PAISII HILENDARSKI
UNIVERSITY OF PLOVDIV
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WEB-BASED LEARNING FOR A HEALTHY LIFESTYLE IN BIOLOGY AND HEALTH EDUCATION IN 8TH GRADE

ABSTRACT OF A DISSERTATION

of a dissertation

for obtaining a doctoral degree in education and science

Field of higher education: **1. Pedagogical Sciences**
professional field **1.3. Pedagogy of Teaching ...**
doctoral program **"Methods of Teaching in Biology"**

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The dissertation was discussed and directed for defense at a meeting of the Department of Botany and Biological Education at the Faculty of Biology of the Paisii Hilendarski University of Plovdiv, held on 19.05.2022.

The dissertation is structured in an introduction, three chapters, conclusion and inferences, contributions, publications on the topic, bibliography and 7 appendices. The total volume is 201 pages, of which 166 constitute the main text. There are 83 tables and 74 figures included. The list of literature sources includes 132 sources, of which 80 titles are in Cyrillic, 52 titles - in Latin. The author's list of publications consists of 6 titles.

The materials on the defense are available in the Department for "Development of scientific staff and PhD programs" at the Paisii Hilendarski University of Plovdiv and in the Central Library of the Paisii Hilendarski University of Plovdiv.

The defense of the dissertation will take place on 30.09.2022 at 13.30 in the Faculty of Biology of the Paisii Hilendarski University of Plovdiv at a meeting of the Scientific Jury consisting of:

Prof. Zhelyazka Dimitrova Raykova, PhD

Prof. Yulia Georgieva Doncheva, PhD

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Assoc. Prof. Atanas Georgiev Baltadjiev, PhD

СЪДЪРЖАНИЕ

INTRODUCTION

The European Framework of Reference (European Union, 2018) lists eight key competences. They all need to be developed to some degree among the students during their schooling. Two of them have been emphasized in the present dissertation.

The first one is **"digital competence".** It is related to the ability to use, access, filter, evaluate, create, program and share digital content. Websites have become ubiquitous in our daily lives - we cannot imagine modern society without them.

The second group of competencies is **"Personal, social and learning to learn competence"**. Successful interpersonal relationships and social communication require "knowledge of the components of a healthy mind, body and lifestyle" (European Union, 2018). And this is especially important for today's adolescents. According to a WHO study, our students are "at the forefront of Europe in terms of smoking, alcohol and cannabis use and early sexual intercourse" (World Health Organization. Regional Office for Europe, 2020).

In 2018, the Council of the EU made a recommendation to the Member States: in order to maintain the current standard of living, it is necessary to "increase the level of personal, social and learning to learn competence to improve health conscious, future-oriented life management."

In support of competence-oriented education, training and learning in lifelong learning context, three challenges have been identified: "the use of a variety of learning approaches and contexts; support for teachers and other educational staff; and assessment and validation of competence development. In order to address those challenges, certain examples of good practices have been identified:

- Learners, educators and providers of education, training and learning can be encouraged to use digital technologies to make learning more successful and to support the development of digital competences.
- Educational staff could be provided assistance in creating innovative practices, taking part in research and making appropriate use of new technologies, including digital technologies, for competence-oriented approaches in teaching and learning." (European Union, 2018).

European directives are also reflected in the Pre-school and School Education Act (Ministry of Education and Science, 2015). Article 77 lists nine key competencies that should be formed among students during their training period from first to twelfth grade. Our research has focused on two of those - digital competence and skills to support sustainable development and a healthy lifestyle and sports.

The proposed study is dictated by the need to optimize the integration of modern information and communication technologies in the field of health

education in schools. The use of these technologies in the learning process is the basis for modernizing the education system.

