Development of an Information System for Accounting for the Level of Training of Future Specialists in the Field of Information Technology

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Abstract
The article is devoted to the design and development of an information system for preserving the results of testing to verify the residual knowledge of students of the resource for training specialists in information and communication technologies. The purpose of the study is to provide a scientific justification for the problem of developing professional training of specialists in information and communication technologies in the process of using an information system to save test results to verify students' residual knowledge and to verify the effectiveness of its implementation in universities. According to the results of the experiment, it can be argued that the introduction of an information system to preserve the results of testing to test students' residual knowledge in the educational process contributes to the professional training of specialists in information and communication technologies at the universities of Ukraine. The practice of development and use of modern information technologies focused on the implementation of psychological and pedagogical goals of teaching and education is fundamentally new mediated by modern technical and technological innovations.

Keywords:
Software Product, Information System, Specialist, Information and Communication Technologies.

1. Introduction

At the present stage of development of the higher education system, the issue of the quality of education of future information technology specialists, the understanding of which includes not only professional knowledge, but also the ability and willingness to apply them in professional activities, becomes especially relevant. An important indicator of the quality of training at the university is the strength of the assimilation of educational material by students. In this regard, the work of researchers and practical developers on the design and implementation of an information system is necessary to preserve the results of testing to verify the residual knowledge of future information technology professionals.

In modern researches of domestic and foreign scientists the analysis of process of preparation of experts in information technologies is constantly carried out. Numerous investigations devoted to the formation of professional competence of future specialists in information technology in universities, testify to the increased interest of scientists in this problem. At the same time, the analysis of scientific and pedagogical literature proves that the formation of professional competence of future specialists in information technology in pedagogical science has not become the subject of special comprehensive work. In particular, it needs to develop and implement educational and methodological support, which aims to increase the level of formation of students' professional competence in the chosen field. Problems of formation of professional competence of future specialists of different specialties in the field of

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knowledge «Information Technologies» were studied by [13; 19; 21; 14; 17; 24; 2-4; 8-9].

Of particular note is the analysis of the work of foreign scholars, among the results of which should be singled out [20], who considers the use of information technology to improve the training of future IT professionals. The consequences of the application of modern learning technologies mediated by the development of information technologies in the education system are investigated by [12]. [23] considers methodical aspects of training of specialists in information technologies in higher education institutions. [1] scientific works are devoted to the problems of analysis of the process of standardization of information competencies in higher education institutions at the state level. [10] study the problems of development and research of the model of formation of professional competencies of future specialists with the use of information technologies in the context of improving the quality of education.

The problem of improving the training of information technology specialists in terms of modifying the information educational space and increasing the level of development of innovative technologies, including interactive resources, information systems is urgent today and requires a comprehensive analysis.

2. Materials and methods

The aim of the study is to design and develop an information system to preserve the results of testing to test the residual knowledge of students and test the effectiveness of its implementation in universities.

The set goal defined the tasks: to analyze the current problems of professional training of information technology specialists; perform design and develop an information system to store test results to test students' residual knowledge; identify further areas for improving the training of future information technology professionals.

To test the level of training of bachelors in information technology at universities, namely residual knowledge, starting in 2019, it was proposed to conduct testing using the developed resource, which implements them: providing remote consultations, organizing forums and chats on the most complex issues of curricula; conducting automated input control, interactive lectures and laboratory work, testing and questioning, etc. Approbation in the educational process of the developed resource was used during the study of various disciplines studied in all courses during the bachelor's degree. Experimental work was organized during 2019–2021 in three stages of scientific and pedagogical search (preparatory, ascertaining and formative). The experiment involved 740 students (KG – 368, EG – 372), 26 teachers of free economic education, who train students majoring in 122 «Computer Science» from University of Ucoopspilka «Poltava University of Economics and Trade», National University «Poltava Polytechnic named after Yuri Kondratyuk». The experimental and control groups were tested for the presence or absence of statistically significant differences between them using the Pearson test. At the beginning of the experiment, it was found that the differences between the study groups were statistically insignificant.

Among the research methods used in the experiment are as follows: theoretical – analysis of pedagogical, educational and methodical literature on the topic, synthesis, comparison and comparison, induction and deduction, analogy, generalization, formalization, design and forecasting; empirical – conversation, testing, focus group interviews, narrative method, pedagogical observation, graphic methods, pedagogical experiment to test the effectiveness of the system; methods of mathematical statistics – for statistical processing of experimental research data.

