

Usage of an Interactive Electronic Textbook Application: Reflection of Ukrainian Experience (Based on the Integrated Course “Health, Safety, and Well-Being”)

Lenina Zadorozhna-Kniahnytska
Faculty of Psychology and Education
Mariupol State University
Kyiv, Ukraine
l.z.k@mu.edu.ua

Oksana Goliuk
Department of Pedagogy and
Education
Mariupol State University
Kyiv, Ukraine
o.holiuk@muo.edu.ua

Olha Hroshovenko
Department of Pedagogy and
Education
Mariupol State University
Kyiv, Ukraine
o.hroshovenko@mu.edu.ua

Larysa Prysiazhniuk
Department of Pedagogy and
Education
Mariupol State University
Kyiv, Ukraine
l.prysiashniuk@mu.edu.ua

Iryna Khadzhynova
Department of Pedagogy and
Education
Mariupol State University
Kyiv, Ukraine
i.hadzhinova@mu.edu.ua

Abstract—In 2018, a full-scale reform of general secondary education called “The New Ukrainian School” was launched in Ukraine. The reform will continue until 2029 and aims to update educational content to develop students' competencies and cross-cutting skills necessary for successful personal and professional realization; employ active learning methods; create an innovative and inclusive educational environment; and enhance preparation for future professional and educational trajectories. In this context, pedagogical science and practice face a number of complex and responsible tasks related to the implementation of effective learning models that extensively use digital and interactive technologies, ensuring the formation of lifelong learning competencies (Recommendations of the European Parliament and the Council of the European Union). An important tool for effective learning is an interactive electronic textbook application, which significantly expands the capabilities of a printed textbook through multimedia content and interactive functions. The development of such an application requires not only compliance with the current regulatory framework of Ukraine but also an examination of best practices in the use of electronic textbook applications in the educational theory and practice of European countries. This article is written by the authors of school textbooks for the integrated course “Health, Safety, and Well-Being” for the 7th and 8th grades of the New Ukrainian School. The aim of our study is to theoretically justify and empirically examine the functionality and content fullness of the

interactive electronic application to the “Health, Safety, and Well-Being” textbook. The theoretical and experimental study was conducted during 2023-2024 in general secondary education institutions in Ukraine that used the authors' textbook in the educational process. The study involved 600 respondents – school teachers. Our research addressed three main objectives: 1) to analyse the experience of European countries in developing and implementing interactive electronic textbook applications to integrate best practices into the Ukrainian educational space; 2) to conduct a pilot implementation of the interactive electronic application developed by the authors; 3) to identify the factors and conditions that enhance the effectiveness of using an interactive electronic textbook application. The article describes the stages of the research, provides an analysis of the best European practices in using electronic applications to school textbooks, and presents the interactive electronic application developed as a result of this study for the “Health, Safety, and Well-Being” integrated course for the 7th and 8th grades of the New Ukrainian School. The article also includes an analysis of empirical data obtained during the research.

Keywords—*Electronic learning tools, interactive electronic application, interactive functions, multimedia content, teaching methods, textbook.*

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I. INTRODUCTION

Educational strategies in many countries worldwide involve the development and implementation of digital learning resources, the use of which significantly expands students' cognitive abilities and ensures the formation of their competencies in the shortest way possible. Today, digitalization is not merely a technological process or product; it represents a modern approach to creating and utilizing digital materials, which play a crucial role in providing high-quality, continuous education and ensuring equal access to educational resources for students, their parents, and teachers. This necessitates the updating of teaching methodologies and the implementation of new learning tools in accordance with the requirements of the digital environment. This applies particularly to textbooks, which should not merely be content carriers, but also tools aimed at developing students' ability to apply acquired knowledge in real-life situations, serving as an effective instrument for managing cognitive activities. The integration of printed textbooks with their interactive electronic applications enables the realization of the best achievements of both traditional and modern learning through the formula: content+ methodology + computer [1]-[2]. A productive approach today is the strategy of using electronic learning tools as a supplement to traditional teaching methods. Experts emphasize that IT technologies should be integrated into curricula and used alongside other educational tools, such as printed textbooks, artistic materials, written samples, game materials, and books, which together facilitate students' self-expression in various types of activities [3]-[8].