CHAPTER ONE
THEORETICAL STUDY OF THE PROBLEMS RESEARCHED

1. Web-based learning

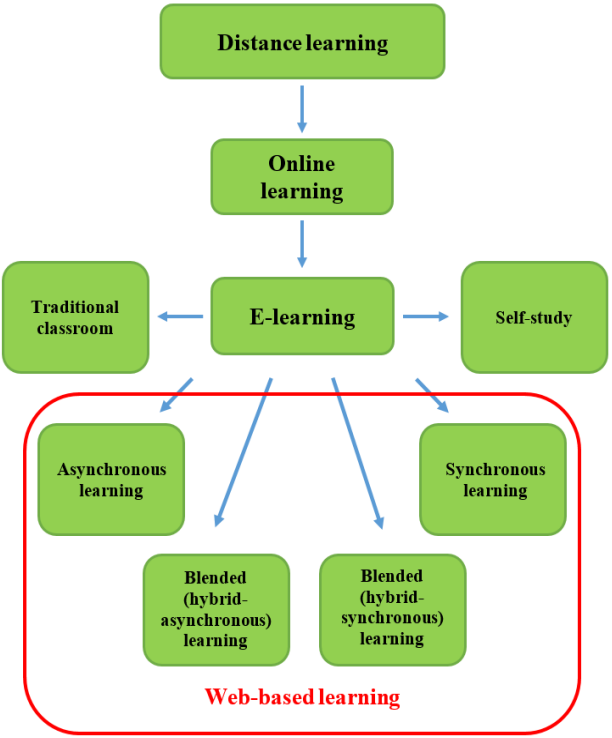

Figure 1.1. Place of web-based learning in the e-learning system

Item 1.1 provides a brief overview of the basic concepts related to web-based learning - e-learning, distance learning, online learning and web-based instruction. The essence of web-based learning as a didactic category is analyzed, on the basis of which the working formulation of the concept of ***"web-based learning" is reached***: **A type of e-learning, a set of all learning activities that use the Internet as an aid or main tool.**

The content and volume of the concept are defined, an attempt is made to build a hierarchy of concepts about the place of web-based learning in the e-learning system (Figure 1.1, p. 13 of the dissertation).

Several models of web-based learning are considered in item 1.2 (McKimm, Jollie & Cantillon, 2003; Tsai, 2009; Fadli, 2013; Wasim, 2014; Kremenska, Tashev &

Pangalova, 2013), a model based on them was chosen (Stanislavov, Penkov, Panayotova & Vakleva, 2018) and used in the study.

Figure 1.2. Experimental model
for creating web-based learning resources

Some main characteristics of several systems for delivery of educational content are compared - Moodle, Google Classroom, Microsoft Teams (Table 1.12, p. 31 in the dissertation).

2. Web-based learning in school practice - methodological aspects

A content analysis of the regulatory base for web-based learning was performed in item 2.1 (Ministry of Education and Science (MES), 2015; MES, 2016b; MES, 2017a; MES, 2017b; MES, 2020). Summary data for this analysis are shown in Table 1.13, p. 34 of the dissertation.

Based on the content analysis, an equivalence was found between the concepts in the legal framework and the classification of web-based learning, developed for the purposes of the research (Table 1.1).

Table 1.1. Equivalence of the concepts in the legal framework with the classification developed for the purposes of the research

Concept	Definition in the regulatory framework	Regulatory document	Analogue in Figure 1.1.
Distance learning in an electronic environment	"Learning that takes place through the use of information and communication technologies, as the trainer and the trainees are not physically in the same place."	Pre-school and School Education Act (MES, 2015) additional provisions, §17	Web-based learning
Synchronous distance learning	"In synchronous distance learning, distance learning includes a synchronous lesson and synchronous teacher-student interaction, as well as synchronous ongoing feedback on learning outcomes."	Regulation 10 (MES, 2016a), Art. 38, paragraph 3	Web-based synchronous learning
Synchronous distance learning in an electronic environment	"Distance learning in an electronic environment, in which the trainer and the trainees interact in real time, simultaneously, in person, through visual contact through an electronic platform."	Pre-school and School Education Act (MES, 2015) additional provisions, paragraph 29; Regulation 10 (MES, 2016b), Art. 7, paragraph 6	Web-based synchronous learning
Asynchronous distance learning	"Distance learning is asynchronous, when distance learning involves lesson observation without interaction with the teacher and other students."	Regulation 10 (MES, 2016a), Art. 38, paragraph 4	Web-based asynchronous learning
Asynchronous distance learning in an electronic environment		Regulation 10 (MES, 2016a), Art. 7, paragraph 7	
Web-based distance learning system	Not specified	Regulation № 24 (MES, 2020), Article 60	Web-based learning system

There is a comparison in item 2.2, based on the analysis of the opinions of (Marc (2002), Klein & Ware (2003), McKimm, Jollie & Cantillon (2003), Cook (2007), Wasim (2014), Nikolova, M. (2012), Totkov (2016), Abdillah (2021), etc.) between the traditional and the web-based learning, which highlights their most important differences.

Based on the studied literature and Table 1.15 of the dissertation, the advantages and disadvantages of web-based learning have been summarized (Table 1.2).