3. Results and Discussion

The study and generalization of the processes of reforming higher IT education, scientific sources and pedagogical practice of forming the professional competence of future information technology specialists served as a basis for fixing a number of problems that need to be urgently addressed. If we consider this issue in the context of the social order, there are contradictions between the needs of employers in the implementation of acquired knowledge and skills in information technology in universities at the present stage of European integration of Ukraine and the level of professional competence of future professionals.

Attention should also be paid to the requirements for organizational, methodological and

software for the formation of professional competence of future specialists in information technology and insufficient elaboration of theoretical and practical aspects of their implementation in the information educational environment of universities. Examining this issue in the context of pedagogical science, it is impossible not to notice some contradictions between the objective need to build a sound system of professional competence of future specialists in information technology universities and the lack of developed theoretical and methodological foundations of the problem.

Regarding the analysis of the problem in the context of pedagogical practice, it is necessary to emphasize the need to modernize information technology support of universities, despite the lack of educational and methodological developments for the formation of professional competence of future IT professionals in the educational process of universities. There is also a need to use the latest information technology in the process of interactive pedagogical support for higher education, although there is a lack of their use in the formation of professional competence of future professionals in information technology.

In today's conditions there are a number of contradictions directly related to the level of informatization and technologicalization of professional training of future specialists in information technology, and between the need for constant access to electronic educational and information-consulting interactive resources and educational complexes of universities and insufficient level of their development. and use.

Today, as never before, we should focus on the practice-oriented component of professional training of students in the field of knowledge «Information Technology», which is aimed at continuous practical training, continuous process of building professional knowledge, development of future information and communication technology interest in future professional activity in the modern information society through the implementation of educational work and cooperation with representatives of this field of knowledge. The integrative approach involves the formation of professional competence of students through the integration of knowledge of professional disciplines included in the curricula for future training of future specialists in information and communication technologies; updating the content of certain professional disciplines, which are closely related to the problem of forming the professional competence of future specialists in information and communication technologies; development of new courses for purposeful influence on the formation of professional competence. Formation of readiness for future professional activity directly depends on the quality and quantity of knowledge, skills and abilities of the student. A graduate of a higher education institution, having acquired knowledge in the field of information and communication technologies and completed the educational program, must have a certain system of knowledge, skills and abilities, have a high level of professional competence as one of the leading components for professional activity in modern information educational environment.

Residual knowledge means «a certain amount of information related to educational standards, curricula and programs, which is stored in the student's long-term memory at a fixed point in time and under the influence of appropriate incentives can be used by him in educational and professional activities». The main technology for measuring residual knowledge is test control, which allows you to quickly and objectively assess the knowledge of a large number of students with minimal resource consumption. Electronic tests can be used to measure the level of residual knowledge of students in academic disciplines [12].

When preparing tests to control residual knowledge, it is advisable to use a criterion-oriented approach, which provides an absolute standard with which to compare the results of each subject, on the basis of which a conclusion is made whether or not learned material [25]. One of the varieties of such tests are subject-oriented tests that allow you to estimate the percentage of the total amount of educational material that has been mastered by the student [15].

The residual knowledge control procedure was conducted annually at the beginning of the autumn semester according to the schedule, for students who did not appear for testing for good reasons, it was possible to pass it at other times. This event allowed to cover the maximum possible number of students with the testing procedure. This procedure should be performed using technical means that are more effective.

That is why the task was set to develop an information system to preserve the results of testing

to verify the residual knowledge of students. The developed system will include a number of modules covering one or another aspect of storage and analysis of test results to verify the residual knowledge of students. So, based on this, define the essence of the future database:

To save evaluation data – two entities «Exam_Grades» and «Test_Grades». The first is responsible for storing data on students' grades in the exam for the past year. The second is responsible for maintaining data on students' grades in residual knowledge testing.

To save data about students, the essence of «Students» corresponds. The entity «Subjects» corresponds to save data about objects.

The essence of «Deterioration» corresponds to the preservation of data on the classification of deterioration of students' grades. The essence «Exam_Grades» contains data on student grades for the last year and has the following attributes: ID – ID of the grade on the exam, has the type bigint, is the primary key, can not be NULL; SubjectID – the identifier of the object, has the type bigint, is the primary key, can not be NULL; Grade – exam grade, has type int, cannot be NULL; StudentID – student ID, has the type bigint, is the primary key, cannot be NULL.

The essence «Test_Grades» contains data on the grades of students for testing to test residual knowledge and has the following attributes: ID – the identifier of the test score, has the type bigint, is the primary key, can not be NULL; SubjectID – the identifier of the object, has the type bigint, is the primary key, can not be NULL; Grade – grade from the test, has type int, cannot be NULL; StudentID – student ID, has the type bigint, is the primary key, cannot be NULL.

