



EXPERIENCE OF INVOLVING FUTURE IT PROFESSIONALS IN THE DEVELOPMENT OF LEARNING TOOLS AS AN ELEMENT OF DIGITAL TRANSFORMATION OF EDUCATION

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Abstract: *The development of digital educational resources is currently the primary task of IT specialists, which, in turn, is a component of the digital transformation of education in general. Since the digital transformation of education consists of the development of significantly new electronic resources for educational purposes, we have considered specific examples of the development of digital educational resources by students and analyzed their feasibility of development and use within the framework of the digital transformation of education. The article also shows how the involvement of students of IT majors in the development of such digital educational resources contributes to the improvement of their professional and linguistic competencies. At the same time, students reflect exactly their vision of learning a foreign language with the help of such tools, and all this contributes to the digital transformation of higher education.*

Keywords: digital transformation of education, IT specialists, e-learning tools

INTRODUCTION

Under the conditions of war, the digital transformation of education has acquired particular importance (Kovalchuk, 2023, Glazunova 2023; Ryabko, 2023). In particular, the pandemic caused by COVID-19 was an essential condition for the digital transformation of education (Sych, 2021; Ovcharuck, 2022). However, the challenges facing the educational process in Ukraine's higher education institutions today are entirely different than they were a year ago. The full-scale Russian invasion of Ukraine showed that the educational process is simply impossible without the digital transformation of the educational process. Thus, a significant role is played by developing new digital educational resources that can be used in the educational process of institutions of different levels (from kindergartens (Trubavina, 2021) to universities (Budinskii, 2021)).

Moreover, English has become an integral part of our life, recognized as an international language, and some of its words are also found in everyday life (Lemeshchenko-Lagoda, 2020). Furthermore, international scientific cooperation and the current development of digital technologies necessitate the creation of various digital educational resources, including educational resources for learning a foreign language and electronic multilingual explanatory dictionaries.

The demand for electronic multilingual explanatory dictionaries is due not only to the need to objectify research, optimize and rationalize the professional work of a specialist but also to the growing demand of an ordinary user for adapted objective, reliable information of a linguistic nature in the form of such dictionaries. Furthermore, creating simple and easy-to-configure dictionaries will provide access to an array of factual material, which will help optimize the work of specialists in various specialties. Moreover, the need to develop digital educational resources for learning a foreign language will help improve the linguistic competence of participants in the educational process. At the same time, the development of such resources will become an integral part of the digital transformation of the educational process.

Involving students of IT specialties in developing digital educational resources will help improve their professional and linguistic competencies. Moreover, students will reflect on their vision of learning a foreign language using such means. Therefore, it contributes to the digital transformation of higher education since the digital transformation of education hinges on the development of significantly new electronic resources for educational purposes.

1. THEORETICAL BACKGROUND

An increasing number of scientists are exploring various aspects of the digital transformation of society in general and education in particular. For example, Mitra and Banerjee (Mitra, 2023) tried to show that learning programs based on artificial intelligence for learning English are successful. Furthermore, the authors argue that AI-based strategies should help teachers interact with English teaching more fun. Takamatsu et al. (2023) proposed a new concept of digital transformation of education, also institutional research, and ICT based on Eduinformatics. The authors

clarify that Eduinformatics is a field that combines computer science and education. Scientists cited the experience of a Japanese university based on Eduinformatics. Cabrera et al. (2023) described the experience of applying the transformational model of school digital sustainability to develop the professional identity of a teacher, and experimentally confirmed the feasibility of such an application. Del Castillo Castro et al. (2023) conducted an experimental study on the application of a new digital transformation model for learning strategies in Education 4.0, successfully demonstrating its feasibility.

Msila (2022) explored the issue of digital transformation in African universities, highlighting strategies for effective digital transformation. The author interviewed university leaders, concluding that the digital transformation of higher education is not possible without collective decision-making and depends on employees' skills in the digital technologies field. Hoang et al. (Hoang, 2022) conducted an experimental study to determine the digital level of teachers in universities of education in Vietnam as a result of which they found that digital competency of teachers in middle-level teacher training schools in Vietnam. At the same time, they also found that competence depends on the level of awareness of digital opportunities, scientific degrees, and gender. D'Ambra et al. (2022) considered another aspect of digital transformation, namely the use of electronic textbooks in Australian higher schools, through the prism of accessibility theory. As a result, scientists concluded that when using digital textbooks, some parameters should be considered (accessibility, copying, portability, selection and viewing etc.).

Jain et al. (2022) conducted a pilot study at universities in India on the effectiveness of collaborative learning exchange during the COVID-19 pandemic using digital tools and technologies. Trujillo Valdiviezo et al. (2022) studied the problem of digital transformation in Latin America, leading to the conclusion that digital transformation occurred in the following areas: education, companies, and people. Hofstetter et al. (2022) explored the problem of digital transformation due to the creation of one's own or the use of a federal framework training program, with the latter having only a minor impact on the acquisition of digital competencies.

