Model of using cloud-based environment in training databases of future IT specialists

Olha V. Korotun[1][0000-0003-2240-7891], Tetiana A. Vakaliuk[1][0000-0001-6825-4697] and
Vladimir N. Soloviev[2][0000-0002-4945-202X]

[1] Zhytomyr Polytechnic State University, 103 Chudnivska Str., Zhytomyr, 10005, Ukraine
`olgavl.korotun@gmail.com, tetianavakaliuk@gmail.com`
[2] Kryvyi Rih State Pedagogical University, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine
`vnsoloviev2016@gmail.com`

Abstract. The authors substantiates and develops the model of using cloud-based environment (CBE) in the training of databases of future information technology (IT) specialists, which consists of interrelated units: target (purpose, task of using CBE), conceptual (pedagogical approaches, didactic principles), organizational and semantic (characteristics of CBE, basic requirements for CBE, subjects of training, CBE of the teacher, CBE of the student, curricula of institution of higher education, educational-methodical complex of discipline "Databases", installation and configuration of database management system, development of educational material from the database in electronic form, selection of cloud-based systems of distance learning, introduction of cloud-based systems of distance learning in the training of students' databases, selection of CBE in database training (databases, forms, methods, tools), evaluative (criteria, indicators, levels of professional and practical competence of future IT specialists on the use of CBE in database training), effective (increased formation of the information and communication technologies of future IT specialists on the use of CBE in database training).

Keywords: model, usage, cloud-based environment, database training, future IT specialists.

1   Introduction

1.1   Formulation of the problem

The process of training future IT specialists involves the obligatory study of databases, in which the teacher emphasizes on the features of database technologies so that students understand the basic trends of development of modern databases, advantages, and disadvantages in their use, specifics of work in database management systems data, etc. The acquired knowledge, skills from databases are necessary for future IT specialists in their professional activity.

To increase the efficiency of the educational process in training databases and improve the professional training of future IT specialists, teachers use a cloud-based

environment (CBE). The use of such an environment in the educational process is currently a pressing issue in the theory and methodology of using ICT in education.

The use of CBE in the training of databases of future IT specialists enables the teacher to organize various forms of students' education (full-time, distance, distance, mixed, electronic), to provide the student with educational materials for the discipline, to test theoretical knowledge and practice, student learning outcomes, analyze student learning outcomes, organize an archive of study materials, and more.

1.2   Analysis of recent research and publications

Creating educational environments of domestic educational institutions in their works described Olga V. Bondarenko [1], Olga P. Pinchuk [12], Halyna V. Popova [22], Yevhenii B. Shapovalov [14], Mariia P. Shyshkina [17], Nataliia V. Soroko [18], Oleksandr V. Spivakovskiy [19], Snizhana O. Zelinska [23] and others; the use of a CBE was investigated by Dmytro S. Antoniuk [20], Olena G. Glazunova [5], Oleksandr H. Kolgatin [6], Larysa M. Petrenko [11], Mariya P. Shyshkina [15], and others.

We agree with the opinion of Svitlana H. Lytvynova [8], that the purpose of creating a CBE is to achieve certain didactic goals, to fulfill pedagogical tasks, to unite the subjects of the educational process for effective cooperation, focused on improving the educational results of students by tools of cloud services.

We share the opinion of Mariya P. Shyshkina [8] and Maiia V. Marienko [10], who state that cloud services are used to provide the user with electronic educational resources that make up a meaningful content of a CBE, as well as to provide creative and delivery processes educational services.

The learning environment, as noted by Valerii Yu. Bykov is an artificially constructed system whose structure and components contribute to the achievement of the goals of the educational process [2]. Vitalii V. Lapinskyi states that it is the set of material objects and the links between them that form a system designed to support the learning activities of the subjects of learning [7].

Valerii Yu. Bykov also considers such a concept as a cloud-based educational and scientific environment, in which he understands the ICT environment of a higher education institution, in which certain didactic functions, as well as some fundamentally important functions of scientific research, provide for the appropriate coordinated and integrated use and cloud computing technologies [4].

Based on the analysis of the source database, the cloud-based environment in training database at higher education institutions (HEI), we understand the HEI learning environment, which envisages the use of cloud computing technology to ensure a level playing field, educational interaction, and cooperation between subjects (teacher and students) database training activities.

The development of cloud computing has led to the emergence of new cloud-based ICT and has influenced the training tools of future IT teachers. The use of cloud-based tools facilitates the formation of CBE in higher education institutions and opens the way to individualization of learning, interactive interaction and active collaboration between participants in the educational process, and allows the use of the CBE in training databases.

