VI International Forum on Teacher Education

Psychological Groundings for the Development of Digital Educational Resources

Ildar R. Abitov* (a), Pavel N. Afanasyev (b), Rezeda M. Khusainova (c), Inna M. Gorodeyskaya (d)

(a), (b), (c) Kazan Federal University, 420008, Kazan (Russia), 18 Kremlyovskaya street, ildar-abitov@yandex.ru
(d) International Psycho-Educational Projects Association, Tel-Aviv, Israel, e-mail: innamgor@gmail.com

Abstract

Many leading educational institutions in Russia, including Kazan Federal University develop and implement digital educational resources for different courses. However, Janelli points out that so far there is no unified theory of E-learning. The study aims at elucidating universal psychological patterns that may be used in developing digital educational resources for different psychological and educational (pedagogical) disciplines and at working out recommendations basing on the revealed patterns. Theoretical analysis of psychological views on digital educational resources and studies that assess their effectiveness was the main research methodology. Theoretical research resulted in a set of revealed psychological patterns and recommendations concerning the development of successful digital educational resources. In particular, it was concluded that 1) educational resources following on from behavioral and constructivist theories are more efficient than those based on cognitive ideas; 2) the most useful educational tasks are designed to be done by students independently (by themselves) on the basis of the information acquired in the course; 3) a digital educational resource is more effective if students are informed about instruments that may help them in their studies; 4) a digital educational resource is more effective if the author uses special strategies to communicate with students, such as FAQ or "Ask your teacher" sections. Thus, the following techniques are used to improve the performance of the designed digital educational resources: meta-information about the course and its specifics, special communicational strategies aimed at getting good feed-back from the students, various ways of data presentation (written information, visual image, teacher's video-explanations of storytelling), and tasks for self-tuition based on the information acquired in the course.

Key words: Psychological patterns, Digital educational resources, E-Learning, E-Learning Theories.

---

* Corresponding author. E-mail: ildar-abitov@yandex.ru

Introduction

Nowadays when many people are willing to acquire higher education and full-time students have to miss some face-to-face classes because they work to be able to pay for their studies, distant learning becomes more and more important. One of the comprehensive, up-to-date tools to support distant learning is digital educational resources. They comprise lectures, topics for seminars and discussion sessions, questions and tasks for self-training, short video-lectures, and also may contain extra learning materials such as assigned literature and additional multimedia and texts. However, Janelli (2018) points out that so far there is no unified theory of E-learning. Cognitivism, constructivism, behaviorism, digital media theory, activity-oriented theory and active learning theory are mentioned as the most significant approaches for the development of E-learning resources (Cooper, 1993; Dietinger, 2003).

Purpose and objectives of the study

The aim of the study is to systemize the existing psychological data concerning the E-learning theories and conceptions and to elucidate practical recommendations that may be used in the E-learning process.

Literature review

Digital media theory in the E-learning context focuses on technological tools that may be used during the training process (computers, mobile devices, recording devices, etc.) rather than educational contents (McLuhan & Gordon, 2003). Activity-oriented theory and active learning theory states that the more active a student is during the training the better he acquires the material. Active learning is any educational strategy that implies students' involvement into the educational process. This approach forms the basis for using learning-by-playing methods in E-learning (Mayes & de Freitas, 2005; Pange & Pange, 2011). Cognitive multimedia learning theory seems to successfully combine educational media-content and cognitive demands in processing the information that comes. Mayer is one of the leading cognitivism-oriented researchers of E-learning and online education. He developed cognitive a multimedia learning theory that aims at extraneous processing overload among students using digital educational resources, managing essential processing and fostering generative processing in multimedia learning. Cognitive multimedia learning theory supposes that people have two channels of information processing: visual/figurative and audial/verbal. Conctrictivistic approach to learning implies a higher degree of autonomy for trainees, their responsibility in the course of knowledge acquisition anchored in their previously gained experience. Koohang et al. (2009) points out that assessment, self-evaluation, and students' capability to reflect their learning activity are very important in the context of this approach. According to Koohang et al. (2009) critical thinking is also very important in problem solving. Stavredes

