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Development of Students' Digital Competence When Using the "Oracle" Electronic Portal

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Abstract

In today's constant change in the market of educational services and opportunities to engage in various formats of education (vocational, general education, special, higher, and others), consumers are faced with the question of choosing the quality education. High-quality education is one of the key conditions of student motivation and the attractiveness of higher education. The present study explores indicators of the quality of education in the context of the development of digital competence in future specialists in economics as part of a combination of interactive digital technologies and electronic platforms for the pedagogical interaction of participants in the educational process. The purpose of the study is to design a pedagogical technology relying on the management of learning and creative activities of economics students with the use of the electronic resource "Oracle" as a means to improve the quality of professional training of specialists in modern conditions. The feasibility of using "Oracle" in the formation of the digital competence of future economists is determined through an expert survey. The conducted pedagogical experiment reveals that the effectiveness of the educational process organization, an indicator of which is the quality of professional training of economic students, is 17.5 % higher with the model of educational management using the chosen info-digital electronic resource (business intelligence platform) compared to the traditional learning system due to improved training of future specialists in all components of digital competence.

Keywords: distance learning, information and communication technologies, info-digital electronic resource, traditional learning system, electronic management.

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1. Introduction

In the age of informatization and high technology, the competitiveness of individual countries in the global market greatly depends on the level of people's education, the development of their creative abilities, and their readiness to obtain new knowledge. Thus, the role of a country in the world is defined by the level of education and culture in it (Artemova et al., 2022; Bikbulatova et al., 2016; Mkrttchian et al., 2020). Therefore, the quality of education (QE), which today is interpreted as compliance with certain standards, is becoming relevant in many spheres of social life, including higher education (Kurkina et al., 2021).

In our opinion, the professional training of modern economic specialists should proceed from updating the pedagogical system with innovative technical means and electronic software products (ESP) in view of the digitalization of the educational space (Shishov et al., 2021; Vasilyeva et al., 2021). The basis for these changes is the electronic management of education with consideration of the concept of digital pedagogy and the introduction of digital learning technologies (Krivova et al., 2021; Nanjundaswamy et al., 2021).

The outlined problem is becoming increasingly relevant in the context of distance learning employed in the COVID-19 pandemic, which has proven the urgent need for pedagogical influence executed by means of interactive digital technologies and electronic platforms for the pedagogical interaction of subjects in the educational process (Williamson et al., 2020). These changes shape the relevance of the topic of our study, since, in our view, the greatest transformations that affect the quality of contemporary higher education take place in the information-digital environment.

2. Literature Review

Researchers characterize the QE from different points of view:

- as a political category, the QE comprises in itself the main directions of state educational policy and the main strategic lines of development of the national education system in the context of global trends (Schindler et al., 2015);
- as a social category, the QE reflects the ideals of educatedness inherent in society and indicates the general objectives of education legally defined and normatively enshrined in state standards (Parri, 2006);
- as a category of management, the QE defines the strategies of influence on certain indicators of the operation of the educational system and selects possible ways to change its development (Cullen et al., 2003).

M.P. Karpenko (2012) understands QE as balanced correspondence (of the result, process, educational system) to the established needs, goals, requirements, and norms (standards). According to G.P. Shlykov (2006), the components of the QE in higher education are the organization of training, scientific and pedagogical staff, material and technical base, the educational environment, including electronic, students' learning achievements, the management system, and the results of scientific research.

K.-L. Krause (2012) asserts that the commonality between the QE at different levels of management is the creation of optimal conditions (staff, scientific and methodological, material, financial, legal, sanitary and hygienic, etc.) for the proper operation and continuous development of the educational system and the institution, which significantly affect the QE. P.T. Knight, M. Yorke (2003) emphasizes that the improvement of the QE is a necessary condition for improving the life of society and constitutes the basis for economic modernization, the development of a culture of innovative thinking, and the assertion of the fundamental values of human existence.

A review of definitions of "digital competence" (DC) (Gisbert et al., 2016; Petrova, Scherbik, 2018; Starčič, Lebeničnik, 2020) suggests that this concept is considered as a technological level of tasks that specialists have to be able to perform in view of the wide use of electronic resources, digital software, SMART educational and information and communication technologies. This concept is examined from the position of the motivational, cognitive, activity, and development components.

Considering the above aspects, we can conclude that the effective formation of the DC of an economic specialist requires the person to have a specialized system of knowledge, abilities, and skills in using information and communication technology (ICT) and experience in using electronic platforms and digital means of communication based on a system of algorithms for managing the solution of economic problems in the given area of professional work (Canada Pujols, 2012).