Using training, we mean a set of objects, ideas, phenomena, and methods of action that ensure the implementation of the educational process.

As for cloud-based tools, we mean such training tools implemented by cloud technologies [21].

The **purpose** of the article is to develop a model of using CBE in training databases of future IT specialists.

2   Methods of the study

Methods of research:

— analysis, classification, summarization psycho-educational, specialized and technical literature on creating a model of cloud-based environment training of higher education institution to isolate the priority areas of research, defining the essence of basic concepts of research;
— method of specifying and systematization of theoretical knowledge for the development objectives of the study;
— modeling – to develop and represent a theoretical model: models of using CBE in training databases of future IT specialists.

3   Results

Simulation is an indispensable part of pedagogical research, which is used to describe and study various processes, including information, innovations, properties, as well as patterns of development of the educational system, educational environments, etc. [13].

We agree with Valerii Yu. Bykov's opinion [3] that a model is a representation (analog, image) of a system that is designed and reflects the features and properties of this system that ensure the achievement of the goals of model construction and use.

Adherence to the system approach allowed us to develop a model of using the CBE in the training of databases of future IT specialists, which consists of the following units: target, conceptual, technological, organizational-meaningful, evaluative, and effective (Fig. 1). Let us consider separately each unit of the presented model.

The target unit identified a goal, namely, to increase the level of professional and practical competence of future IT specialists to use the CBE in the training of databases. The tasks of using a CBE in training databases of future IT specialists are to use a CBE in training databases; improving the educational and methodological complex of the discipline "Databases".

The training of students in the discipline of "Databases" using a CBE is based on several didactic principles and methodological approaches presented in the conceptual unit.

Learning in a CBE relies on methodological approaches:

System – defines the process of formation of the CBE in training databases as a coherent system;
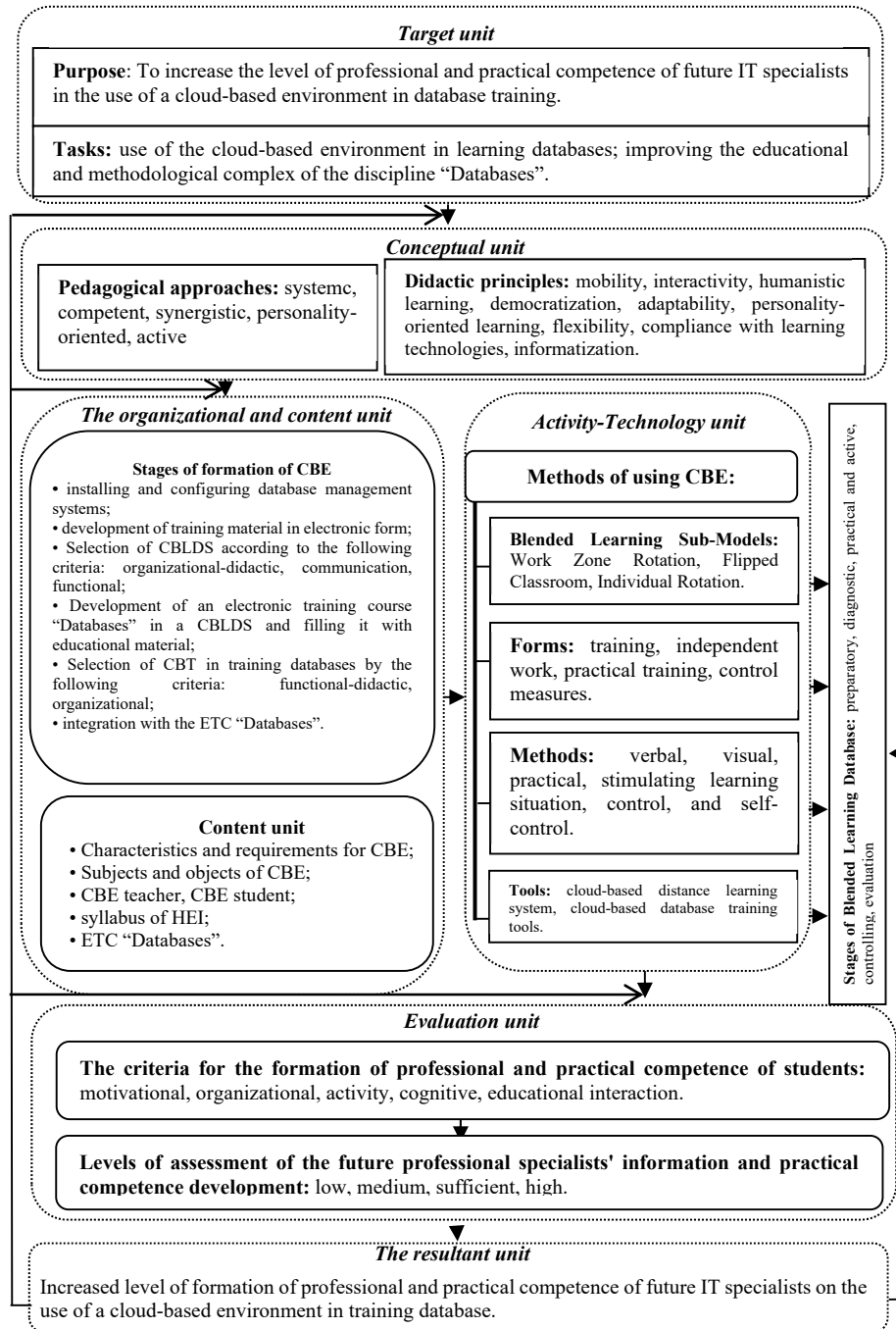
Target unit