The article aims to describe the experience of involving future IT specialists in developing learning tools as an element of the digital transformation of education.

2. METHODOLOGY

This study used empirical methods such as discussion and micro-interviews (a type of survey), as well as a pedagogical experiment that was analyzed using Pearson's criterion. The micro survey included a series of questions to determine the significance of the process of developing digital resources for students themselves. The discussion was used to determine what students wanted to see the developed tools do in the future and whether they were convenient for them to use in the educational process as a finished product. A total of first-year students from the 2021–2022 academic year, enrolled in 121 specialties within the field of Software Engineering participated in the study.

The study's hypothesis was based on the fact that the creation of electronic educational resources by students for further use in the educational process will contribute to the development of their professional competencies.

3. RESULTS

In their professional training, future IT specialists annually carry out various course projects. At the end of the training, they perform qualifying work and participate in the implementation of collective projects within the scope of individual disciplines. In particular, during the training, students can develop digital educational resources while working on course projects, completing qualification papers, and other types of work.

Notably, during the 2021–2022 academic year, students specializing in IT fields at Zhytomyr Polytechnic (Ukraine) develop such digital educational resources, including those designed for learning foreign languages:

1. A web-oriented system of teaching a foreign language.
2. A web-based dynamic testing system using fuzzy logic to assess the level of knowledge.
3. An application designed for foreign language learning and analytical knowledge control.
4. An information and reference application assisting in the learning of English words.
5. A mobile application designed for foreign language learning.
6. A mobile application designed for teaching mathematics to elementary school students.
9. The development of the program “Construction of graphs of functions”.
11. The development of an explanatory multilingual dictionary.
12. The development of a simulator program “Computer equipment”.
13. An English language learning app.

It is important to note that the list above is not exhaustive. The authors chose only those examples that they considered relevant precisely in the framework of the digital transformation of education. In the following sections we will consider specific examples of students' development of digital educational resources and analyze the feasibility of developing and using these resources within the framework of digital transformation of education.

To illustrate, first-year students specializing in “121 Software Engineering”, as part of their coursework in “Object-oriented programming”, developed applications for foreign language learning.

Let's consider the possibilities of the “English Learning” application (see Figure 1). Upon launching the application, the user can see the main tab, which displays all available topics (categories) for study, navigation buttons, and a search bar for searching word sets by name. When you click on one of the topics, the application displays the words available in this topic and a search string for locating specific words. In addition, new buttons appear for interacting with words and topics (see Figure 2).

Within this interface, the user can learn words and their translation within the selected subject area.

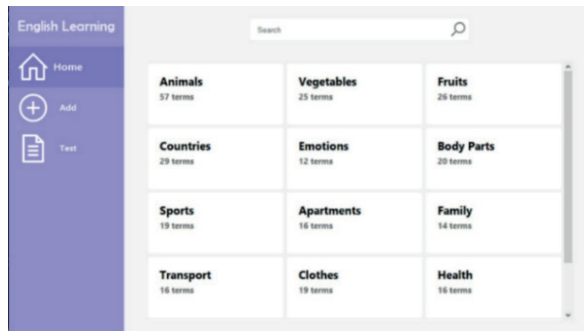


Figure 1. The main tab of the application “English Learning”

Source: Own work.

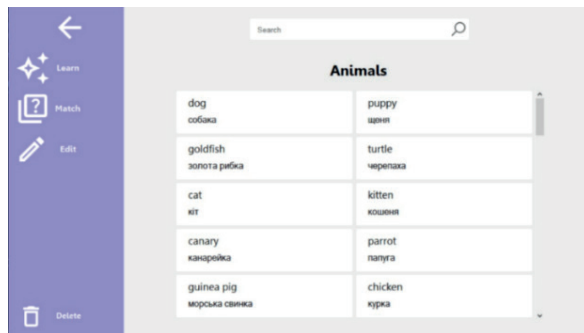


Figure 2. Display a set of words

Source: Own work.

When you click on the “Learn” button, the user’s attention is directed towards a test for learning words. In this case, one should choose the correct translation of the specified word from four available options. If the answer is correct, the next question is displayed. If not, a message with the correct answer is displayed first (see Figure 3). The “Match” button opens a game where the user needs to pair words in Ukrainian and their corresponding English translations. The game begins when the user presses the “Start” button. It’s important to note that this game is timed. In this activity, the user must select word pairs that match in both Ukrainian and English (see Figure 4). If the pair is chosen correctly, both words disappear from the screen. Upon completing the task of the game, the user will receive a feedback on the time taken to complete it.