Table 1.2 Advantages and disadvantages of web-based learning
(according to Cook, 2007; Nikolova, M., 2012)

Web-based learning	
Advantages	**Disadvantages**
Opportunity to participate in the learning process at any time and from any place with access to the Internet.	It cannot be done in the absence of electricity, the Internet or a suitable device.
The inclusion of resources that engage all the senses.	There is a possibility of social isolation with long-term application of this type of learning.
Cost-effective in terms of sustainable use.	It is difficult to create resources for this type of learning - many and well-trained specialists are needed.
Easy exchange of ready-made resources - all that is needed is the Internet.	Excessive use of technology.
Quick updates of outdated information.	Lack of established web content standards.
Rapid introduction of new learning methods related to technology, e.g. augmented reality exercises.[12]	Loss of concentration when surfing the Internet and distraction from the resource sought.
Opportunity for quick inquiries.	Possibility of infection with malware.

The possibilities for web-based learning in Biology and Health Education (BHE) in 8th grade are described, comparing the advantages and limitations of PowerPoint presentation, e-textbook and e-readable textbook (Table 1.16, Table 1.17 and Table 1.18). from the dissertation).

According to Thijs, Almekinders, Blijleven, Pelgrum & Voogt (2001), there are five possibilities for utilizing web-based learning: Web referral, Web quest, Web exploration, E-mail project and Collaboratory. The application of each of them is considered on the website, which is specially created for the research "Знам за 7"

[1] https://ar.smartclassroom.bg/#/#ex
[2] Raykova, Stoyanova, Kafadarova & Stoyanova-Petrova (2014)

(Above the excellent grade) (http://biserstan.ucoz.net/), както и в сайта „Уча.се“ (I.study) (https://ucha.se/).

One of the highlights of our work is research, categorization and selection of available informational educational resources, which are situated on the website "Знам за 7". As such sources we have selected: www. arsmedica. bg/, https://www. zanzu. be/bg, as well as some sections of the websites: https://здравето. com, https://www. medicine. bg/, https://mediabricks. bg/, https://drkehayov. com/, https://www. lekar. bg/, http://www. dr-uzunova. com/, https://bg. khanacademy. org, YouTube videos, etc. A list of links to various online resources, current as of 22.05.2022, is presented in Appendix 1 of the dissertation.

3. Healthy lifestyle and related concepts

Item 3.1 clarifies the nature of the term "health". There is a great variety of opinions of various scholars on the nature of this concept. The most popular opinions are listed in Table. 1.20, p. 44 of the dissertation.

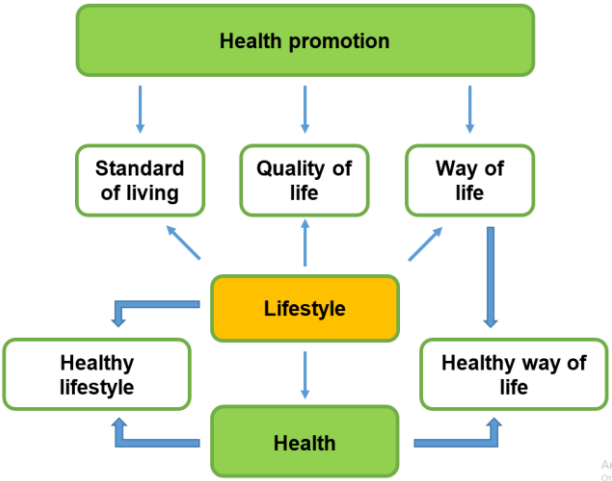

Figure 1.3. Concepts related to a healthy lifestyle

Item 3.2 clarifies the nature of the concept of "Healthy lifestyle". There is no consensus on the components of a healthy lifestyle. Summarizing the different ideas about the nature of the concept of "healthy lifestyle" and based on the objectives of our study, we accept the following components as its main, in terms of students' competencies for: 1. Rational nutrition; 2. Vigorous motor activity; 3. Proper alternation of work, rest and sleep; 4. Non-use of alcohol, cigarettes and drugs; 5. Injury protection; 6. Observance of personal and public hygiene; 7. Prevention of sexually transmitted diseases, unwanted pregnancy and AIDS; 8. Harmonious and positive relationships with people.

Based on the concepts included in the analysis and the literature studied on the subject, we made an attempt to derive their hierarchy. (Figure 1.3). A methodological model for creating the concept of "healthy lifestyle" has been created (Figure 1.4). This model is applied to all types and kinds of lessons from the curriculum in Biology and Health Education in 8th grade, which take into consideration various components of the healthy lifestyle.