The outlined provisions prove that the DC needs to correspond to the specific directions of professional activities and be structurally and functionally organized in the form of a model of DC.

Analytical studies (Cirdan, 2019; Glazunova et al., 2021) define the DC of a future economic specialist as their ability to successfully implement economic measures in a professional environment based on systematic knowledge, skills, and abilities in implementing electronic resources in production, technological process management, providing network operational planning of economic activities, and organizing and controlling the operation of the digital economic data network system, as well as a set of personal qualities that encompass the individual characteristics providing for effective assimilation and updating of experience in the use of digital content.

Analysis of publications allows us to highlight some general approaches to the provision of pedagogical conditions for the development of the DC of future professionals in the economic sphere:

- formation of the motivational-value mechanism of students' mastery of the components of DC, the development of their economic culture (López-Meneses et al., 2020);
- development of models for the management of the content of education based on a comprehensive pedagogical process of DC formation (López-Meneses et al., 2020);
- introduction of computer-oriented systems for organizing economic training (Bashkireva et al., 2020);
- application of modern pedagogical technologies in the formation of DC (Tuomi et al., 2018);
- introduction of student scientific research projects in the sphere of economic education (Ilomäki et al., 2016);
- activation of practice-oriented economic training of future specialists in economics in production settings (Razinkina et al., 2021).

The organization of the educational process based on models of educational management is presented in studies (Morozova, Stepanov, 2016; Kozhevnikova, 2019). Substantiation for using business intelligence platforms as a way to improve the quality of professional training of future economic specialists is given in (Sergeev i dr., 2012; Gorbacheva et al., 2020; Kotlyarova, Shumskaya, 2020).

However, outside the attention of researchers remain some important theoretical and methodological aspects of the formation of DC in the mentioned category of specialists by means of electronic means of pedagogical technology on the basis of models of educational management in higher education institutions using specific business intelligence platforms.

Thus, the goal of the present paper is to give substantiation for the process of forming the DC of future economists and to develop the corresponding pedagogical technology based on the management of students' learning and creative activities with the use of the electronic resource "Oracle" as part of distance learning.

Research objectives:

1. to determine the most promising info-digital resource (IDR) for the formation of the DC of future specialists in economics;
2. to conduct an experimental study to perform a comparative analysis of the formation of DC components among specialists in the sphere of economics under the model of an IDR and in the traditional learning system;
3. to obtain results on the level of effectiveness of distance learning in accordance with the IDR model.

Research hypothesis: the effectiveness of the organization of the educational process by the model of educational management with the use of an info-digital electronic resource (business intelligence platform) is much higher than in the traditional distance learning system.

3. Methods

The objectives of fostering the DC of future specialists and improving the QE in the modern pedagogical space overall can only be achieved with comprehensive introduction of ICT and the corresponding ESP.

The approximate set of qualitative and quantitative research methods deployed to achieve the purpose of the study is as follows. The main qualitative data collection method is the document analysis method, which enables the use of the quantitative methods (expert survey, pedagogical experiment) to compare different electronic portals and select the one most promising for implementation in the learning process of future economists.

The first stage of the study involved analysis of literature covering approaches to the category of "QE", the development of DC, and identification of the component structure of DC in future specialists in economics. Proceeding from the literature analysis, we selected the existing electronic portals (four business intelligence platforms) that served the general didactic functions of organizing a digital learning environment and provided for the development of future specialists' DC.

At the second stage of the study, an expert survey was conducted, asking the respondents to voluntarily give an operational and subjective assessment on a five-point scale proposed for the comparison of electronic portals.

The criteria set for the selection of experts included experience in using information technology in higher education, as well as the duration of this experience for at least 5 years.

The survey sample consisted of 35 experts: 12 male employees of IT companies (aged 29-35 years old) and 23 employees of Russian universities (13 men aged 31-42 years old and 10 women aged 30-37 years old). In this way, we attempted to ensure the greatest variability of the sample in terms of the experts' occupation, sex, age, and work experience (Table 1).