The entity «Students» contains data about students and has the following attributes: ID – student ID, has the type bigint, is the primary key, cannot be NULL; Full_Name – Name of the student, has type varchar (50), cannot be NULL; Group_Name – the name of the student group, has the type nchar (10), cannot be NULL.

The entity «Subjects» contains data about objects and has the following attributes: ID – student ID, has the type bigint, is the primary key, cannot be NULL; Name – the name of the object, has the type varchar (50), can not be NULL; Group_Name – Name of the teacher, has type varchar (50), cannot be NULL.

The essence of «Deterioration» contains data on the deterioration of students' grades and has the following attributes: Deterioration_Group – assessment of the deterioration of residual knowledge, has the type nchar (10), can not be NULL; From-Grade – the lowest degree of assessment of the deterioration of residual knowledge, has the type int, can not be NULL; To_Grade – the upper degree of assessment of the deterioration of residual knowledge, has the type int, can not be NULL. Based on the above, the ER-diagram of the developed information system is constructed (Fig. 1).

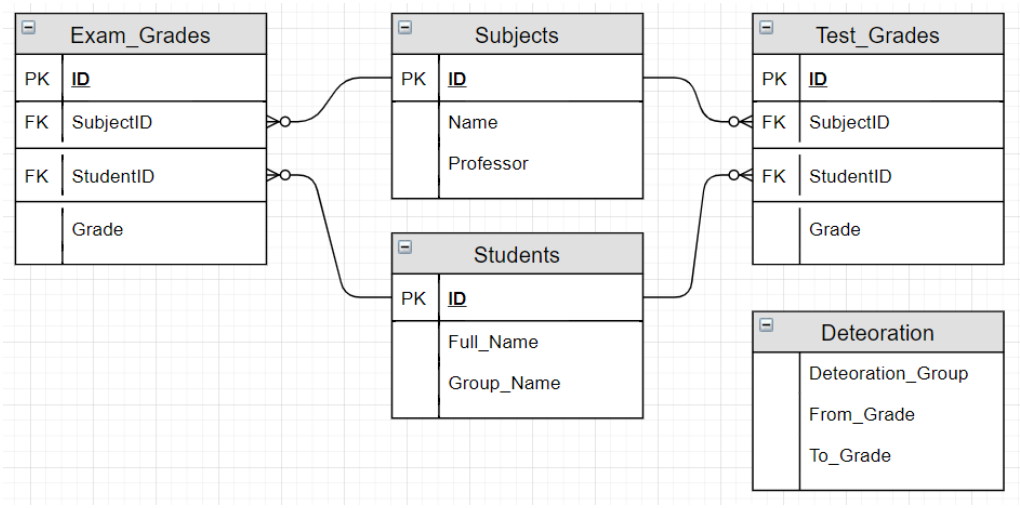


Fig. 1. ER-diagram of the developed information system

The Residual Knowledge database was created using Microsoft SQL Server Management Studio 18. (Fig. 2).

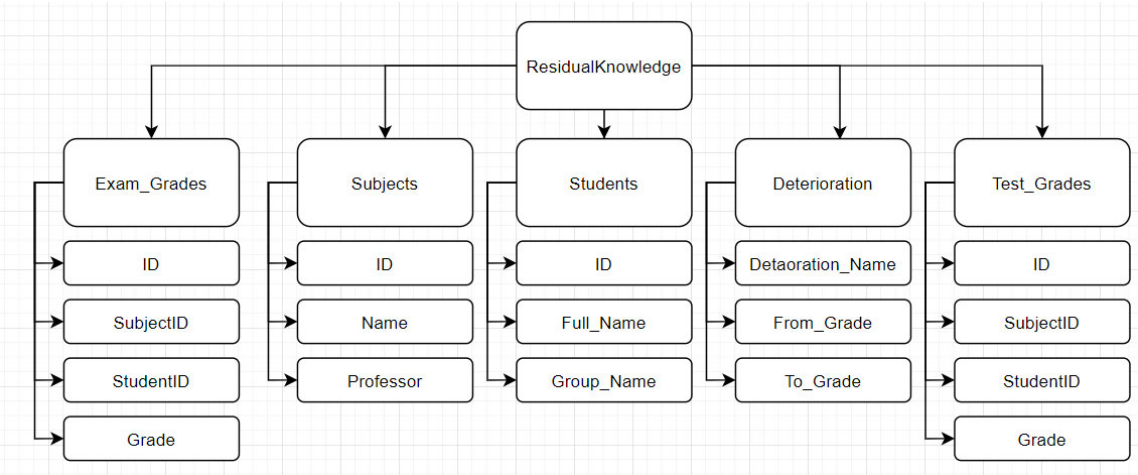


Fig. 2. Database structure

Created tables: Students to save data about students (Fig. 3); Subjects for storing data about objects (Fig. 4); Exam_Grades to save data on students' grades in the exam last year (Fig. 5); Test_Grades to save data on student grades from the test to check the residual knowledge of students (Fig. 6); Deterioration to save data on the classification of deteriorating student grades (Fig. 7). The links between the tables are established (Fig. 8).