(2011) suggests specific actions to improve the E-learning successfulness. First of all, she emphasizes the significance of supporting tools such as instructions and explanations that clarify the students' course of action, describe instruments and of the given E-learning resource, teacher's expectations, important dates and time frames. Modritscer (2006) researched the efficiency of different approaches and methodologies for development and usage of digital educational resources. He compared resources developed basing on constructivistic, behavioral and cognitive approaches. The author pointed out that behaviorally oriented resources are the most labor-intensive both for teachers and students. It requires tasks that will be done independently by students. Therefore literature review allows revealing the following problem: the existing information concerning the efficiency of various approaches for the development of digital educational resources is not yet systematized, and the research findings are not sufficiently used. The aim of the study is to systemize the existing psychological data concerning the E-learning theories and conceptions and to elucidate practical recommendations that may be used in the E-learning process.

Methodology

The main research methodology of the study was theoretical analysis. Works of two types were investigated: 1) studies of psychological theories and approaches that may be used in the development of online courses and digital educational resources; 2) works that contain testing results of different approaches for the development of online courses and digital educational resources, taking into account psychological peculiarities and patterns.

Results

The behavioral approach to designing digital educational resources suggests that training process is divided into small learning steps. Resource developers determine the student's sequence of actions: depending on the control tests results, he/she either repeat or skip some sections. According to the behavioral approach the operation is presented and split into separate parts with appropriate explanation (Modritscer, 2006).

Cognitive concept is one of the frequently used approaches in the design of online courses and digital educational resources. This paradigm suggests including different learning strategies for considering individual learning peculiarities in the information perception and processing. New information needs to refer the information in the student's long-time memory, and the trainee's attention should focus on the basic, critical information. Educational content must be divided into separate modules. Intrinsic and extrinsic (driven by a teacher) learning motivation are important. It is necessary to encourage students to use their meta-cognitive skills, and educational content should be linked to real life situations (Modritscer, 2006).

Mayer, cognitively oriented researcher, suggested a set of principles that help achieving educational goals.

Coherence Principle, that states that students learn better if irrelevant material (words, sounds, pictures, etc.) is excluded.

Signaling Principle that says that people learn better when cues that highlight the essential material are added (words, diagrams, etc.).

Redundancy Principle states that people can learn better from animation (graphics) and narration than from graphics, narration and on-screen text.

Pre-training Principle points out that people learn more efficiently when they know the names and characteristics of the main concepts.

Spatial Contiguity Principle says that people learn more deeply from when corresponding words and pictures are presented near rather than far from each other on the page or screen (on one slide).

Temporal Contiguity Principle states that students learn better when corresponding words and pictures are presented simultaneously rather than successively.

Multimedia Principle, that postulates that people learn better basing on words and pictures than from words alone.

Modality Principle points that people learn more deeply from pictures and spoken words than from pictures and printed words.

Personalization Principle says that people learn better by multimedia presentations when the style of language is informal and conversational rather than formal.

Voice Principle states that people learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine voice.

Image Principle mentions that people do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen.

Mayer (2009) attracts attention to the fact that the suggested principles have their limitations. For example, well-designed multimedia presentations are the best for the students with low level of special knowledge. Training effectiveness may depend on the type of the material.

Constructivism is another approach that may be successfully used for the digital learning. This theory refers to the works of Dewey (2000), Piaget (1972), Vygotskiy (1982), Bruner (1990). The key idea of constructivism is that students actively construct their own knowledge basing on the already existing competences and his previously acquired experience. Learning is considered an active process. Cooperation and collaboration in the educational process are encouraged, and students are able to monitor it. Learning should be meaningful and include interactions (Modritscer, 2006).

Koohang et al. (2009) drew out an E-learning model basing on the "zone of proximal development", high-order thinking and reflection, student's previous experience and his goals. The most important tools in this educational model are considered to be case study, team-work of students and their multiple views on a problem or idea as well as teacher's, other learners' and the student's own evaluation. Koohang et al. (2009) suggested an E-learning model that includes two categories: the design of learning activities and the elements of learning assessment. The basic elements are:

1.   Conceptual interrelatedness and interdisciplinary learning

2.   Exploration

3.   Higher-order thinking skills

4.   Learner's driven goals and objectives

5.   Learner's own previous experiences

6.   Learner's self-mediating and control of learning

7.   Learner's self-reflection

8.   Real world and relevant examples

9.   Scaffolding that can be used to make learners think above and beyond what they normally know.

The collaborative design elements for learning activities are as follows:

