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E-LEARNING BASED ON STUDENT'S PSYCHOLOGICAL CHARACTERISTICS

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Abstract

Great importance is attached to e-learning and distance learning technologies as a powerful factor influencing the quality of university activities. The development of e-learning in the University of Kazan extends interaction within the university. While designing the system of e-learning at the Institute of Psychology and Education at KFU, the strategy of using computers in education was developed, which would consider all the benefits of information technologies and remove the identified deficiencies. Under conditions of technologization in education it was necessary to revise the ideas concerning the cognitive and personal development of the students in the process of university learning. Educators were expected to make a concept of the development of personality, mental processes, activity during the period of technologization in education. An empirical study was conducted at KFU when e-learning was being implemented into the traditional curriculum of higher school. The aim of the study was to research psychological characteristics of students (cognitive processes, mental states, personality traits) while using educational electronic resources. The study was conducted for one academic year. The study sample consisted of two groups of participants: a control group of students - 100 participants studying with standard educational electronic resources, which do not take individual psychological characteristics into account; a treatment group of students - 100 participants using multilevel educational electronic resources. The quality of cognitive processes and self-regulation activities changed during the study with multi-level electronic educational resources.

1. Introduction

Currently, Kazan Federal University is a leading Russian university in terms of scientific achievements and quality of education, it is included in international academic rankings. The strategic goal of the university is to increase the competitiveness of research and to achieve a high quality of international education programs for entry into the top-100 ranking of world universities. What will KFU be like in 2020? - The University, renowned for its graduates and achievements, worthily represented in the global information space, an active participant in the international scientific and educational exchange, an initiator and integrator of complex, multi-disciplinary research projects made to meet the challenges of innovation development.

This paper discusses the results of the work on implementing e-learning in KFU. The university has developed and put into practice the information-analytical system "Electronic University", which focuses on complex automation of the university educational activities. "Electronic University" is integrated into the university system LMS Moddle (Modular Object-Oriented Dynamic Learning Environment). It includes distance education technologies and e-learning, used both in full-time and correspondence courses at different levels: on the programs of higher education, further education, training, and professional development (Timerbaev & Shurigin, 2014; Ustyugova, 2010).

E-learning and distance education technologies are being implemented in KFU with the aim to increase the effectiveness of the university educational activities and research work (Caird & Lane, 2015). Great importance is attached to e-learning and distance learning technologies as a powerful factor influencing the quality of university activities (Browne et al., 2010; King & Boyatt, 2015; White, Warren, Faughnan, & Manton, 2010), promoting the academic image of KFU in the world educational space. The development of e-learning in the University of Kazan extends interaction within the university: students communicate with lecturers and with each other, which opens new possibilities for doing parallel courses at various universities in Russia and abroad.

2. Problem Statement

Basing on the analysis of e-learning experience, gained at foreign and domestic universities, we highlighted its main advantages and disadvantages in comparison with brick-and-mortar learning (Garrison, 2011; Goda et al., 2015; Martynov & Smolnikova, 2006) (Table 1).

Table 01. Pros and cons of e-learning in higher education

Pros	Cons
Initiating students' independence in knowledge acquisition and solution of educational problems. E-learning makes students independent subjects of learning activities. With e-learning, students take more responsibility for the outcomes and planning of their learning activities.	Students with a low level of independence and organizational abilities have poor academic achievements and lower effectiveness of their learning activities in general.
The use of information technology in higher education leads to increased learning efficiency through changing the level of individualization and differentiation, the use of additional motifs.	Individualization shortens the time allocated for live dialogic communication (teachers and students, students and students) which is scarce as it is. Students lack practice in dialogic

