 кг/м³.

Решение: _____

Ученик _____

2 вариант

1. К летательным аппаратам относятся:

2. Если сила тяжести, действующая на тело, больше, то тело будет дно, т.е.

3. В жидкость погружено тело, объемом 100 м³. Определите значение выталкивающей силы, действующее на это тело.

Решение: _____

Figure 2. Tasks according to the method «Problem which cannot be solved»

To determine a level of control-estimating actions in pupils we used an experimentally-methodical way which was named «technique of amendments» (Figure 3).

Внесите поправки в тексте

Вариант 1

- Принцип действия ареометра основан на том, что по глубине погруженного тела в жидкость, можно измерить плотности тела и жидкости.
- Нижнюю часть лодок и железнодорожные шпалы, пропитывают смолой, чтобы увеличить явление смачивания.
- Мы можем мыть руки мылом благодаря отсутствию поверхностного натяжения.
- Шар имеет наибольшую площадь поверхности при заданном объеме. Этим объясняется шаровидная форма мыльного пузыря.
- В состав кожи и перьев гусей входит вещество способствующее смачиванию водой, поэтому они не намокают.

Вариант 2

- На высохшей почве появляются капилляры по которым вода поднимается из нижних слоев к верхним и начинает интенсивно нагреваться.
- Чернилами трудно писать на плотной бумаге, а легко на промокательной.
- Ртуть стекло смачивает, а вода не смачивает.
- Моющая способность мыла основана на явлении смачивания.
- С помощью ареометра можно определить плотность твердых тел, процентное содержание соли и сахара в растворе.

Figure 3. Tasks according to the method «Technique of amendments».

Results of our survey obtained during the pedagogical experiment will be presented in the next publication.

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Оқушылардың оқу іс-әрекетіндегі үлгеріміне өзін-өзі реттеудің ықпалы туралы

Мақалада оқушылардың өзін-өзі реттеу мәселесі олардың үлгеріміне әсер ететін фактор ретінде зерттелді. Авторлар оқушылардың бойына өзін-өзі реттеуді дамытудың мүмкіндіктері, әдістері мен құралдары және оқушылардың оқу іс-әрекетіндегі үлгеріміне оның ықпалын қарастырды. Зерттеу барысында олар өзін-өзі реттеудің үш компонентін игеріп, ұсынды: оқу жұмысында өзін-өзі бақылау, әлеуметтік өзін-өзі бақылау және өзін-өзі реттеу құралы ретінде зияткерлік жұмыста күш-жігер қабілеті.

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О влиянии саморегуляции учебной деятельности студентов на успешность их обучения

В статье исследуется проблема саморегуляции студентов как фактор, влияющий на успешность их обучения. В работе представлена теоретическая часть исследования: цель, задачи, методы, научная новизна и значимость, теоретическая и методологическая основа исследования. Авторы рассматривают возможности, методы и средства развития саморегуляции учащихся и ее влияние на успешность их обучения. В ходе исследования изучены и рассмотрены три компонента саморегуляции: самоконтроль в учебной работе, социальный самоконтроль и способность к волевым усилиям в интеллектуальной работе как средства саморегуляции.

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