Table 1. Profile of the sample of experts

Expert	Age	Organization
EM-1	34	Saint Petersburg Mining University
EM-2	40	Saint Petersburg Mining University
EM-3	31	Saint Petersburg Mining University
EM-4	35	State University of Humanities and Technology
EM-5	42	State University of Humanities and Technology
EM-6	38	State University of Humanities and Technology
EM-7	40	Moscow Aviation Institute
EM-8	41	Moscow Aviation Institute
EM-9	37	Moscow Aviation Institute
EM-10	42	Moscow Aviation Institute
EM-11	39	Moscow Polytechnic University
EM-12	37	Moscow Polytechnic University
EM-13	36	Moscow Polytechnic University
EM-14	30	IT company
EM-15	29	IT company
EM-16	31	IT company
EM-17	35	IT company
EM-18	32	IT company
EM-19	33	IT company
EM-20	34	IT company
EM-21	36	IT company
EM-22	29	IT company
EM-23	30	IT company
EM-24	36	IT company
EM-25	30	IT company
EF-1	37	Saint Petersburg Mining University
EF-2	30	Saint Petersburg Mining University
EF-3	31	State University of Humanities and Technology
EF-4	35	State University of Humanities and Technology
EF-5	32	State University of Humanities and Technology
EF-6	33	Moscow Aviation Institute
EF-7	37	Moscow Aviation Institute
EF-8	36	Moscow Polytechnic University
EF-9	38	Moscow Polytechnic University
EF-10	30	Moscow Polytechnic University

At the third stage of the study, a pedagogical experiment was conducted in order to analyze the development of DC components in economics professionals under the model of the IDR and the traditional training system (TLS). The results of the pedagogical experiment are used to derive conclusions on the effectiveness of organizing the educational process based on the model of educational management using the info-digital electronic resource.

The pedagogical experiment was conducted on a total of 120 students from the Saint Petersburg Mining University, State University of Humanities and Technology, Moscow Aviation Institute, and Moscow Polytechnic University studying "Management" and "Economics" specialties based on the example of disciplines designed to form the DC of future specialists at the bachelor's and master's levels of education. Characteristics of the sample of students recruited for the pedagogical experiment are provided in Table 2.

Table 2. Sample characteristics

Specialty	Sex		Year of study		
	Male	Female	III	IV	V
Management	26	35	26	21	14
Economics	32	27	25	22	12

The pedagogical experiment was organized according to the classical technological structure with the allocation of control and experimental groups based on already existing academic student groups and includes the ascertaining, formative, and control stages. The experimental groups were taught according to the pedagogical model with the use of the IDR, and the control groups studied according to the TLS.

In our study, the quality of professional training is understood as compliance of learning outcomes with the established learning objectives (formation of DC).

The criteria for the quality of professional training of students in the economic profile were the motivational-value, cognitive, activity, and personality development components of DC of future professionals.

During the mathematical processing of the results of the study, the components of DC of future specialists were evaluated on a 100-point scale.

The reliability of differences between the results of students in the experimental and control groups was assessed by Student's t-test for independent samples.

The basis for using Student's t-test was: the correspondence of the frequency distribution of data in the experimental and control groups to the normal distribution law (estimated using the Shapiro-Wilk W-test); the absence of a statistically significant difference between the variances of the experimental and control groups (the homogeneity of the variances was assessed using the Fisher F-test); the presence of the number of observations in the experimental and control groups more than 20.

4. Results

In view of the fact that the market offers more than two dozen educational platforms, based on the analysis of analytical research (Hillman et al., 2020; James, 2014; Sabanovic, Søilen, 2012), we selected four business intelligence platforms that could be used to train future economists to compare their characteristics: Tableau, Oracle, MicroStrategy, and IBM Cognos.

The results of the comparative expert analysis of the selected IDRs are presented in Table 3.

Table 3. Comparative analysis of the platforms

Comparison criterion	Tableau	Oracle	MicroStrategy	IBM Cognos
Expert performance assessment on a five-point scale				
Technical support	5	5	4	3
Scalability	4	5	4	4
Support for Big Data	5	4	4	4
Client access	5	5	5	5

Interface	4	4	2	4
Integrability	5	4	4	4
Visualization	4	5	3	4
Modeling and analytics	4	5	4	3
Administration	5	5	3	4
Build environment	4	5	4	3
Subjective expert assessment on a five-point scale				
Cost-effectiveness of introduction	4	5	4	3
Prospects of implementation	5	5	4	3
Complexity of the system	4	4	4	4

Note: compiled on the basis of the expert survey

As a result of the comparative analysis of the business intelligence platforms included in the initial list, the "Oracle" platform was chosen for the pedagogical experiment.

Table 4 presents the results of the comparative analysis of the development of DC in economics specialists through the model of the "Oracle" IDR and the TLS.