In many cases, the use of modern electronic textbooks enhances differentiation in students' learning through the use of tools and technologies leading to the choice of tasks of different difficulty levels. Consequently, higher-achieving students continue their independent studies, while students, who do badly, return to the material studied insufficiently.	communication, in wording their thoughts in professional language. However, according to psychological research, monological self-communication, known as independent thinking, cannot be developed without enough practice in dialogic communication.
While working on the computer, personal regulation of mental activity undergoes certain changes: protective mechanisms of the person are enhanced, the person is more likely to set achievable goals, control mechanisms are rearranged, the sphere of motivation is transformed. By working on the motivational sphere, one can control goal formation.	Due to the lack of social experience and live communication, maladaptive coping strategies can occur in one's behavioral, cognitive, and emotional spheres. Persistent avoidance of social contacts can be observed as well as passive behavior, and refusal to solve problems by oneself.
The development of reflexive knowledge enables students to make an informed conclusion about the success or falsity of their educational activity. Internal feedback encourages students to reflect, and works as impetus for further actions, enabling to evaluate and correct the learning outcomes.	Due to the reduced practice of social interaction and communication, emotional and social intelligence decrease. The ability to correctly assess behavior and emotions of people and to predict the course of events, basing on the past experience, is likely to take place.
Qualitative characteristics of cognitive processes change. Computer environment generates such features of thinking as originality, flexibility, coherence as well as its structural properties. These features correspond to the cognitive processes related to creative activities and problem solving. Thus, understanding the essence of phenomena and tactics of problem solving are described as the ability to perceive seemingly obvious facts in a new way, to find ways to connect things which seem unrelated at first sight, to find original connections between new and old information.	Negative impact on the psycho-emotional sphere. Information technologies can have a negative impact on the mental state of students while they work with electronic textbooks which can cause serious violations of the psychic sphere.

3. Research Questions

While designing the system of e-learning at the Institute of Psychology and Education at KFU, the strategy of using computers in education was developed, which would take into account all the benefits of information technologies and remove the identified deficiencies. Under conditions of technologization in education it was necessary to revise the ideas concerning the cognitive and personal development of the students in the course of university learning (Gourieva, 1993). Thus, psychologists, educators were expected to make a concept of the development of personality, mental processes, activity during the period of technologization in education (Andreev, 2011; Biesta, 2015).

It was essential that new educational electronic publications and resources should be acceptable for learning activities and deepening students' knowledge of the subject (Cook & Rushton, 2008; Forrester, Motteram, Parkinson, & Slaouti, 2005). Moreover, these e-resources should be easily introduced into the traditional system of education (De Freitas, Morgan, & Gibson, 2015: Lefever & Becka, 2010; Robinson,

Reeves, Murphy, & Hopp, 2009). The main difference is not so much in the content of the training material, but in learning technologies based on the features of the psyche and personality of students, which go beyond the standards and curricula of general higher education (Lu & Chiou, 2010).

Thus, the following educational electronic resources have been introduced:

- Learning resources – to develop knowledge and skills as well as practical activities, providing the required level of learning.
- Training resources – to drill all sorts of skills, to revise and consolidate the material covered in class.
- Monitoring resources –to check, measure and exercise self-control of the level of learning.
- Search engines – to provide information and develop the skill of organizing information.
- Visual resources – to visualize the objects and natural phenomena under study.
- Simulation resources – to present certain aspects of reality with the aim to study their structural or functional features.
- Lab resources – to conduct remote experiments on real equipment.
- Modeling – to model objects and natural phenomena for research and study.
- Educational game resources – to create simulations with learning activities in the form of a game.
- Game resources – to organize students' free time, develop their memory, reaction, attention and other qualities.
- Communication resources – to organize interpersonal interaction between teachers, authorities, learners, their parents, employees, general public and give teachers and students access to information resources.
- Integrated resources – to meet the wide range of needs in the sphere of education.

Educational electronic resources should meet the following traditional requirements (Federico, 2000; Harrell, 2008; Shanahan, 2014):

- The requirement to provide scientific approach - sufficient depth, accuracy and reliability of the scientific content of the educational material based on the latest scientific achievements.
- The requirement to ensure the appropriateness of training - the need to define the degree of theoretical complexity and depth of the study of educational material according to age and individual needs of students.
- The requirement to ensure problem-based learning conditioned by the essence and nature of learning and cognitive activity. When students are faced with a training problem situation that requires solution their intellectual activity increases.
- The requirement to provide visual learning - the need to integrate sensory perception of the objects of study or their models and personal observations of students (multi-sensor training).
- The requirement to provide cognitive training, independence and activity-based learning of the student.
- The requirement to ensure the regularity and consistency of learning - meeting the needs of learning in sequential acquisition of a certain system of knowledge, so that knowledge and skills were formed in a certain system, in a logically reasoned order.