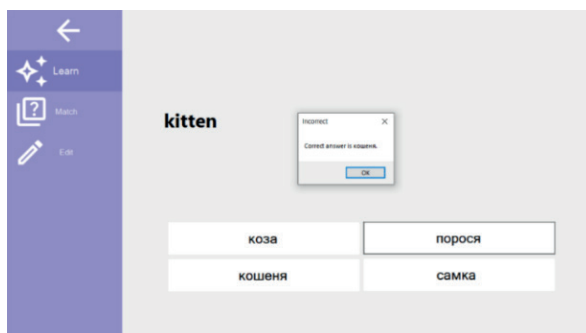


Figure 3. Notification displaying the correct answer when the selected word does not match its corresponding translation

Source: Own work.



Figure 4. Display all words at the beginning of the game

Source: Own work.

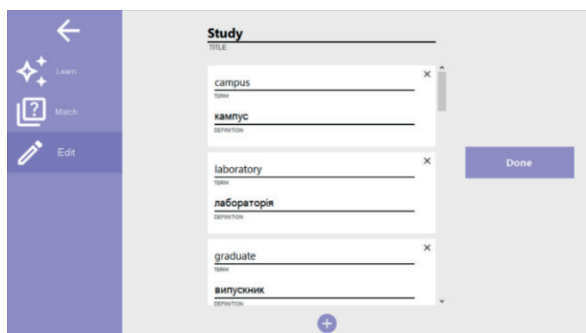


Figure 5. Word editing form

Source: Own work.

Using the “Edit” button, the user can edit and delete words and edit the set’s name, while pressing the “Done” button will save the changes to the database (see Figure 5). In addition, the user can delete a specific topic by entering it, clicking on the “Delete” button, and confirming the action (see Figure 6).

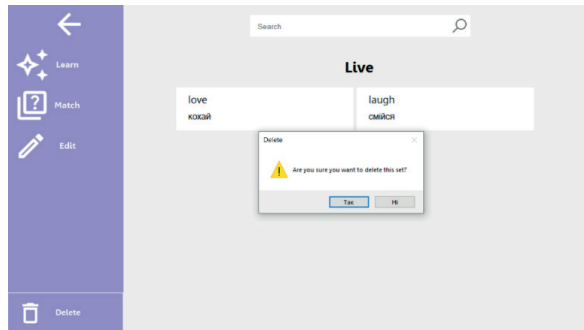


Figure 6. Proof of removal of the topic

Source: Own work.

Among the options not initially visible in the main window, two additional buttons are available: “Add” and “Test”. The first one opens a form for creating a new set of words, where you need to enter the desired name and a few words and click the “Done” button (see Figure 7). The second button, “Test”, allows users to take a test on the selected topic and with a certain number of questions in the test (see Figure 8). The test implies the user has already learned the words associated with the selected topic, and offers questions in one of three possible forms: choosing one correct answer out of four, entering the translation of the word, or matching two words with True / False responses. Upon completing the final question, users will receive a results window (see Figure 9) displaying their.

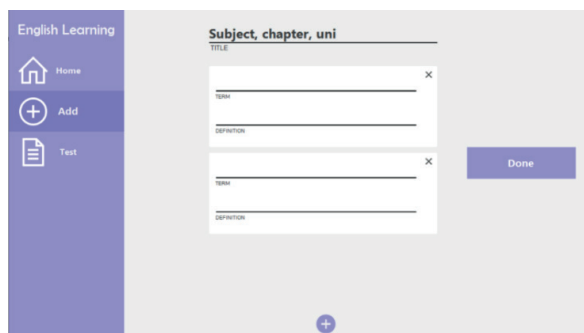


Figure 7. Form for creating a new topic

Source: Own work.



Figure 8. Selecting topics for testing and the number of questions

Source: Own work.



Figure 9. Display of test results

Source: Own work.

Exploring the functionalities of another application “Electronic multilingual terminological dictionary”, its main screen displays all available topics (sections), a search bar for searching a topic by title, a drop-down list for selecting the order in which topics are published, and a button for adding new topics (see Figure 10).



Figure 10. Creating a new topic

Source: Own work.

When selecting one of the topics, the terms related to the selected topic and a search bar for searching for a single word are displayed. There are also new buttons available for interacting with words and a top panel with a search bar and language selection option. Users can also add a new term, delete a topic, and return to the original window using the “Back” button (see Figure 11).

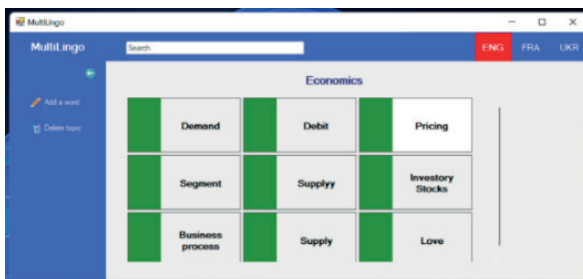


Figure 11. Viewing words on the topic in English

Source: Own work.