Purpose: To increase the level of professional and practical competence of future IT specialists in the use of a cloud-based environment in database training.

Tasks: use of the cloud-based environment in learning databases; improving the educational and methodological complex of the discipline "Databases".

Conceptual unit

Pedagogical approaches: systemc, competent, synergistic, personality-oriented, active

Didactic principles: mobility, interactivity, humanistic learning, democratization, adaptability, personality-oriented learning, flexibility, compliance with learning technologies, informatization.

The organizational and content unit

Stages of formation of CBE
• installing and configuring database management systems;
• development of training material in electronic form;
• Selection of CBLDS according to the following criteria: organizational-didactic, communication, functional;
• Development of an electronic training course "Databases" in a CBLDS and filling it with educational material;
• Selection of CBT in training databases by the following criteria: functional-didactic, organizational;
• integration with the ETC "Databases".

Content unit
• Characteristics and requirements for CBE;
• Subjects and objects of CBE;
• CBE teacher, CBE student;
• syllabus of HEI;
• ETC "Databases".

Activity-Technology unit

Methods of using CBE:

Blended Learning Sub-Models: Work Zone Rotation, Flipped Classroom, Individual Rotation.

Forms: training, independent work, practical training, control measures.

Methods: verbal, visual, practical, stimulating learning situation, control, and self-control.

Tools: cloud-based distance learning system, cloud-based database training tools.

Stages of Blended Learning Database: preparatory, diagnostic, practical and active, controlling, evaluation

Evaluation unit

The criteria for the formation of professional and practical competence of students: motivational, organizational, activity, cognitive, educational interaction.

Levels of assessment of the future professional specialists' information and practical competence development: low, medium, sufficient, high.

The resultant unit

Increased level of formation of professional and practical competence of future IT specialists on the use of a cloud-based environment in training database.

Fig. 1. Model of using CBE in training databases of future IT specialists

Competent – involves increasing the level of professional and practical competence of future IT specialists in the course "Databases", which is manifested in the following features: understanding of the principles of construction and operation of different databases models, the procedure for creating databases using databases management systems, principles ensuring the security and demarcation of databases access rights in Databases Management Systems (DBMS); able to develop relational databases, create tables, forms, reports, queries in DBMS; ability to make rational use of cloud-based distance training systems to solve personal and professional problems;

Synergistic – orient the student to self-organization and self-development;

Personality-oriented – takes into account individual features defines each student as his/her main subject of study to create favorable learning conditions for him/her;

Activity – determines the focus on the organization of active educational, cognitive, independent, and communicative activities for the formation of professional and practical competence of a future IT specialist.

Consider the didactic principles of using a CBE, aimed at meeting the personal educational needs of future IT specialists as a subject of study and suggest the use of cloud-based learning tools:

- Mobility – providing the student with access to communication and collaboration tools regardless of time and place of residence;
- Interactivity – reflects the communicative interaction in a CBE of teachers with students in synchronous and asynchronous modes;
- Humanistic education – creation for the student in a CBE of the most favorable and convenient conditions for obtaining a chosen profession, reorientation of the educational process to his personality;
- Democratization – tools the distribution of rights, powers, and responsibilities among participants in the educational process in a CBE;
- Adaptability – involves the adaptation of the educational process in a CBE to the cognitive characteristics of each student;
- Person-centered learning – the realization that a student in a CBE is a person with his or her own experience and stock of knowledge and skills, the use of which leads to the best results in learning and the educational needs of each student;
- The principle of the flexibility of learning – a student in a CBE can absorb the learning material at a convenient time and place, at the right pace;
- Conformity to learning technologies – use of forms, methods, learning tools that are implemented only in a CBE;
- Informatization is the access of students and teachers to the tools of modern ICT.