In global pedagogical theory and practice, the use of interactive learning tools has been discussed since the early 1980s [9]. However, the development and implementation of interactive electronic textbooks with multimedia elements, hyperlinks, games, tests, as well as interactive electronic applications to school textbooks over the past decade, have significantly intensified research into their content, functions, and effectiveness [4]-[5], [10]-[13].

M. J. Koehler, P. Mishra, and W. Cain emphasize the need for an effective combination of educational content, pedagogical technologies, and digital tools in learning [14]. They identify electronic textbooks and interactive electronic applications to printed textbooks as the foundation of educational technologization. Research findings indicate that an interactive electronic application to a school textbook promotes independent learning and enables students to organize cognitive activities in different conditions and with varying sets of input data [15].

Today, interactive electronic applications to school textbooks are attracting increasing attention from Ukrainian researchers. This growing interest is not coincidental. In 2018, Ukraine launched a large-scale reform of general secondary education called “New Ukrainian School”, which will continue until 2029. The goal of the reform is to update educational content to

develop key competencies necessary for students' successful personal and professional realization, apply active teaching methods, create an innovative and inclusive educational environment, and strengthen preparation for future professional and educational trajectories. As a result, Ukrainian pedagogical science and practice face a number of complex and responsible tasks related to the implementation of effective learning models that widely use digital and interactive technologies to foster lifelong learning competencies (as recommended by the European Parliament and the Council of the European Union).

On the other hand, today's students, who have a modern type of thinking and are adapted to virtual reality, are entering schools. According to the “Generations Theory” (Neil Howe, William Strauss), today's school students belong to Generation Z – “digital” children, the children of multimedia technologies [16]. Ukrainian schoolchildren's learning and cognitive activities are characterized by the ability to quickly perceive and process large volumes of information, easily switch attention from one activity to another, concentrate on multiple information streams, and quickly find the necessary data among a vast amount of information [6], [17]. These characteristics must be taken into account when developing learning tools.

A generalization of theoretical developments, as well as the results of Ukrainian and international research, provides grounds for the following conclusions regarding the use of interactive electronic supplements to school textbooks: this is not about passive technology use where students merely consume content. Instead, an interactive electronic supplement ensures students' active engagement, as they utilize resources for meaningful learning [18]-[20]. This is especially important for teaching integrated courses based on an interdisciplinary approach.

Over the past few years, the authors of this article have been working on creating school textbooks for the integrated course “Health, Safety, and Well-being” within the New Ukrainian School framework. This course addresses the tasks of social and health-preserving educational fields in accordance with the State Standard of Basic Secondary Education through a four-group learning cycle:

- personal health and safety care, risk avoidance, response to factors and activities that have a threat to life, health, and well-being of oneself and others;
- identifying alternatives, predicting consequences, and making decisions beneficial to one's own safety and the safety of others, as well as their health and well-being;
- making an informed choice for a healthy lifestyle, analysing and assessing consequences and risks;

- entrepreneurship and ethical behaviour for improving health, safety, and well-being.

Given the specifics of the integrated course “Health, Safety, and Well-being”, teachers should prioritize active and interactive, creative, and flexible forms and methods of organizing learning activities, fostering active collaboration among all participants in the educational process. These methods include group work, discussions, brainstorming, mind mapping, role-playing games, excursions, problem-solving modelling, debates, research, practical tasks, and project-based learning [20]-[23]. Thus, our primary goal was to create a next-generation school textbook with an interactive electronic application that would fully consider the specific features of the integrated course.

At the time of developing the “Health, Safety, and Well-being” textbook for the 7th grade, there were no regulatory documents in Ukraine defining the content and requirements for interactive applications. Therefore, we²⁾ relied on research findings and international experiences in implementing electronic textbook applications. During the first half of 2023, we analysed a significant array of scientific publications and publicly available information on various aspects of implementing interactive electronic applications for school textbooks. This analysis and the generalization of research results enabled us to design the architecture of the electronic application based on the following key principles:

- 1) the content of the application must align with the textbook’s content and consider its specific features;
- 2) the volume of educational, multimedia, and other content in the application must take into account the technical capabilities of the storage where it is hosted and the characteristics of the devices used to access it;
- 3) the application must include tasks of varying complexity and provide individualized learning trajectories;
- 4) the application must include self-assessment tasks for evaluating learning outcomes;
- 5) the application must contain multimedia elements, tools for interactive engagement, the ability for users to review their accomplishment of interactive tasks, and a user guide explaining the functions of all interface elements;
- 6) the application must not contain advertisements.