ID	bigint	☐
Full_Name	varchar(50)	☐
Group_Name	nchar(10)	☐

Fig. 3. Table Students

Tables were filled in, links between tables were established, and a data diagram with all tables and relationships was checked (Fig. 8).

ID	bigint	☐
Name	varchar(50)	☐
Professor	varchar(50)	☐

Fig. 4. Table Subjects

ID	bigint	☐
SubjectID	bigint	☐
Grade	int	☐
StudentID	bigint	☐

Fig. 5. Exam_Grades table

ID	bigint	☐
SubjectID	bigint	☐
Grade	int	☐
StudentID	bigint	☐

Fig. 6. Test_Grades table

Deterioration_Group	nchar(10)	☐
From_Grade	int	☐
To_Grade	int	☐

Fig. 7. Deterioration table

Tables were filled in, links between tables were established, and a data diagram with all tables and relationships was checked (Fig. 8).

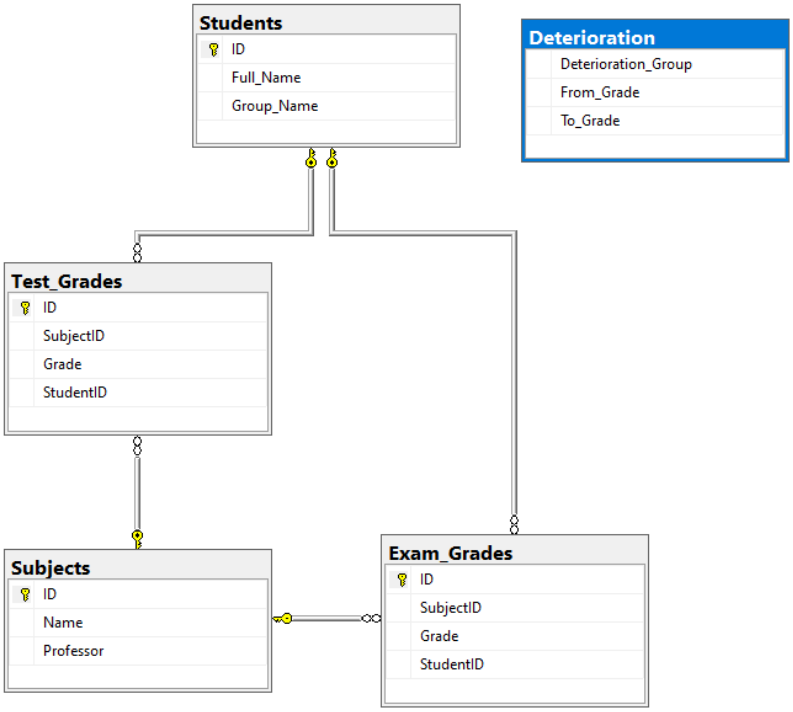
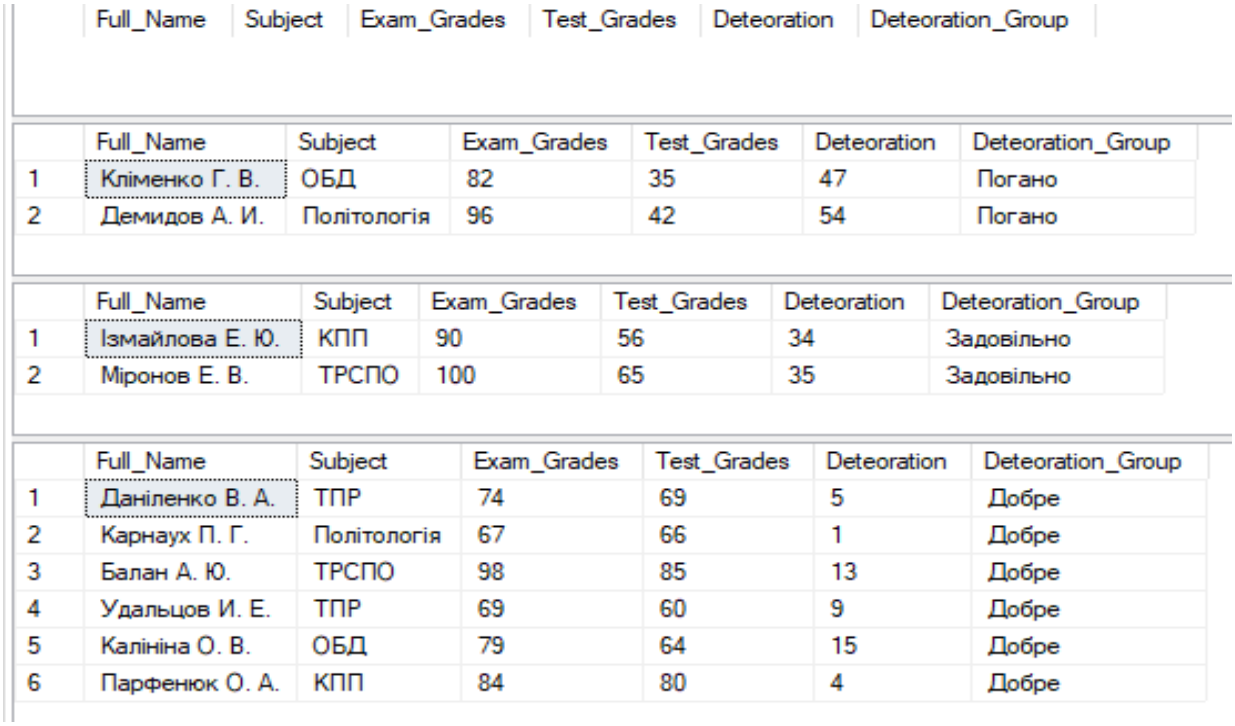