The organizational and content units of using a CBE are the stages of the formation of such an environment and its content component. The stages of formation include the installation and configuration of DBMS, the development of educational material with databases in electronic form, the selection of cloud-based systems of distance learning, the introduction of cloud-based systems of distance learning in the training of student databases, the selection of cloud-based databases, integration into the e-learning complex "Databases". Content component – characteristics and requirements for CBE, subjects, and objects of the CBE, cloud-based teacher environment (Fig. 3) and CBE

of the future IT specialist (Fig. 2), educational plans education, an educational-methodical complex of discipline "Databases", electronic training complex (ETC) "Databases".

The technology unit reflects the use of the CBE in the educational process of the discipline "Databases", organized in a blended form, so it consists of sub-models of blended learning. Also in this unit, the teacher selects traditional forms of organization, methods, and learning tools that can only be implemented in a CBE to achieve didactic goals. The evaluation unit contains criteria for assessing the level of professional competence of future IT specialists regarding the use of the CBE in Database training. Assessment of the level of formation of the specified competence of future IT specialists is performed according to certain criteria, indicators, and levels.

Resulting unit – the result of the model implementation is to increase the level of professional and practical competence of future IT specialists on the use of the CBE in Database training.

Therefore, the CBE model in Databases training consists of the six units described above and is a prerequisite for its effective implementation into the educational process of future IT specialists.

The use of CBE in training databases provides support for new modern trends in the educational process; openness and accessibility of training for all subjects; confidentiality; efficiency, the flexibility of learning; determining the level of academic achievement of students; communicative interaction and effective cooperation between the subjects of study; rapid dissemination of educational material; formation of an individual trajectory of learning, as well as, encourages students to independent and active educational and cognitive activity, promotes self-development and increase interest in learning using modern ICT.

Formation, implementation, and use of the CBE in the training of databases of future IT specialists in higher education institutions should be carried out to achieve the didactic goals and meet the educational needs of all subjects, according to the following characteristics:

— Individualization of learning. The teacher, taking into account the individual characteristics of each student during the study of databases, uses the possibilities of a CBE to increase the motivation for learning, the level of educational training (some students in the school course of computer science did not study databases, some had difficulties in learning this topic, and some successfully studied it and participated in school competitions and competitions in which it was necessary to use knowledge of databases), the speed of perception of educational material, the implementation of group activities hone in carrying out group projects, etc.;