Over the next six months, we worked on creating the 7th-grade textbook for the integrated course “Health, Safety, and Well-being” and its interactive electronic supplement (<https://svitdovkola.org/books/zbd7>). In early 2024, the textbook was recommended by the Ministry of Education and Science of Ukraine for use in Ukrainian schools and became one of the winners of the competition for selecting 7th-grade textbooks.

However, in April 2024, the Ministry of Education and Science of Ukraine issued an order approving requirements for interactive electronic textbook applications. This document fully aligns with the conclusions we reached in our research. Our next challenge was to develop a new textbook for the 8th-grade integrated course “Health, Safety, and Well-being’ and its interactive electronic application. This new application was created based on the results of the pilot implementation of the 7th-grade application.

II. MATERIALS AND METHODS

Organizing the experimental study, we set the following objectives:

- 1) to develop and conduct the pilot testing of an interactive electronic application for the author’s textbook of the integrated course “Health, Safety, and Well-being” for the 7th grade;
- 2) to study its effectiveness and design ways to improve the application for the textbook, with the possibility of implementing these improvements in the electronic edition for the 8th grade.

To determine the factors and conditions for increasing the effectiveness of using the interactive electronic application for the “Health, Safety, and Well-being” textbook, the authors conducted an empirical study. The research sample included 600 respondents – school teachers who used the 7th-grade textbook developed by the authors during the first semester of the 2024-2025 academic year. The participants in the study represented the following regions of Ukraine: Vinnytsia (6.5%), Dnipropetrovsk (9.0%), Donetsk (6.3%), Zaporizhzhia (11.2%), Ivano-Frankivsk (8.8%), Kyiv (17.8%), Luhansk (3.8%), Odesa (11.5%), Poltava (13.2%), and Sumy (11.8%) regions. The teachers’ survey, conducted in January 2025, was anonymous, and gender differences were not considered.

To collect the necessary information, a web questionnaire was developed using Google Forms, and a quantitative research methodology was adopted, with electronic surveys serving as the primary data collection tool. The questionnaire contained closed-ended questions evaluated on a 4-point Likert scale (from 1 – strongly disagree, to 4 – strongly agree), as well as open-ended questions. Respondents also had the opportunity to justify their opinions regarding the statements proposed for evaluation.

The questions presented to the participants can be grouped into the following blocks:

- attitudes toward the availability of an electronic application to the textbook and their willingness to use it;
- advantages and disadvantages of the electronic application for the “Health, Safety, and Well-being” textbook (7th grade) developed by the authors;
- suggestions for improving the electronic

application to the textbook.

The results of the survey among school teachers regarding the effectiveness of the interactive electronic application for the integrated course “Health, Safety, and Well-being” textbook enabled the research team to design further improvements. A detailed description of the study results and conclusions is presented below.

III. RESULTS AND DISCUSSION

As we previously mentioned, the electronic educational publication developed for 7th-grade students within the integrated course “Health, Safety, and Well-being” was created by the authoring team before Ukrainian legislation officially established mandatory requirements for the use of electronic applications to textbooks and formulated clear guidelines regarding their structure and content. At the same time, a thorough review of research findings from both Ukraine and abroad, along with an in-depth study of the practical experience of using similar digital resources in education, contributed to the successful creation of a high-quality and functional application to the textbook.

Next, we will analyse the key components of this digital product, highlight its main characteristics, and explain its functional role in the educational process.

The structure of the electronic edition fully aligns with the structure of the textbook, with the number and titles of topics corresponding exactly. On the website of the Svitych publishing house (<https://svitdovkola.org/>), under the “For Students” section, each topic in the textbook is supplemented with learning materials that expand its functional and content capabilities, including:

- video and audio materials;
- online tasks;
- interactive games and various exercises created using different online resources (LearningApps, Wordwall, Livework-sheets, etc.);
- instructions and algorithms for completing tasks, as well as infographics.

These tasks are integrated into the structure of the lesson and can also be used as additional resources to diversify the forms, methods, and techniques of classroom work. Importantly, the provided materials serve as a crucial component of educational resources, and their selection depends on the teacher's level of preparation as well as the students' capabilities and competencies.