Figure 1.4 Methodological model for building the concept of "healthy lifestyle"

Item 3.3 traces the results of several studies conducted in Bulgaria on students' behavior related to sexual culture, attitudes towards the use of psychoactive substances and their general behavior in relation to health.

The analysis of the data from the mentioned large-scale studies has lead us to the following conclusions:

1. There is work to be done with the students towards improving their health culture through the acquisition of knowledge, skills and competencies for a healthy lifestyle, including: healthy nutrition, mental well-being and sexual health, non-use of psychoactive substances, etc.

2. We need to develop intolerance and negative attitudes towards the use of psychoactive substances - alcohol, nicotine and other drugs among students.

3. We need to work with the school and family community to provide emotional support to adolescents in their efforts to limit and avoid unhealthy practices.

In item 3.4. we analyze the content of the curriculum on Biology and Health Education (8th grade) and Regulation No 13 on the civil, health, environmental and intercultural education (MES,

2016a) on the key concepts adopted by us as components of a healthy lifestyle. The content analysis of the two documents shows that the components of a healthy lifestyle adopted by us are not equally represented in the cognitive and affective taxonomy. This shortcoming can be compensated by appropriate technology of presenting the learning content in the lessons included in the pedagogical experiment (Chapter Three of the dissertation).

CHAPTER TWO
METHODOLOGY OF PEDAGOGICAL RESEARCH

In item 1 we formulated the **object, the subject, the objective, the tasks and the hypothesis of the research.**

Object of research: Students from 8th (9th) grade from different schools in the country in the process of forming competencies for a healthy lifestyle in the conditions of a model for web-based learning.

Subject of the research: Development and testing of a methodological model of web-based learning for the formation of competencies for a healthy lifestyle in the teaching process of Biology and Health Education in 8th grade.

Objective: To construct a model of web-based learning for the formation of competencies for a healthy lifestyle among students and to test experimentally its effectiveness in the teaching process for Biology and Health Education in 8th grade.

To achieve this objective, the following ***tasks*** have been completed:

1. Study of the state of the problem in pedagogical theory and practice:

1.1. Research and systematization of the nature and content of the *web-based learning* concept in the specialized literature and in the regulatory documents for education;

1.2. Research and systematization of the nature and content of the *healthy lifestyle* concept in the scientific literature, in educational regulatory documents and in the curriculum of Biology and Health Education in 8th grade.

2. Development of a methodology for pedagogical research.

2.1. Building a conceptual model for *web-based learning, aimed at* forming competencies for a *healthy lifestyle*.

2.2. Development of a system of criteria, indicators and a toolkit for reporting the results.

3. Development and testing of web-based educational resources.

3.1. Lessons and tests on the website "Уча.се".

3.2. Creation of a "Знам за 7" website.

4. Planning and conducting a pedagogical experiment.

5. Processing of the received data and analysis of the results.

6. Laying out of the dissertation.

7. Promotion of the results of the pedagogical research with publications in journals, participation in conferences, training courses and webinars.

Hypothesis: *If in the teaching process of Biology and Health Education for 8th grade a specially developed methodological model of web-based learning is applied, this will lead to:*

- raising the awareness of the students about healthy lifestyles
- positive change in the attitude and dispositions of students about healthy lifestyles
- formation of health conscious behavior.

Item 2 presents the methods of pedagogical research.

Theoretical research - aims to clarify the working concepts in the dissertation research, as well as good pedagogical experience in such experiments. Specialized literature sources on the research topic have been studied. We have reviewed and analyzed articles in Bulgarian and foreign pedagogical, methodological and psychological journals, as well as technological literature on the creation of a web-based site and resources for it.

Conceptual modeling. Includes creating a concept of pedagogical research; modeling of electronic educational resources (Chapter Two, item 3.1 and Appendix 1 in the dissertation); development of a conceptual model for the formation of competencies for a healthy lifestyle (Chapter Two, Figure 2.8 in the dissertation) and a methodological model for building the concept of "healthy lifestyle" (Chapter One, Figure 1.19 in the dissertation), as well as methodological model with application of web-based learning in lessons of Biology and Health Education in 8th grade for the formation of a healthy lifestyle (Chapter Two, Figure 2.1 of the dissertation). Modeling of the website "Знам за 7" has also been carried out. The most important sections of the content of the website are listed in Chapter Two, Table. 2.4 in the dissertation.