Fig. 8. Data diagram with all tables and relationships

After filling in the table with data, to display the results of the test, we will perform a query that will display information about all students, subjects, their grades in the exam and after passing the test to test residual knowledge. Finding the difference between the obtained estimates, we determine the level of formation of professional competence of future specialists in information technology and classify them according to the table Deterioration (Fig. 9).



Full_Name	Subject	Exam_Grades	Test_Grades	Deteoration	Deteoration_Group

	Full_Name	Subject	Exam_Grades	Test_Grades	Deteoration	Deteoration_Group
1	Кліменко Г. В.	ОБД	82	35	47	Погано
2	Демидов А. И.	Політологія	96	42	54	Погано

	Full_Name	Subject	Exam_Grades	Test_Grades	Deteoration	Deteoration_Group
1	Ізмайлова Е. Ю.	КПП	90	56	34	Задовільно
2	Міронов Е. В.	ТРСПО	100	65	35	Задовільно

	Full_Name	Subject	Exam_Grades	Test_Grades	Deteoration	Deteoration_Group
1	Даніленко В. А.	ТПР	74	69	5	Добре
2	Карнаух П. Г.	Політологія	67	66	1	Добре
3	Балан А. Ю.	ТРСПО	98	85	13	Добре
4	Удальцов И. Е.	ТПР	69	60	9	Добре
5	Калініна О. В.	ОБД	79	64	15	Добре
6	Парфенюк О. А.	КПП	84	80	4	Добре

Fig. 9. The result of the query

As a result, the conceptual design of the database of the information system for saving the test results for testing the residual knowledge of students was carried out, namely: the conceptual design of the database for saving the test results for testing the residual knowledge of students was performed; created a database and developed its tables; the tables were filled with data, as well as their modification; created a data schema for the database.

We also offer software for the formation of professional competence of future specialists in information and communication technologies, which provides for the development and implementation of electronic educational and methodological complexes of disciplines, CRM-solution designed to automate, optimize and operate the developed system of professional competence of future specialists in information and communication technologies. - communication technologies. It is clear that digital technology not only complements but also displaces traditional educational methods, provided that the constant use of innovative methods can gradually reduce the efficiency of information assimilation. The use of software for the creation of electronic educational and methodological complexes of disciplines (by means of WinCHM), which are studied by future specialists in information and communication technologies, is substantiated. Educational innovations, as well as the actual blurring of borders between individual countries, provide access to any educational content on the network, the number of which is growing today. Within the outlined tasks, CRM-solutions have been developed to increase the level of professional competence of future specialists in information and communication technologies; the developed CRM-solution on real data is implemented and tested; created a neural network for an additional module for processing the results of surveys using artificial intelligence systems; the results of the implemented CRM-solution are analyzed and its advantages are determined.