For example, for the lesson on the topic “Mine Safety”, the interactive electronic application includes the following multimedia content: a video clip on mine safety by the Ukrainian band Tanok na Maydani Kongo; an infographic of explosive hazardous objects; an online task for identifying such objects, an educational video on mine safety created by the State Emergency Service of Ukraine; an online task for detecting explosive devices; an animated film for teenagers “Enforcers – The Super Team Against Mines”; an online quest “Super Team Against Mines” by

UNICEF Ukraine (Figure 1).

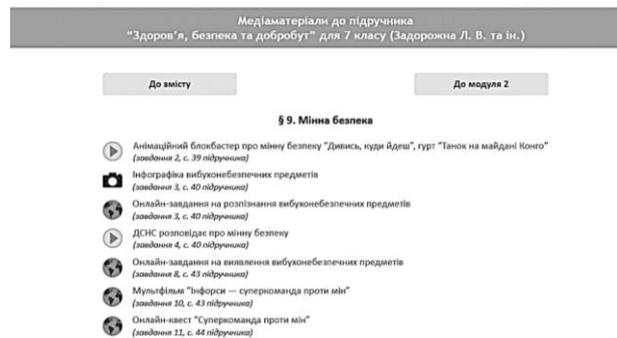


Fig 1. Multimedia content of application to §9. Mine safety.

In the printed version of the textbook, a QR code is provided at the beginning of the relevant section, directing students to this page of the e-application (Figure 2). This ensures access to these materials in an offline mode. For easier navigation within the textbook content, tasks that require using multimedia resources from the e-application are marked with a special icon.

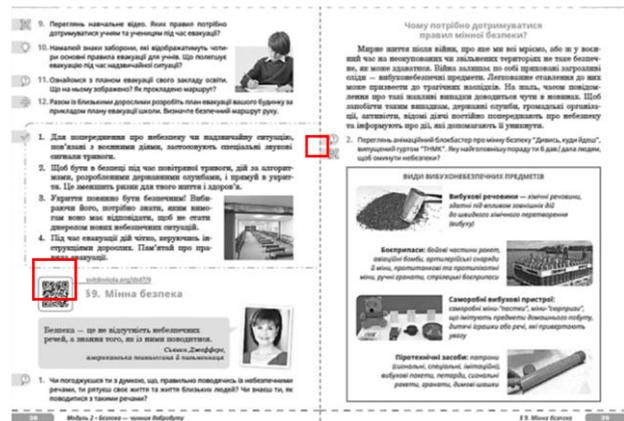


Fig. 2. Screenshot of the textbook pages with a QR code that links to the e-appendix page and an example of the rubric of the task contained therein.

We have developed tasks of varying levels of difficulty for the e-application. This allows each student to independently choose the task option they prefer to complete. Thus, the electronic application facilitates the creation of an individual learning trajectory for each student. A mandatory component of the interactive electronic application is diagnostic assessments designed to evaluate students' learning achievements during final assessments.

To support teachers in working with the textbook, the electronic application includes a “For Teachers” section. This section contains a comprehensive set of educational and methodological resources, including:

- a sample calendar-thematic lesson plan for the integrated course “Health, Safety, and Well-being”;
- lesson plans for all topics;
- printable didactic materials.

A particularly valuable resource for educators, in our opinion, is the collection of lesson plans for textbook topics (Figure 3). In addition to the content presented in the textbook, these lesson plans include supplementary materials aimed at deepening the topic. Given teachers' pedagogical autonomy in selecting methodological tools, these materials can be used in a modular approach. That is, depending on the content of the textbook section, its depth, and the number of hours allocated for its study, a teacher can use any task independently or as a component for effectively delivering the lesson content.



Fig. 3. Development of lessons on the topics of the curriculum as a component of the e-appendix to the textbook.

In addition to lesson plans for traditional in-person instruction, the e-application also includes plans for distance-learning lessons.

A survey conducted among teachers from Ukrainian general secondary education institutions (Figure 4) showed that the majority of teachers (508 respondents – 84.7%) hold a completely positive attitude toward electronic applications for textbooks, have experience using them in lessons, and are willing to continue integrating them into their teaching practice. Furthermore, 467 respondents (77.8%) noted that the availability of an electronic supplement was the decisive factor in choosing our textbook for their work. However, 68 teachers (11.3%) expressed a generally positive attitude but mentioned difficulties in adapting to using e-applications in lessons due to the lack of digital devices among all students in their classrooms and school-wide internet access issues. Only 24 respondents (4.0%) had a negative view of e-applications, considering them as mere entertainment elements. These teachers believe that mobile phones should be banned in schools as they only distract students from the learning process.