Content analysis of educational documentation on the concepts in the regulatory documents for secondary education related to web-based learning (Table 1.13 of the dissertation). An analysis of competencies as expected results in the areas of competence in Regulation № 13 and the curriculum of BHE in 8th grade and the thematic units of of the curriculum in Biology and Health Education for 8th grade in alternative textbooks. This is how the topics included in the didactic experiment are determined.

Research of web-based learning environments - different learning environments and the web-learning resources offered within them have been studied,

their advantages and limitations have been taken into account. In our opinion, a suitable web-based learning environment has been chosen - the websites "Знам за 7" and "Уча.се", which contain original web-based learning resources.

Pedagogical experiment for checking the effectiveness of web-based learning resources in lessons on health topics in Biology and Health Education for 8th grade. It examines the effectiveness of students' learning activities depending on various conditions and factors. The objective is to establish a combination between them that achieves the best possible results. In our pedagogical experiment we have used a control variant and two experimental variants, described in Chapter Two, item 3.2

Testing students according to the objectives and tasks of the experiment. The content of the tests, the specification of questions and indicators, as well as the number of points for each question are shown in Annex 4, and the results are presented in Chapter Three, item 1, item 2, item 3.1. and item 3.2 of the dissertation.

The test tasks used in the research are entirely original. The $T_1 – T_4$ tests are a standardized system of questions and tasks, checking the level of healthy lifestyle training of the students under equal conditions.

Surveying students according to the objectives and tasks of the experiment. The content of the survey is shown in Appendix 5, and the results are presented in Chapter Three, item 3.3 of the dissertation.

The survey we use is:

- *written* - provided for filling in electronic format
- *standardized* - the individual questions and their possible answers are given in advance in a specific sequence. Respondents are only required to indicate which answer corresponds to their opinion.

Peer review - Lessons and tests are subject to peer review. Recommendations have been made regarding the content of the lessons and the quality of the tests for each lesson.

Mathematical-statistical methods - serve to interpret the results in the context of the problem that is being investigated. Due to the specifics of the data obtained, the Student-Fisher test was used, which is applied in the parametric distribution of data. The results and their analysis are presented in Chapter Three, item 1, item 2 and item 3.1 and item. 3.2. They are visualized by appropriate tables, diagrams and histograms.

The analysis of the results of the study was performed in the following sequence: *establishing a normal distribution* of the aggregates of the compared samples (in the preliminary experiment - $B_к/B_1$, $B_к/B_2$ or B_1/B_2, in the main and final experiment - B_1/B_2); *construction of a linear frequency diagram* to determine the difference between the test results for each of the compared groups of students; *selection of the correct statistical procedure* for testing the

hypothesis; *checking for similarity or difference in the variances* of the two groups - for equal variances the procedure for comparing two mathematical expectations is applied for unknown but equal variances of the aggregates; calculation and comparison of the values $t_{набл}$ and $t_{крит}$ to establish a statistically significant difference.

The stages of the pedagogical research are presented in Table. 2.1.

Table 2.1. Stages of pedagogical research

Objectives	Number of schools	Number of students	Research activity
1. Preparatory stage - 2018/2019			
1. Theoretical research on the conceptual apparatus and current accents related to the formation of competencies through web-based training in "Biology and Health Education" - 8th grade 2. Preparation of a research concept and a conceptual model for the formation of competencies for a healthy lifestyle through web-based learning in BHE in 8th grade (Figure 2.1) 3. Setting objectives and tasks for the study. 4. Development of a system of criteria and indicators and a toolkit for diagnosing the results of the experiment. 5. Justification of the methodology for conducting the research 6. Development of a conceptual design of a methodological model for experimental work in school (Figure 2.2) 7. Development of a website "Знам за 7" and a system of educational Internet resources for a healthy lifestyle	-	-	Carrying out of literary research of specialized literary sources on pedagogy, methodology of teaching biology, medicine, etc.; Systematization of resources for *Web-based learning and Healthy lifestyle;* Study of the characteristics of web-based learning; Study of the state of the problem in school practice; Content analysis of educational content; Developments of the experimented topics; Research and preparation of educational resources for the pedagogical experiment;