1. Learners' collaboration

2. Learners' cooperation

3. Learners' multiple perspectives

4. Learners' multiple representations of content/idea/concept

5. Social negotiation among learners.

The learning assessment elements are:

1.   Individual self-assessment

2.   Team collaborative assessment

3.   The facilitator's assessment.

Thus, using the E-learning educational resource the learner's mind mediates information that comes from the outside world to determine what he is going to learn and to encourage him to create new knowledge. The facilitator either presents reals world situation to the student or suggests him to find it. Learners set their goals and tasks by themselves through analyzing individual situation and in general in the course of studies. This approach makes it possible to stimulate the students' research activity and their self-control over the learning process. Students also take responsibility for their training.

Stavredes (2011) emphasizes the importance of scaffolding for improving the quality of an E-learning resource. In particular she points out that students may face problems in realizing what to do in the very beginning. To prevent such difficulties, it is necessary to make instructions-explanations for students that include a sequence of steps to continue the learning process, educational conditions (teaching style, teacher's expectations, important dates and time-frames). The author also mentions some techniques that may facilitate communication between the course leader and the students. For instance, Stavredes (2011) recommends to create a chat called "Frequently Asked Questions" for the course beginners and copy-paste there all the answers that the course author had ever given. She also recommends to create a system of special signs and signals that allows tracking down that a learner is not sufficiently active and he needs to participate in discussions more to improve his performance.

Modritscer (2006) carried out comparative research of three resources based on three different approaches (behavioral, cognitive and constructivist). The came to some significant conclusions. The digital resource based on behavioral ideas turned out to be the most time- and effort-consuming both for students and teachers. Constructivism-oriented resource demanded less efforts except for team collaborative assessment. Students gave the highest scores to the courses developed on the basis of behavioral and constructivist paradigms. These courses were the most efficient (judging from the students' academic records). The good results were achieved by the self-tuition tasks.

Discussions

Recommendations stated and analyzed during the literature review were used in the designing of original digital educational resources (DER). Constructivist ideas discussed by Koohang et al. (2009) formed the basis for the DER developed by the authors of the given article. In the Kazan Federal University digital educational resources are developed on the Moodle platform supported by various educational, psychological and interactive technologies. We believe that digital educational resources within Moodle system will be successful if they are based on definite (task-relevant) technologies. Thus, the digital educational resource "Psychology of personality" designed by Ildar Abitov was built upon the SPOC technology. SPOC forms a bridge between distant and traditional academic learning. SPOC format makes it possible to encourage students to develop skills of independent analysis and systematization of the acquired information; develop learning motivation and self-cognition competences; form students' responsibility for their learning; organize individualized educational trajectories for students who are often absent in class (possibility to get additional points during self-studies); improve self-guided work of students by focusing their attention on definite materials (video-lectures, compendium of lectures) and completing special tasks. Therefore, this technology makes it possible to be flexible in combining digital resources and personal interaction between teachers and students to develop professional competences. The given educational resource includes tasks for students within the Moodle system with a set of video-lectures aimed at self-diagnostics and self-testing. The digital educational resource "Psychology of professional communication" developed by Pavel Afanasyev deals with the Peer Assessment, or Peer-Review technology. Its provides the possibility for mutual assessment by "peer commenting", "peer review" and "peer assessment" in the LMS Moodle environment by means of the following tools: "Forum", "Seminar", and "Wiki". Peer assessment allows a teacher solving the following tasks: to develop the knowledge systematization and generalization skills of students; to motivate students for the deeper acquisition of the course material; to form the students' responsibility for their learning; to develop critical thinking; to improve cognitive activities; and to develop collaboration skills. Peer assessment of course-mates' works allows the student remember and understand material better; acquire analytical, systematization and assessment skills; analyze and compare the level of their own knowledge of the studied topic; develop the skills of creating texts of predetermined structure and content; develop self-assessment models (meta-cognition); and learn to properly comprehend criticism they receive. Rezeda Khusainova designed a digital educational resource of the discipline called "Methods of psychological and pedagogical interaction of the educational process participants". It was based on flipped classroom technology focusing on the case-study. The advantage of the flipped class technology is that it encourages students to be active in their studies due to rational usage of their in-class and out-of-class activities. Case-study method integrates developmental teaching technologies including individual and team communication, and therefore developing various personality