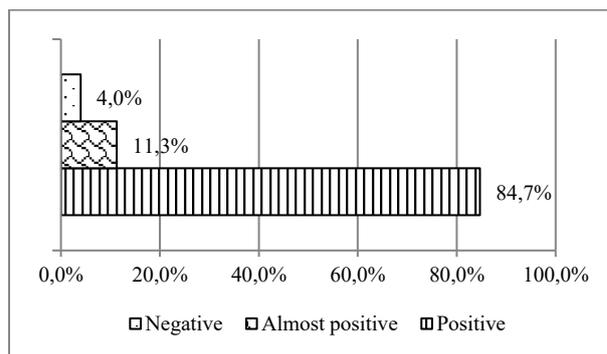


Fig. 4. Attitude of teachers to the electronic application of the textbook.

Analysis and interpretation of the collected research data allowed us to summarize the key strengths of the electronic supplement to the textbook as highlighted by practicing teachers. The obtained results are presented in Table 1.

The drawbacks highlighted by a few participants in our survey were mostly of a recommendatory nature. For example:

Respondent 36: There are no critical shortcomings. However, not all digital tools are available in sufficient quantity.

Respondent 434: It would be helpful to provide a more detailed guide on how to use some multimedia applications.

Respondent 523: The textbook contains excellent multimedia applications, but the authors should consider adding a library of online services so that teachers can create digital content independently.

TABLE 1 ADVANTAGES OF THE ELECTRONIC APPLICATION TO THE “HEALTH, SAFETY, AND WELL-BEING” TEXTBOOK (7TH GRADE)

Positive features of the e-application	Percentage of respondents who emphasized this
Increases students' motivation to learn	83,5%
Enhances students' cognitive engagement	91,2%
Expands the use of interactive learning methods	81,0%
Supports personalized learning pathways	72,0%
Enables formative assessment and self-evaluation through instant feedback	68,5%
Develops digital competence in both teachers and students	65,7%
Allows the inclusion of students' real-life experiences	86,8%
Improves the effectiveness of blended learning	84,2%
Helps develop teamwork skills	83,2%
Encourages parental involvement in the educational process	56,2%

Before creating the electronic supplement for the “Health, Safety, and Well-being” textbook for the 8th grade, the authors greatly valued teachers' practical

suggestions for its improvement. To gather these insights, we included an open-ended question in our survey. Unfortunately, the majority of respondents (90.7%) simply reiterated their positive feedback on the 7th-grade e-application and expressed a desire to receive similar content adapted to students' age-related changes. Some responses (1.3% of respondents) identified the lack of correct answers for online tasks as a drawback.

Among the most significant improvement suggestions provided by survey participants were:

- adding a separate "Remote Lessons" section;
- diversifying the multimedia content;
- increasing the number of infographics;
- including informational reference materials within studied topics;
- adding self-assessment tasks for students;
- expanding the educational and methodological resource set, incorporating a student workbook and teacher's practical task guidelines.

IV. CONCLUSIONS

The experimental study allowed us to analyse the main advantages and disadvantages of the electronic application for the "Health, Safety, and Well-being" textbook (7th grade). The feedback received enabled us to refine the electronic edition, improve its content and structure, and consider teachers' recommendations when developing the 8th-grade e-application. Specifically:

- diversified the multimedia content by adding presentations and animated videos.
- increased the number of visual elements, particularly infographics.
- to deepen individual topics and support differentiated learning, we added reference materials with extra information beyond the curriculum.
- to develop students' reflective skills, self-assessment tasks were included for every lesson.
- for teachers' convenience, remote lessons were placed in a separate section.
- the educational-methodological complex was expanded with teacher guidelines for practical tasks and a student workbook.

We believe these enhancements will improve the content and structure of the interactive electronic application, increase its functionality, and ultimately enhance its effectiveness in helping students master the model curriculum and achieve the required learning outcomes.

Our work on improving the e-application does not end here. We are exploring the possibility of integrating online services and programs into the supplement, enabling students to create their own digital products individually

and collaboratively. The results of this work will be presented in our future research.

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