- The requirement for meaningful and functional validity of electronic publications and educational resources for test and measuring and their components, for their compliance with the content of educational materials (content validity) and the assessed levels of students' activity (functional validity).

- In addition to traditional didactic requirements for the means of informatization, there are particular didactic training requirements which have been set owing to the advantages of modern information technologies in the sphere of educational electronic publications and resources.

- The requirement for adaptability implies flexibility of educational electronic publications and resources to individual psychological characteristics of the student. When developing and using electronic publications and resources it is useful to distinguish three levels of adaptation. The first level of adaptation is considered to be the choice of the individual rate of learning most suitable for the student. The second level of adaptation involves the diagnosis of the student's state, on the basis of which the content and methods of teaching are devised. The third level of adaptation is based on the open approach, which does not require any classification of potential users, the authors develop electronic resources as many options as possible targeting the largest possible contingent of potential trainees.

- The requirement for interactive learning means that the learning process should be interactive, providing students' dialogue with educational electronic publications or resources and feedback. Feedback can have external and internal forms. Internal feedback is information that comes from the electronic publication to students in response to their actions. Such communication is intended for self-correction of learning activities by students themselves. It encourages students to reflect, gives impetus for further actions, helps to evaluate and correct their learning outcomes.

- Information supplied by external feedback comes to the teacher and is used by them to correct students' activity and the mode of the electronic resource operation.

- The requirement for the development of the intellectual potential in students working with educational electronic publications and resources meets the needs of the education system to develop students' thinking styles (algorithmic, visual-figurative, theoretical), their ability to make optimal decisions or variable solutions in a difficult situation and to process information (through the use of data processing systems, search engines, databases, etc.).

- The requirement for the systemic approach and structural-functional coherence of the learning materials presentation in educational electronic publications and resources.

Ergonomical and ergonomy related requirements, which are devised in accordance with the age of learners, boost the level of motivation to learn and establish requirements for visual information and modes of operation of educational electronic publications and resources.

4. Purpose of the Study

An empirical study was conducted at KFU when e-learning was being implemented into the traditional curriculum of higher school. The aim of the study was to research psychological characteristics of students (cognitive processes, mental states, personality traits) while using educational electronic

resources. The study was conducted for one academic year. The study sample consisted of two groups of participants: a control group of students - 100 participants studying with standard EERs, which do not take individual psychological characteristics into account; a treatment group of students - 100 participants using multilevel EERs.

5. Research Methods

Multilevel educational electronic resources are constructed in differential way. Students are provided with the various types of educational materials (presentation, practical tasks and methods of control) which allow them to make their own choice. Emotional breaks, pace of work, and even the content of instruction a real so chosen by students themselves.

The diagnosis of the studied parameters was carried out at the beginning of the academic year and at the end. Multilevel characteristics of EERs meant that the development of electronic textbooks should be based on particular features of students' *perception* of their learning material and specificity of information processing (Martynov & Smolnikova, 2006). For students with auditory perception the information in electronic textbooks should have a soundtrack: the text is read rhythmically with different pitch, tempo, timbre, height and frequency. The learning material should be accompanied by presentations, speech and background music. For visuals it is recommended to reinforce a holistic view of the text: with pointers - arrows, bullets, different colors, underlining, etc. It should be accompanied by appropriate illustrations, and certain size and position of things should be accentuated. The learning material and tasks for kinesthetic type of students is demonstrated in such a way that they are able to use key boards, touch screens and 3D images.

The use of information technologies expands the capacity of human *thinking* for solving problems in case the leading type of mental activity and quality of thinking are taken into account (Vygostsky, 1978). Also, electronic textbooks should be used in learning as a method for developing students' thinking (Kornilova & Tikhomirov, 1990).

Multilevel EERs are based on the systemic approach to teaching, differentiation and individualization of learning which stimulates the dynamic balance between "rational" thinking with its linear, focused and analytical nature, and "intuitive" thinking that is found in developed consciousness. Rational thinking is consistent with the trend toward autonomy, while intuitive thinking is comparable to integral trends in the system. Both kinds of thinking are balanced, and their isolation leads to imbalance.