Increasing attention to the student's personality requires the search for new effective tools that guide the process of forming the professional competence of the future specialist in information and communication technologies. It is for this task that the potential of the CRM-system is used, which simplifies and automates the management of teachers' relationships with future specialists in information and communication technologies, namely allows to use relations with students as a

resource that enhances the professional competence of future information specialists. communication technologies. The means of CRM-systems directly and indirectly realized the positive impact on the motivational and activity sphere of future specialists in information and communication technologies, which optimized the formation of their professional competence.

After analyzing the CRM market to perform the task, the cloud service «Airtable» was chosen. Airtable is a web service for organizing a flexible database in the form of a table. It is also suitable for creating flexible checklists, organizing collections or ideas, managing customers or contacts – all in one place. You can start work with many templates at once. The solution supports collaboration in real time, so you can share the results with friends and teammates and see the latest changes [16; 11].

Advantages of the Airtable service: simplicity, clarity – one of the key factors, as this service is actually a hybrid of database and spreadsheets where the user of the created CRM can easily adapt to the program interface, which reduces the likelihood of staff rejection of the software product; Extensive customization capabilities are a very important factor, as the finished CRM solution can be adapted to any industry, which increases its efficiency and, consequently, the efficiency of the company as a whole; availability of a free license and its wide functionality; availability of simple and clear training materials on the use of the service; a large number of ready-made open templates – allows you to get acquainted with a large number of ready-made CRM based on this platform and allows you to use them to implement new ideas; cross-platform usability – access from any computer, phone or tablet, which allows you to always keep up to date information; cloud service – does not require the installation of expensive equipment, which reduces implementation costs.

It is also worth noting that the service has integration with e-mail services and online storage services, which allows you to configure the sending of e-mail messages immediately from CR. List of services integrated with «Airtable»: Google Drive; Dropbox; Evernote; Gmail; Slack Zapier. To develop a neural network for processing the results of student surveys, a software package for statistical analysis was selected - Statistica, developed by StatSoft. Statistica is a powerful analytical system that provides users with unrivaled capabilities in the field of interactive data analysis, including the latest methods of data mining, text analysis and neural networks, as well as creating effective solutions in various areas of human activity. Statistica is a unique system that allows you to comprehensively examine the data and make rational decisions based on analytical calculation, rather than on unconscious impulses and desires. This best of the known data analysis systems allows you to conduct research in a friendly dialog mode, as well as create your own applications using the language STATISTICA Visual Basic (SVB) [22]. With the help of Microsoft Project, a project plan was developed to develop and create a CRM solution for the information system of student performance accounting for higher education. It consists of the following components: start of work; initial development; analysis of the functionality of analogues; derivation of system requirements; designing the initial plan of the system; transfer of the initial plan to Airtable; consultation on the initial plan with the head; final development; making changes to the CRM structure; filling in test information; creation of operating instructions; implementation of work. Since the Airtable service on which the CRM system is built is cross-platform, its use requires any device running Windows, Linux, MacOS, Android or IOS operating systems and on which a browser or, for the mobile version, the Airtable application is installed.

According to research over the past year in Ukraine, the most common desktop operating system is Windows, its market share is 84.77 % of all operating systems used in Ukraine (according to the Internet resource «Statcounter»). After filling the database with students, the data from it are downloaded to the program «Statistica» and processed using the created neural network, after which the results are entered into CRM. After entering the results into the system, each teacher has the opportunity to see which type of activity is more suitable for a particular student and on its basis to build a proposal individually for each student. Table 1 describes the possible applications of the developed CRM-system and the main benefits that the user receives by choosing this system [22].

Table 1. Description of the idea of CRM-solution

Content of the idea	Directions of application	Benefits for the user
CRM-system for higher education institutions with the possibility of intellectual analysis of student data	Higher educational institutions of Ukraine	Allows users who use spreadsheets to easily switch to CRM without additional difficulties, to conclude new transactions using a ready-made database of students, based on analyzed by an additional neural network module of the data system allows you to develop personalized proposals for each client.

Analysis and formation of market opportunities and threats for the project allows to form further directions of project development, its prospects taking into account the state of the market environment, requirements and needs of potential clients, as well as competing projects. Table 2 shows the characteristics of potential users of the CRM solution.

Table 2. Characteristics of potential users of CRM-solutions

The need that shapes the market	Target audience	User requirements
The need to rethink the concept of higher education as a business project	Higher education in Ukraine ease of use of the system	Possibility of scaling and customization; development or subscription cost; capabilities and functionality; ease of system implementation; low cost of development and implementation.

We will analyze the market environment: tables of factors that contribute to the market implementation of the project, and factors that hinder it (Table 3).