2. Preliminary experiment - 2019/2020			
1. Research of the healthy lifestyle as a system of competencies and the possibilities for application of the web-based learning in their construction. 2. Development of an optimized methodological model for the formation of competencies for a healthy lifestyle with the application of web-based learning in the biological preparation of students. 3. A check of: - the effectiveness of the developed methodological model with the application of web-based learning; - the system of criteria and indicators as well as a toolkit for their reporting.	4	220	Development of experimental variants - $B_к$, B_1 and B_2 and establishing their effectiveness; Statistical processing and analysis of experimental data; Optimization of the researched methodological model, the criterion system and the toolkit. Conducting tests to determine the degree of formation of competencies for a healthy lifestyle.
3. Main experiment - 2020 - 2021			
1. Conducting a basic pedagogical experiment to test the effectiveness of the optimized methodological model for web-based learning in the formation of a healthy lifestyle among students. 2. Enrichment of the theoretical analysis, didactic and diagnostic materials used in the research.	4	220	Conducting experiments, diagnosing results, their systematization and analysis.
4. Final experiment - 2020 - 2021			
1. Conducting a final pedagogical experiment to confirm the effectiveness of the methodology studied in the main experiment. 2. Proving the stability of the results obtained in the experiment. 3. Summarizing the theoretical analysis, didactic and diagnostic results obtained in the study in view of their presentation in the dissertation.	2	132	Formulation of the general conclusions and contributions of the dissertation research.
5. Implementation in practice - 2020 - 2022			
1. Popularization of the results of the pedagogical research and their implementation in practice 2. Forming a dissertation			Publications in the press, participation in scientific and practical seminars and conferences

A conceptual model for the formation of competencies for a healthy lifestyle through web-based learning in Biology and Health Education was developed in the preparatory stage of the research (Figure 2.1).

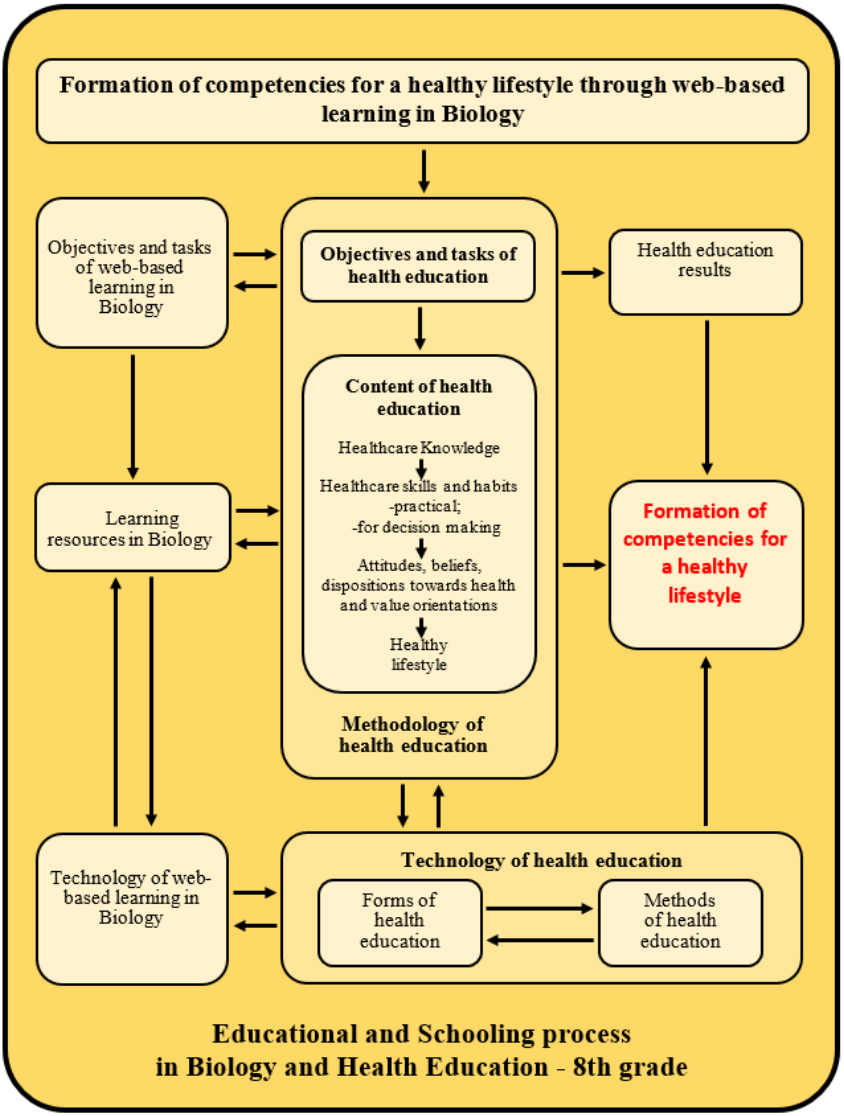

Figure 2.1. Conceptual model for the formation of competencies for a healthy lifestyle through web-based learning in Biology and Health Education

As a concretization of the conceptual model, a methodological model for experimental work was developed in three variants, presented in Figure 2.2.