traits of learners. There are two steps of case work within the flipped classroom technology: in class and during e-learning. In class students determine the succession of operations in their case-work basing on the following plan: described situation, assessment, forecasting effort, solving. Students with the help of a teacher learn to diagnose the situation, analyze the data, and make their own independent decisions. Second time when students turn to case-study is when they work with the digital resource. If necessary, they have the possibility to watch video-lectures where pedagogical situations are analyzed, and then to solve the cases presented in the digital educational resource. The videos were recorded specially for the course.

Therefore, video-lectures that make it possible to study a topic both in the text and in the visual formats, also became a psychological grounding for the designing of digital educational resources. Thus, digital educational resources developed by the authors of the article show that it is possible to provide both educational interaction between a teacher and students and feedback from students concerning their understanding of material using definite LMS Moodle instruments and basing on constructivistic ideas.

Conclusion

The theoretical analysis leads us to the following conclusions:

1.   Cognitive, behavioural or constructivist paradigms or their combinations may be used in the designing and development of digital educational resources.

2.   E-courses built upon behavioural and constructivist approaches are evaluated higher by students and demonstrate better learning effectiveness.

3.   Introducing tasks that should be done independently by students during their self-guided work provides better learning efficiency.

4.   Resources that imply communicational possibilities between teachers and students (chats, FAQ sections and a system of signals that provides communicational feedback) are more comfortable for students.

5.   Digital educational resources where a teacher explains the available instruments and tools that students may use, as well as educational conditions and steps that students will have to follow during the course, are more comfortable and student-friendly.

6.   Designing and development of digital educational resources within the Moodle platform will be successful if they base on a set of educational, psychological and interactive technologies.

References

Bruner, J. S. (1990). *Chids talk. Acts of Meaning.* Cambridge (Mass.): Harvard University Press.

Cooper, P. A. (1993). Paradigm shifts in designing instruction: From behaviorism to cognitivism. *Educational Technology, 33*(5), 12-19.

Dewey, J. (2000). *Demokratiya i obrazovanie* [Democracy and education]. Moscow.

Dietinger, T. (2003). *Aspects of E-Learning Environment* (Doctoral dissertation, Graz University of Technology, Graz, Austria). Retrieved from https://graz.pure.elsevier.com/en/publications/aspects-of-e-learning-environments

Janelli, M. (2018). Elektronnoe obuchenie v teorii, praktike i issledovaniyakh [E-Learning in Theory, Practice, and Research]. *Voprosy obrazovaniya [Educational Studies Moscow], 4*, 81-98.

Koohang, A., Riley, L., Smith, T., & Schreurs, J. (2009). E-Learning and Constructivism: from Theory to Application. *Interdisciplinary Journal of E-Learning and Learning Objects, 5*, 91–109.

Mayer, R. E. (2009). *Multimedia Learning*. Cambridge University Press.

Mayes, T., & de Freitas S. (2005). *Review of E-Learning Theories, Frameworks and Models.* London: JISC e-Learning Models Desk Study.

McLuhan, M., & Gordon, W. T. (2003). *Understanding Media: The Extensions of Man. Critical Ed. Corte Madera.* CA: Gingko Press.

Modritscer, F. (2006). E-Learning Theories in Practice: A Comparison of three Methods. *Journal of Universal Science and Technology of Learning, 28*, 3-18.

Pange, A., & Pange, J. (2011). Is E-Learning Based on Learning Theories? A Literature Review. *World Academy of Science, Engineering and Technology, 5*(8), 56–60.

Piaget, J. (1972). *Psychology and Epistemology: Towards a Theory of Knowledge.* Harmondsworth: Penguin.

Stavredes, T. (2011). *Effective online teaching: foundations and strategies for student success.* The Jossey-Bass Higher and Adult Education Series.

Vygotskiy, L. S. (1982). *Voprosy teorii i istorii psihologii* [Studies on theory and history of psychology] (Vol.1). A. R. Luria, M. G. Yaroshevskiy (Eds.). Moscow.