Table 3. Threat factors

Factor content	Threat	Possible reaction of the company
The presence of great competition	Entering the market of a large company	Exiting the market. Select a new target audience. Anticipate the benefits of the product to report them right after a large company enters the market
Changing user needs	Users need solutions with different functionality	Provide the ability to add new functionality to the product

Let's analyze the state of further research and prospects for system development. Given that in today's realities the use of information technology in all areas is significantly increased, the functionality of the developed system is only the first step to the management system of all functions of higher education, which would greatly facilitate and simplify document management, simplify and make more efficient management of all its processes, because the manager can quickly analyze where and

why the efficiency of work has decreased and quickly apply the right measures. Therefore, the development and implementation of a CRM system is only one of the steps to increase the level of training of future specialists in the field of information technology.

4. Conclusions

The preparatory stage of the pedagogical experiment involved the study of the state of research of the problem of professional training of future specialists in the specialty 122 «Computer Science»; development of information and consulting resource for future specialists in information technology, its implementation; determination with the experimental basis of the study.

During the ascertaining stage of the experiment, the subjects of diagnostics were singled out; the criteria, indicators and levels of formation of professional competence of future specialists of the specialty 122 «Computer Science» are substantiated; the attitude of scientific and pedagogical staff of the Free Economic Zone to the need to use the developed information system is determined; the possibility of constant virtual consultations with the searcher on the implementation of the program of pedagogical experiment is provided; developed diagnostic tools; a diagnostic section, analysis and interpretation of its data were performed. Diagnosis of the levels of professional competence of future specialists at the stage of the observational experiment revealed approximately the same results: a high level of professional competence of future specialists in the specialty «Computer Science» was recorded in 6.90 % of CG and 5.48 % of EG; the average level of formation of professional competence of future specialists – in 37.12 % of CG students and 35.06 % of EG students; low level of formation of professional competence of future specialists in the specialty «Computer Science» – 55.98 % of respondents CG and 59.46 % of respondents EG, which indicates the lack of efficiency of the process of professional training of students majoring in «Computer Science».

During the formative stage of the pedagogical experiment, the developed software product was introduced into the educational process. The results of diagnostics of the general level of training of future specialists in the field of knowledge «Information Technology», due to the use of development show that the high level of professional competence of future specialists in 122 «Computer Science» in CG increased by only 1.47 %, while as in EG, it increased by 20.75 %; the average level of formation of professional competence of future specialists in the specialty 122 «Computer Science» in CG increased by 12.83 %, and in EG – by 15.43 %; the low level of formation of professional competence of future specialists in the specialty 122 «Computer Science» in CG decreased by 14.29 %, and in EG – by 36.18 %.

The probability of the results of the experimental work and the reliability of the experimental data were determined using the nonparametric Pearson test. The results of the formative stage of the experiment confirmed the legitimacy and effectiveness of the developed software product, which is part of a holistic system of professional training of future specialists in the specialty 122 «Computer Science» based on the interaction of its subsystems, pedagogical conditions and scientific and methodological support.

The project was created with the help of modern Internet technologies, because only through their use you can get fast, high quality and reliable communication. The interactive resource is designed according to the classic client-server software architecture and is a Web application. The functionality of the resource will depend on the type of user, namely: student, teacher and administrator.
Informatization of education is characterized by the use of computer-oriented methodological systems at different stages of education in higher education, the use of educational information technology, which is, in turn, part of computer-oriented educational systems. Therefore, further work should be the physical stage of development of the database project, which includes the construction of the database structure, and finally its design for the studied problem area. The purpose of this process is to obtain databases that allow you to effectively solve these problems. The methodology of using the developed software of the educational process should be researched and, based on the obtained results, improved. The practice of development and use of modern information technologies focused on the implementation of psychological and pedagogical goals of teaching and education is fundamentally

new, mediated by modern technical and technological innovations, so it requires further thorough research, especially in demand by modern educational requirements.

References

[1] Bykov, V., Bilous, O., Bogachkov, Yu. 2010. Fundamentals of standardization of information competencies in the education system of Ukraine method rekom. Kyiv. 88 p.

[2] Encyclopedia of Education Acad ped Sciences of Ukraine ed V. G. Kremen. Kyiv. 2008. 1040 p.

[3] Griban, G., Prontenko, K., Zhamardiy, V., Tkachenko, P., Kruk, M., Kostyuk, Y. & Zhukovskyi, Y. 2018. Professional Stages of a Physical Education Teacher as Determined Using Fitness Technologies. *Journal of Physical Education and Sport*. 18 (2), pp. 565–569.

[4] Kononets, N., Baliuk, V., Zhamardiy, V., Petrenko, L., Pomaz, Y., Kravtsova, N., Shkola, O. 2021. Didactic model of information and communication competence formation of future specialists of economic. *Journal for Educators, Teachers and Trainers*, Vol. 12 (4). P. 170–181.