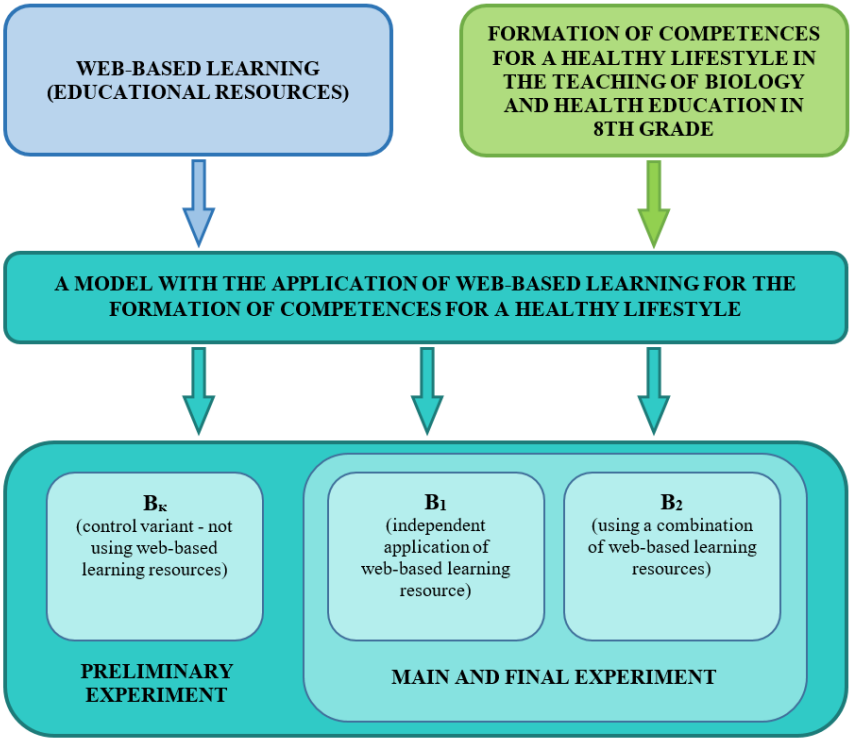

Figure 2.2. Methodical model with application of web-based learning in Biology and Health Education lessons in 8th grade for the formation of a healthy lifestyle

The essence of the variants is as follows:

In the ***control version*** $B_к$ learning is carried out through traditional methods and working equipment, without the use of web-based resources.

In ***experimental variant*** B_1, the learning is performed using the independent use of a web-based resource. It can be applied at different stages in the course of the lesson. It is possible to use it at the beginning of the lesson, thus solving the motivational component; during the stage of perception and awareness of new information; at the stage of comprehension and summarization of the new material or at the stage of consolidation of knowledge.

In ***experimental variant B_2***, the learning is performed using a combination of two or more web-based resources.

Students from 4 schools in the country participated in the three stages of the experiment. Their distribution is indicated in Table 2.2.

Table 2.2. Distribution of students by stages of research, number of schools and number of students

Stages of research	Schools	Number of students
Preliminary pedagogical experiment	"Baba Tonka" High School of Mathematics - Ruse	88
	"Friedrich Schiller" German Language School - Ruse	66
	"Bratya Miladinovi" Secondary School - Plovdiv	22
	High School with Humanitarian Profile "St. St. Cyril and Methodius" - Plovdiv	44
Basic pedagogical experiment	"Baba Tonka" High School of Mathematics - Ruse	88
	"Friedrich Schiller" German Language School - Ruse	66
	"Bratya Miladinovi" Secondary School - Plovdiv	22
	High School with Humanitarian Profile "St. St. Cyril and Methodius" - Plovdiv	44
Final pedagogical experiment	"Friedrich Schiller" German Language School - Ruse	66
	"Baba Tonka" High School of Mathematics - Ruse	66
Overall	**Schools - 4**	**572**

In item 4. the criteria, indicators and the toolkit of the research are considered.