Standard EERs are more focused on the "rational" way of thinking, they do not give space to original ideas, suppress attempts to challenge authorities, encourage regular behavior.

Consequently, EERs should contain tasks aimed at increasing the capacity of thinking and cause specific changes in the structure of mental activity. This approach allows one to develop such features of thinking as originality, flexibility, fluency, elaboration, absence of stereotypes. Creative activities and search for new solutions to the problems develops students' ability to perceive seemingly obvious facts in a new way, and establish original connections between new and old information.

Standard EER slack *speech activity* and practice in dialogic communication, and the idea, formulated in students' professional language finds no expression. KFU experts were to include interactive tasks in the EERs they developed.

The educational material of EERs is better memorized. Structured and systematic content of EERs gets deeply internalized, incorporated into the existing system of knowledge. Regular monitoring of knowledge acquisition, mid-term certification, and joint projects initiate reflexive knowledge. These factors have a positive effect on *mnemonic processes*, as memorizing is not mechanical, but is a result of students' meaningful perception.

The following indicators were subjected to measurement:

- features of the cognitive sphere (perception, thinking, speech, memory, imagination, attention);
- features of the psycho-emotional and volitional sphere (mental stability, independence, initiative, commitment, responsibility, decision-making, motivation);
- personal characteristics (temperament, character, personality attitudes, self-esteem, coping strategies, defense mechanisms)
- features of mental states (the diagnosis of different states at the beginning and at the end of the participants' work with electronic resources).

6. Findings

The results of the research on the features of *mental states* behavior made it possible to trace the origin and dynamics of unbalanced states, which have destructive influence on students' acquisition of learning material and productivity of their performance in the course of learning with standard EERs. A mental state is the person's reflection of a situation in the form of sustainable holistic syndrome (complex) in the dynamics of mental activity, which is expressed in the unity of behavior and experience in the continuum of time (Prokhorov, 2013). Actualization of unbalanced states is the cause of irrational, inappropriate behavior. The author notes that unbalanced states are a functional structure formed when the symmetry between the organism and the environment is broken.

When developing e-learning courses, a transition of increased mental activity to the destructive form should be taken into account. Thus, the mobilization of mental resources provides for greater learning efficiency, however, with excessive length of this condition other states of increased mental activity may occur: distress, anger, panic, anxiety. Another vector of the negative impact on the state of students is the emergence of a decreased mental activity, namely, fatigue, monotony, prostration, confusion, depression. A reduced emotional tone is accompanied by increased anxiety, irritability, and a sense of alienation. Often, the inability to cope with the negative state leads to uncertainty, lower self-esteem, and a loss of interest in learning activities.

Intellectual features of unbalanced states include lack of relevant information, prevalence of negative thoughts, breach of logic, confused or impulsive thinking, narrowing of the "field of view" of possible actions. Among the changes in intellectual processes with negative states, a significant breach of attention is observed, along with difficulties in concentration, due to the formation of the corresponding dominant in the cerebral cortex. Violation of basic properties of intelligence is a consequence of the development of an unbalanced state which prevents the successful management of one's own conditions.

In an unbalanced state, students' cognitive assessment of the learning situation is infringed. Cognitive imbalance leads to a distorted interpretation of learning activities, and the subjective importance of the performed tasks is reduced as well as the productivity of learning with EERs (Prokhorov & Serezhkina, 1995).

Effective methods of management and self-management of states were included into multilevel EERs. Their use in e-learning practices depends on students' individual abilities for self-management of their mental states (Lynch & Dembo, 2004). These methods can be reflexive and non-reflexive. Music, multimedia, complexes of respiratory exercises, rehabilitation gymnastics, and autogenic training can be referred to non-reflexive methods in e-learning. To normalize cognitive states, methods for regulation of functions of attention, memory, and thinking are used.

Music can affect the cardiovascular, respiratory and nervous system of humans. Music, if skillfully used, becomes an effective tool for managing mental states. Direct impact on mental states is also used - libropsychotherapy - a method based on reading specially selected literature. While reading, the person is unconsciously drawn into the world created by the writer, becomes a participant of the events. The use of artistic images, metaphors, parables, real life events, individual cases, biographies of famous people contributes to the students' involvement in the process of familiarization with the learning material, develops their interest in the subject and serves as prevention of adverse conditions.