Table 4. Analysis of the development of DC components among economics professionals using the Oracle IDR and the TLS

Academic discipline	Assessment of the components of DC of future specialists on a 100-point scale							
	Motivational-value component (MVC), in points		Cognitive component (CC), in points		Activity component (AC), in points		Personality development component (PDC), in points	
	IDR	TLS	IDR	TLS	IDR	TLS	IDR	TLS
Information systems and technologies	95	78	92	81	91	80	96	80
Economic cybernetics	93	81	90	78	88	73	95	82
Economic and mathematical modeling	94	80	89	76	88	77	92	75
Information systems in economics	92	79	88	73	87	75	93	78
Mean score	93.5	79.5	89.75	77	88.5	76.25	94	78.75
Effectiveness of the pedagogical model of PTC, %	17.6		16.6		16.1		19.4	
Overall effectiveness, %	17.5							

The results of the pedagogical experiment show that the proposed IDR model is significantly more effective than TLS. Specifically, improvement in the level of specialist training is detected across all components of future specialists' DC: a 17.6 % increase in the motivational-value component; a 16.6 % increase in the cognitive component; a 16.1 % increase in the activity component; a 19.4 % increase in the personality development component.

Statistical analysis of the reliability of differences by Student's t-test for students trained according to the model of the "Oracle" IDR and the traditional learning system confirm the higher results of students trained by the "Oracle" model ($tEmp = 3.9$; $p \leq 0.01$).

5. Discussion

As evidenced by scientific research (Knight, Yorke, 2003; Glazunova et al., 2021), current curricula of professional disciplines in IT double the volume of information support for business processes in all companies every two years. M. Gisbert and colleagues give a number of projections for the development of digital content of the educational management system until 2025, justifying that by 2025, more than fifty billion devices will be connected to the Internet, and 90 % of teachers will use digital learning tools (Gisbert et al., 2016).

In the meantime, our findings demonstrate that the introduction of key technological aspects of using the electronic resources of the "Oracle" corporation portal in teaching economics students results in the activation of students' learning activities, enhancement of their creative abilities, and the acquisition of the skills of independent search and use of modern digital resources for solving economic problems on the example of modeling of production situations.

To make the opportunities for the use of the proposed solutions more understandable, we need to clarify the technological sequence of the use of the "Oracle" educational product in our experimental study. It is reasonable for students to first explore the applications of technology that help bring about technological change (transformational technology). This requires an introduction to entry-level materials, which include illustrative and practical materials based on the case method.

In order to cultivate students' research skills, it is recommended to use problem situations that require analytical evaluation (Tuomi et al., 2018). Later on, students can attempt to work independently with some products of the corporation, such as "Oracle" Always Free cloud services. Students who are looking to advance their knowledge and skills in this digital content sphere can be offered other "Oracle" learning tools.

Proceeding from the results of the study, we assert that in order to improve the quality of economic education in the conditions of digitalization, it is advisable to develop an interactive pedagogical system that would embody the concept of managing students' learning and creative activities during distance learning in the system "digital educational complex – student – teacher" (Krause, 2012).

According to our findings, the main directions for solving this problem lie in the digitalization of the pedagogical system of the university through the implementation of the following measures:

1) designing and organizing a digital educational environment based on a single Internet resource for online communication interactive mode (Petrova, Scherbik, 2018);

2) creating an online educational platform for educational management (Petrova, Scherbik, 2018) based on the "Oracle" IDR;

3) creating electronic distance learning complexes (DLC) in "Oracle" IDR based on the development of electronic textbooks, teaching aids, recommendations for students' independent work in the digital system;

4) creating a digital diagnostic complex (Cirdan, 2019) on the basis of "Oracle" IDR and designing an electronic base of remote control (electronic logs of class attendance, records of independent and individual work, knowledge testing (current, interim, final);

5) developing the legal framework for distance learning in the context of digitalization of pedagogical processes (Cirdan, 2019).

Realization of the proposed measures requires high decentralization of pedagogical influence and a structure of the didactic process that would allow students to add to the information subsystem some elements of self-planning, self-organization, and self-control in accordance with the objectives of digital training (Chumaceiro Hernandez et al., 2022). In this, the functions of the teacher need to change considerably. The teacher has to become a facilitator who ensures effective educational online communication in the "Oracle" IDR.

6. Conclusion

Analysis of the experimental results confirms the hypothesis that the effectiveness of the organization of the educational process based on the model of educational management using an info-digital electronic resource (business intelligence platform) is much higher than with the traditional distance learning system. The proposed educational management model provides for online management of the educational process, which determines the high level of development of DC in future specialists in economics. The overall effectiveness of the educational process of DC

development in economic specialists under the model of the IDR "Oracle" is 17.5 % higher compared to the traditional learning system.

The article has methodological limitations in view of the fact that there was no probabilistic selection of subjects for the control and experimental groups.

The obtained results suggest the following direction for further scientific and pedagogical research in this area: the development of electronic information systems of educational and methodological support for the formation of DC in future economic specialists; integration of educational electronic resources by "Oracle" and pedagogical SMART-technology in the educational process of development of the components DC in specialists in the economic profile.

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