— Optimizing learning in a CBE. The teacher provides an appropriate set of modern methods and training tools for databases in a CBE for best results. Optimization of study of the specified discipline implies an increase of efficiency of training and success of results of students at the minimum expenditure of time and forces of subjects of study, and the results of education of students correspond to program results of training of discipline "Databases";
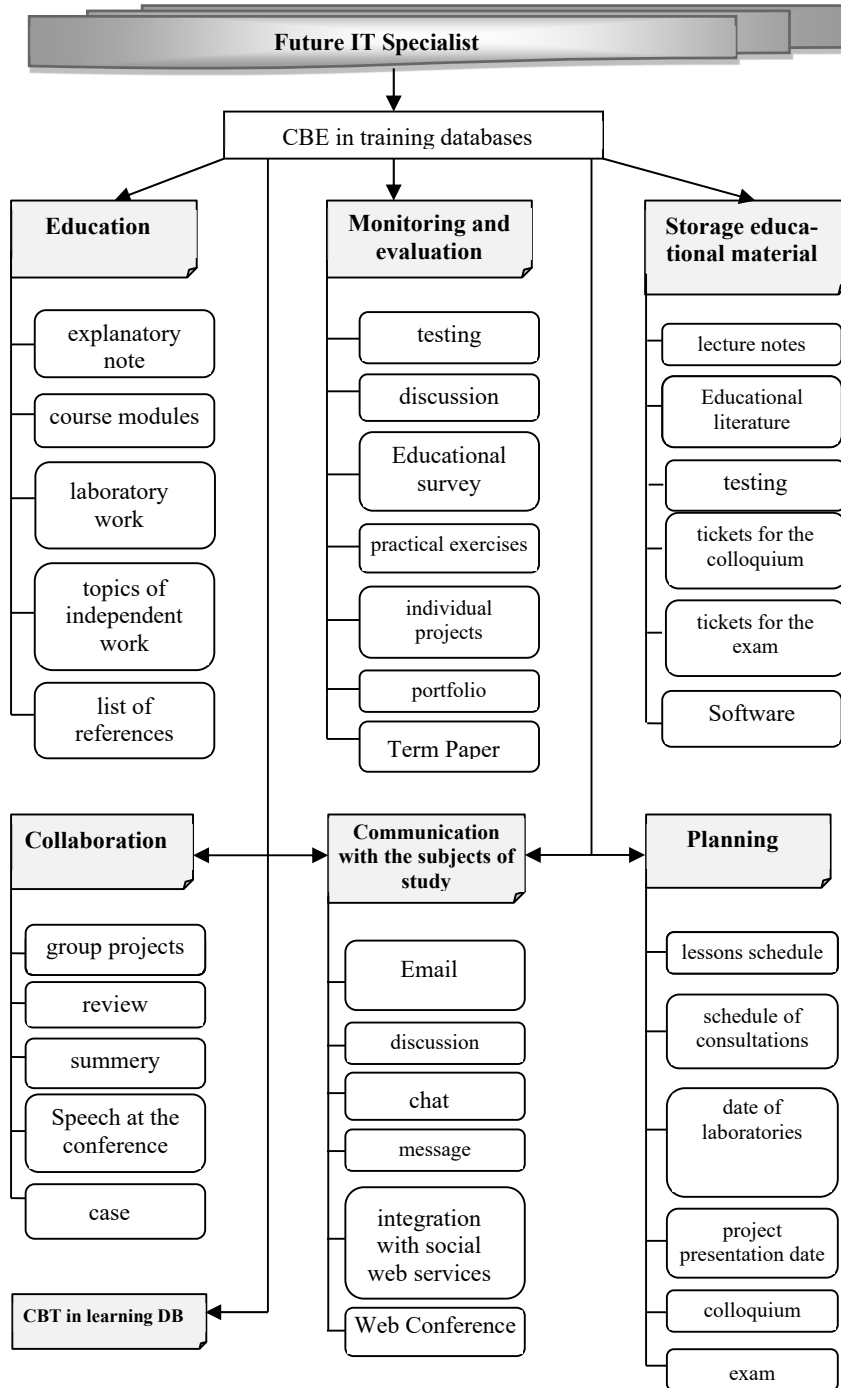
Future IT Specialist

CBE in training databases

Education

- explanatory note
- course modules
- laboratory work
- topics of independent work
- list of references

Monitoring and evaluation

- testing
- discussion
- Educational survey
- practical exercises
- individual projects
- portfolio
- Term Paper

Storage educational material

- lecture notes
- Educational literature
- testing
- tickets for the colloquium
- tickets for the exam
- Software

Collaboration

- group projects
- review
- summery
- Speech at the conference
- case

Communication with the subjects of study

- Email
- discussion
- chat
- message
- integration with social web services
- Web Conference

Planning

- lessons schedule
- schedule of consultations
- date of laboratories
- project presentation date
- colloquium
- exam