An important component in the structure of educational electronic resources is a set of supporting procedures which make it possible to apply psycho-techniques to the development of self-reflection. The choice of methods for self-regulation depends on the effectiveness of mental processes. People with a high level of productivity of mental processes have their "own" methods of self-regulation - intellectualized and related to cognitive activity. While students, characterized by low productivity characteristics of mental processes, have other techniques - speech acts, socialization, and passive methods of self-regulation. The higher the level of reflection in the person, the more successful is the regulatory process, the more fully actual and desired states are realized, the faster is their transition to the desired state. A conscious image of one's mental state in the course of self-regulation is a guide to the individual as it causes both the change of one's state and the inclusion of regulatory impacts. Reflexive methods of state management include a situation analysis, rationalization of the performed tasks, self-awareness, and positive thinking. All EER tasks that are performed by students, focus not only on knowledge acquisition and practical skills in the subject, but also include questions that involve logical introspection.

Next, *personality traits* of students, working with electronic educational resources, were studied. In multi-level EERs teachers arranged teaching materials and tasks depending on individual psychological characteristics of students (Mironova, 2010). Thus, depending on the characteristics of temperament, introverts choose restful teaching methods, based on the familiar learning material, on repetition, on finding common, essential elements, but not something different. Extroverts are oriented to tasks, which contained unusual comparisons, specific situations, while frequent distractions by new elements and change of activities increase the success of their learning.

It was found that students working with standard EERs, in which they were not able to select the type of tasks in accordance with their personal characteristics (temperament, character, attitudes, self-esteem), are less productive. If students do the same type of task irrespective of their personality type, it

can lead to lack of involvement and generate maladaptive coping strategies, namely, avoidance of solving problems, passivity, information displacement, and emotional stress. In multi-level EERs, students' successful performance is enhanced by correlating the type of a task with their personal characteristics, self-confidence, and their involvement in this process. As a result, adaptive coping strategies are developed: making learning activities meaningful to students, exercising strong influence on the learning situation, guiding students towards information search.

Depending on the characteristics of *temperament*, introverts choose quiet teaching methods, based on familiar material, on the knowledge they have already gained, on repetition, on the search for common, essential elements but not something different. Extroverts are oriented towards the tasks, which contain unusual comparisons and specific situations, and frequent distractions caused by new elements and change of activities contribute to the success of their training.

These educational techniques lead students away from memorizing facts and gaining skills characteristic of the industrial model of education to promoting the development of interconnected and interdependent thinking, aimed at solving educational problems.

7. Conclusion

The quality of cognitive processes and self-regulation activities change during the work with multi-level electronic educational resources. The information technologies under discussion increase the potential of the human mind, promote creativity, and the role of reflexive knowledge in learning. Multilevel EERs help to avoid the states of monotony, fatigue, anxiety, and contribute to a higher level of students' involvement in learning activities. Their subjective awareness of education significance increases, monitoring activities are reconstructed, motivation is transformed towards achieving one's goals, and independence and responsibility for their actions are also increased. E-learning resources should be modularly designed and consisted of individual blocks. The individual approach to studying should be taken into account when creating electronic resources: certain types of learning activity according to individual predispositions. Individual features and psychological personality characteristics of students should be defined and considered in the learning process. On this basis, optimal strategies and adaptive tactics of learning should be selected.

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References

Andreev, V. I. (2011). Resource-based approach to foster innovation and self-development of the individual in terms of higher teacher education. *Education and self-development, 1,* 23, 3-7.

Biesta, G. (2015). What is Education For? On Good Education, Teacher Judgement, and Educational Professionalism. *European Journal of Education, 50*, 75–87. https://doi.org/10.1111/ejed.12109

Browne, T., Hewitt, R., Jenkins, M., Voce, J., Walker, R., & Yi, H. (2010). *Survey of technology enhanced learning for higher education in the UK*. Oxford: Universities and Colleges Information Systems Association.