[5] Kononets, N., Grynova, M., Zhamardiy, V., Mamon, O., Liulka, H. 2020. Problems of Implementation of The System of Resource-Based Learning of Future Teachers of Physical Culture. *International Journal of Applied Exercise Physiology (IJAEP)*. Vol. 9 (12). P. 50–60.

[6] Kononets, N., Ilchenko, O., Zhamardiy, V., Shkola, O., Broslavska, H., Kolhan, O., Padalka, R., Kolgan, T. 2021. Software tools for creating electronic educational resources in the resource-based learning process. *Journal for Educators, Teachers and Trainers JETT*, Vol. 12 (3). P. 165–175.

[7] Kononets, N., Nestulya, S., Soloshych, I., Zhamardiy, V., Odokienko, V. 2021. Investigating the Didactic System of Research Competence Formation for Prospective PE Instructors. *Journal of Research in Medical and Dental Science*, 2021, Vol. 9, Issue 7, P. 414–418.

[8] Kornosenko, O., Denysovets, T., Danysko, O., Synytsya, S., Voloshko, L., Zhamardiy, V., Donchenko, V., Shkola, O., Prystynskyi, V. & Otravenko, O. 2020. System of Preparation of Future Fitness Coaches' for Health-Improving Activity in the Conditions of Rehabilitation Establishments. *International Journal of Applied Exercise Physiology*. 9 (8), pp. 33–41.

[9] Kornosenko, O., Khomenko, P., Taranenko, I., Zhamardiy, V., Shkola, O., Tolchieva, H., Saienko, V., Batieieva, N. & Kyzim, P. 2021. Professional competencies as a component of professional training of a fitness trainer-teacher in higher education institutions. *Journal for Educators, Teachers and Trainers*. Vol. 12 (1), pp. 72–81.

[10] Morse, N., Kocharyan, A. 2014. Model of the standard of ICT competence of university teachers in the context of improving the quality of education Information technology and teaching aids. Vol 43. Issue 5. pp. 27–39.

[11] Morze, N., Kuzminska, O., Protsenko, G. 2013. Public Information Environment of a Modern University ICT in Education. *Research and Industrial Applications : Integration Harmonization and Knowledge Transfer* EUR Workshop Proceedings. pp. 264–272.

[12] Polat, E., Bukharkina, M. 2007. Modern pedagogical and information technologies in the education system : a textbook for students of higher education. Moscow. 368 p.

[13] Raven, J. 2002. Competence in modern society identification development and implementation. Moscow. 412 p.

[14] Ryabukha, A. 2014. Model of preparation of future teachers of natural and mathematical disciplines for the application of multimedia technologies Young Scientist. № 2 (5). pp. 128–131.

[15] Selevko, G. 1998. Modern educational technologies : a textbook. Moscow. 256 p.

[16] Sovetov, B., Tsekhanovsky, V. 2009. Information technologies : textbook for universities. Kyiv. 263 p.

[17] Shkola, O., Zhamardiy, V., Saienko, V., Tolchieva, H. & Poluliashchenko, I. 2020. The Structure Model of Methodical System Usage Fitness-Technology in Student Physical Education. *International Journal of Applied Exercise Physiology*. 9 (10), pp. 89–96.

[18] Unt, I. 2020. Individualization and differentiation of learning. Moscow. 192 p.

[19] Walo, H. 2006. Key competencies for Europe Report of the Symposium Berne Switzerland. pp. 15–32.

[20] Wellington, J. 1992. Information Technology. Moscow. 148 p.

[21] Chernikova, L. 2008. The essence of the concept of ICT competence of the teacher : All-Ukrainian Science - practice Conf Computer literacy of teachers in terms of EU standards. Poltava. pp. 40–42.

[22] Yurchuk, N. 2019. CRM-systems : features of functioning and analysis of the Ukrainian market Scientific Bulletin of Uzhhorod National University. 23 (2). pp. 141–147.

[23] Zhaldak, M. 2005. On some methodological aspects of teaching computer science at school and pedagogical university. Scientific notes of Ternopil National University V. Hnatyuk. Series: Pedagogy. № 6. pp. 17–24.

[24] Zhamardiy, V., Shkola, O., Tolchieva, H. & Saienko, V. 2020. Fitness Technologies in the System of Physical Qualities Development by Young Students. *Journal of Physical Education and Spor*t. Vol 20 (1), Art 19, pp. 142–149.

[25] Zimnyaya, I. 2003. Key competencies – a new paradigm of educational outcome Education Today. № 5 pp. 34–42.

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