Clicking on a specific term enables users to access its definition. In this view, several buttons are present: one for editing the term, another for deleting it, and one for marking the term as a favorite (see Figure 12). The user can review all their selected terms in a separate window (see Figure 13).



Figure 12. Viewing your favorite term in French

Source: Own work.

In the event a user selects a term for editing from the drop-down list, the “Create Term” button becomes inactive. If the user leaves one of the “New Term” or “New Definition” fields empty during editing, the corresponding field in the definition being edited will remain unchanged. However, if both fields are left empty, a prompt will appear, requesting the user to enter data to continue the operation (see Figure 14). Upon creating a new term, the drop-down list is updated to include the newly created term, which is automatically selected. Users have the option to complete the term in other languages. It’s worth noting that the dictionary is organized into three languages: French, English, and Ukrainian.



Figure 13. Viewing the favorite terms section

Source: Own work.

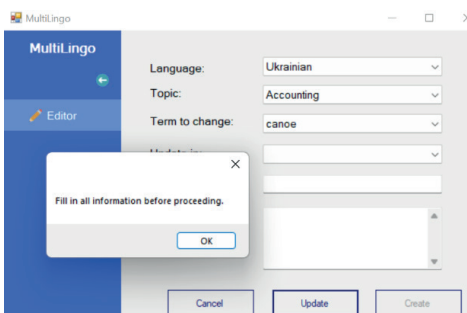


Figure 14. Notice the need to enter test information before continuing with editing

Source: Own work.

It should be noted that, in both cases, all data is stored in an external database, even though first-year students have not yet studied database concepts as part of their training. That is, the development of such projects contributes to the organization of their working time to get acquainted with new material, interest in new knowledge and skills, improve programming skills and databases, that is, the development of their professional competencies as IT specialists.

Also, the availability of ready-made digital educational resources allows for their use in the educational process to form the linguistic competence of not only future IT specialists but also, for example, applied linguists.

In particular, the first English Learning tool was used to teach English to future IT professionals to improve their language skills. The second tool “Electronic multi-lingual terminological dictionary” was used in teaching English to future applied linguists to improve their digital and linguistic competence. In both cases, the tools were offered to students for discussion as experts, indicating their preferences and comfort levels with using them.

Thus, students noted that in the first application they would like to see additional language options beyond just English, and in the second case, they would like to see more than three languages. It, of course, is not critical and can be improved in further modification of the proposed applications. Furthermore, since all data is stored in the database, there are no problems with adding fields or tables.

4. DISCUSSION

To assess the practicality of developing and using digital educational resources, micro-interviews were conducted with students. These interviews aimed to understand what benefits students derived from creating such resources and why they selected specific topics and functionalities.

As a result, it was found that the primary motivation behind developing such tools was the convenience they offered, particularly the ability for the user to create and categorize words into collections/topics. This organizational structure allowed users to concentrate on specific words and subjects. Furthermore, when developing such tools, one should pay attention to the fact that the words in the game are better remembered, which makes it possible to memorize better and practice already learned words. Moreover, when developing such applications, one should consider the possibility of choosing a topic for testing knowledge in the form of tests or other forms. As for the second application, within the framework of the research work “Creation of an electronic multilingual terminological dictionary”, this tool was immediately tested and compared with other prototypes (Vakaliuk, 2020).

To confirm or refute the hypothesis, a pedagogical experiment was conducted to measure the state of formation of professional competencies of future IT specialists in the control and experimental groups, which showed that there was an increase in the number of students in the EG compared to the number of students in the CG with a high and sufficient level. It is worth noting that students in the EG participated in the development of e-learning resources and their use in the educational process, while in the CG – only in their use. Considering this data, it was concluded that the development and use of digital learning tools had a significant positive impact on the increase in the percentage of students in the experimental group.

To substantiate the conclusions about the effectiveness of the forms of the pedagogical experiment, the data obtained were statistically processed using Pearson’s χ^2 criterion, which resulted in the conclusion that the samples have statistically significant differences, i.e., the experimental methodological system is more pedagogically appropriate than the traditional one. Thus, the pedagogical experiment has confirmed that the development and use of digital educational resources are effective for the formation of professional competencies of future IT specialists.

CONCLUSION

The development of digital educational resources is currently a top priority for IT specialists, which, in turn, is a fundamental component of the digital transformation of education in general. The search, development, and use of digital educational resources are complex and require further study. Nevertheless, all these stages contribute to the development of professional and linguistic competencies of future IT specialists and their self-development, which is necessary for their future professional activities.

The prospects for further research endeavors should include comparing the developed tools by students of different courses for the correlation and dynamics of developing their professional competencies.

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