Caird, S., & Lane, A. (2015). Conceptualizing the role of information and communication technologies in the design of higher education teaching models used in the UK. *British Journal of Educational Technology, 46*, 1, 58-70. https://doi.org/10.1111/bjet.12123

Cook, A., & Rushton, B. S. (2008). *Student Transition: Practices and Policies to Promote Retention*. London: SEDA.

De Freitas, S. I., Morgan, J., & Gibson, D. (2015). Will MOOCs transform learning and teaching in higher education? Engagement and course retention in online learning provision. *British Journal of Educational Technology, 46,* 3, 455-471. https://doi.org/10.1111/bjet.12268

Federico, P. A. (2000). Learning styles and student attitudes toward various aspects of network-based instruction. *Computers in Human Behavior*, *16*, 359–379.

Forrester, G. Motteram, G., Parkinson, G., & Slaouti, D. (2005). Going the Distance: Students' Experiences of Induction to Distance Learning in Higher Education. *Journal of Further & Higher Education, 29*(4), 293-306.

Garrison, D. R. (2011). *E-learning in the 21st Century: A Framework for Research and Practice*. Taylor & Francis.

Goda, Y., Yamada, M., Kato, H., Matsuda, T., Saito, Y., & Miyagawa, H. (2015). Procrastination and other learning behavioral types in e-learning and their relationship with learning outcomes. *Learning and Individual Differences, 37*, 72-80. https://doi.org/10.1016/j.lindif.2014.11.001

Gourieva, L. P. (1993). Psychological consequences of computerization: Functional, ontogenetic and historical aspects. *Voprosy psychologii, 3,* 5-16.

Harrell, I. L. (2008). Increasing the Success of Online Students, *Inquiry, 13*(1), 36-44.

King, E. & Boyatt, R. (2015) Exploring factors that influence adoption of e-learning within higher education. *British Journal of Educational Technology*. https://doi.org/10.1111/bjet.12195

Kornilova, T. V., & Tikhomirov, O. K. (1990). *Making intelligent decisions in a dialogue with the computer*. Moscow.

Lefever, R., & Becka, C. (2010). *How can technology be used to improve the learner experience at points of transition?* York: The Higher Education Academy.

Lu, H. P., & Chiou, M. J. (2010). The impact of individual differences on e-learning system satisfaction: A contingency approach. *British Journal of Educational Technology, 41*(2), 307-323. https://doi.org/10.1111/j.1467-8535.2009.00937

Lynch, R., & Dembo, M. (2004). The relationship between self-regulation and online learning in a blended learning context. *International Review of Research in Open and Distance Learning, 5,* 2.

Martynov, D. V., & Smolnikova, I. A. (2006). *Federal electronic educational resources - the basis for further work*. Moscow.

Martynov, D. V., & Smolnikova, I. A. (2006). *Typology and recommendations for the creation of the federal comprehensive electronic resources.* Moscow.

Mironova, L. I. (2010). Electronic educational resources as a tool for forming competitive personality in graduating students. *Omsk Scientific Bulletin, 89*(4), 172-176.

Prokhorov, A. O., & Serezhkina, A. E. (1995). Features of mental states of computer users in the process of computer-based training, *Voprosy psychologii, 3,* 53-61.

Prokhorov, A. O. (2013). Mental state image. *Psikhologicheskii Zhurnal, 34*(5), 108-122.

Robinson, L., Reeves, P., Murphy, F., & Hopp, P. (2009). Supporting socialization in the transition to university: A potential use for on-line discussion boards, *Radiography, 16*(1), 48-55.

Shanahan, T. (2014). How and How Not to Prepare Students for the New Tests. *The Reading Teacher*, *68*(3), 184–188. https://doi.org/10.1002/trtr.1315

Timerbaev, R. M., & Shurigin, V. Y. (2014). Activation of self-development of students studying the course "Theoretical Mechanics" on the basis of LMS Moodle. *Education and self-development, 4*(2), 146-151.

Ustyugova, V. N. (2010). *Distance learning system Moodle*. Kazan: Tatar State Humanitarian Teachers Training University.

Vygostsky, L. S. (1978). Mind in society: the development of higher mental processes. Harvard University Press, Cambridge.

White, D., Warren, N., Faughnan, S., & Manton, M. (2010). *Study of UK Online Learning Final Report.* University of Oxford.