CBT in learning DB

Fig. 2. Structure of the CBE of the future information technology specialist in database training
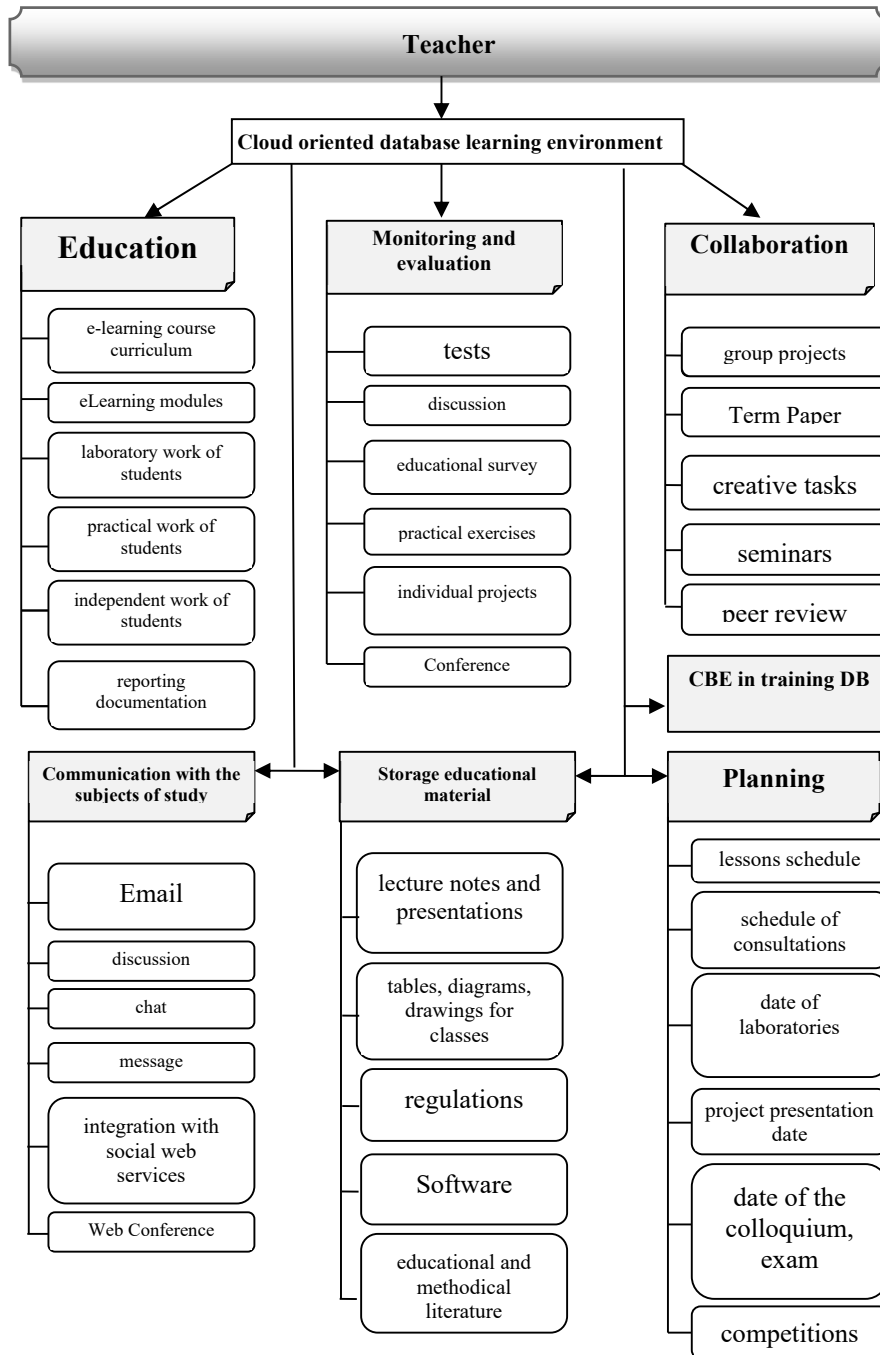
Fig. 3. Structure of cloud-based teacher environment in training databases

— creation and placement by the teacher of their course on databases in a CBE, which includes the author's development of lectures, practical and laboratory works, control works, etc.;
— rapid dissemination of educational material from databases in electronic format in various formats through cloud repositories, prompt notification of this to students and their access to materials regardless of location, time of stay from any computer-oriented medium;
— self-assessment of students' knowledge in a CBE to check their current learning outcomes from databases based on tests, practical exercises after studying a specific content module;
— convenient communication of the teacher with the future IT specialists: remote consultations in synchronous and asynchronous modes (both from the teacher and classmates) on the issues arising during the study of training material from databases;
— conducting group research in a CBE, when students perform such research in real-time, evaluate the performance of each group member. The teacher completely controls the process of such work, if necessary, may express comments, wishes, etc.;
— convenient cloud-based tools for learning databases.

4   Conclusions

The use of the CBE in the training of databases of future IT specialists s is advisable to implement based on a specially developed model consisting of the following units: target, conceptual, organizational-content, activity-technological, evaluative, and effective. The result of the application of the proposed model is to increase the level of professional and practical competence of future IT specialists in the use of CBE in databases training, which tools the confirmed ability of the future IT specialist to implement the professional activity in the field of databases practical skills, attitudes, personal qualities and experience that he has acquired while learning databases in a cloud-based environment.

The performed research does not claim to be a definitive solution to the problem of using a CBE in training databases of future IT specialists. The analysis of its results outlined the following areas of further research: the use of cloud services for the formation and development of professional competencies of future IT specialists.

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