To empirically prove the degree of formation of competencies for a healthy lifestyle, we have developed a system of criteria and indicators, including the following:

1. ***Criteria for "Awareness of a healthy lifestyle"*** - reflects the level of awareness of the student on issues of protection, restoration and strengthening of personal and public health and a healthy lifestyle. It is assessed through the "*Identification and operation of key concepts of a healthy lifestyle*" *indicator*, which corresponds to the levels of knowledge, understanding and application of Bloom's cognitive taxonomy.

2. ***Criterion*** "Attitudes and dispositions towards a healthy lifestyle" - *The attitude* reflects a positive or negative predisposition of students towards healthy lifestyles, which contributes to determining their various behaviors in this aspect. It includes a system of values and beliefs of the individual who is predisposed to feel and react in a certain way to certain stimuli associated with healthy lifestyles. *Dispositions* reflect the susceptibility of students to a certain type of reaction and determine their actions and experiences related to various aspects of a healthy lifestyle. This criterion is taken into account through the indicator *"Mediation of*

a healthy lifestyle", in the sense of mediation for the promotion, design and implementation of various forms of healthy lifestyles. It assesses the level of students' modern understandings of health and lifestyle. Analysis, synthesis and evaluation of Bloom's cognitive taxonomy correspond to this indicator.

3. Criterion "Healthy responsible behavior" - this is a positive characteristic of students who are able to engage and act properly in the context of a healthy lifestyle. It is accounted for using two indicators:

- *"Functional skills for a healthy lifestyle"* - reflects the ability of the student to perform a certain health action or system of actions properly, under the control of consciousness and in compliance with the established rules for this purpose. Includes levels of perception and response according to Bloom's affective taxonomy
- *"Value orientation for a healthy lifestyle"* - establishes a complex attitude of the student to healthy lifestyles. Includes a level of determining values according to Bloom's affective taxonomy.

The toolkit for reporting the results of the first two criteria includes four T_1 - T_4 tests with tasks (structured or with an open answer), corresponding to the indicators of Bloom's cognitive taxonomy. The numbers of the tests and tasks are given in Table 2.3. Their content is presented in Appendix 3 of the dissertation.

The third criterion is accounted for with a survey containing 28 questions, which examines the functional skills and value orientations of students towards healthy lifestyles. They correspond to the levels of Bloom's affective taxonomy, listed here in Table 2.3. The content of the survey is presented in Appendix 4, and the analysis of the results is discussed in Chapter Three, item 3.3 of the dissertation.

Table 2.3. System of criteria and indicators for diagnostics of the degree of formation of competencies for healthy lifestyle

Criteria	Indicators	Compliance with:		Toolkit
		Levels of B. Bloom's cognitive taxonomy	Key indicators (expected results - knowledge, skills, attitude)	
Cognitive sphere				
Awareness of a healthy lifestyle	Identification and operation of key concepts for a healthy lifestyle	Knowledge, understanding, application	To know and be able to operate (at the level of knowledge, understanding, application) with information about the content components of a healthy lifestyle	Knowledge – T_1 - 1, 2, 3, 4, 5, T_2 - 1, T_3 - 1, 2, 3, T_4 – 1, 2, 4 Understanding - T_1 - 6, T_2 - 6, 7, 8, T_3 - 4, 5, T_4 - 4, 5 Application - T_1 - 7, 8, 9, T_2 - 2, 3, 4, 5, T_4 - 7, 8, 9
Attitudes and dispositions towards a healthy lifestyle	Mediating a healthy lifestyle	Analysis	To demonstrate skills for analysis and argumentation of knowledge about health, solving current problems related to physical and mental health	T_1 - 10, T_2 - 9, 10, T_3 - 6, 7, 8, T_4 - 10, 11
		Synthesis		T_1 - 11, T_2 - 11, 12, T_3 - 9, 10
		Assessment	To assess the health status of the individual by physiological, anatomical and psychological parameters; To assess the health reserves and compensatory capabilities of the body.	T_1 - 12, 13,T_2 - 13, 14, T_3 - 11, 12, T_4 - 12, 13
Affective sphere				
Healthy responsible behavior	Functional skills for a healthy lifestyle	**Perception** - sustainable motivation for a healthy lifestyle	To be ready to achieve a healthy lifestyle based on acquired experience	1, 16, 20, 23
		Response - self-control and self-affirmation of a healthy lifestyle	Responding to a specific requirement for a healthy lifestyle	5, 6, 10, 11, 12, 13, 14, 15, 17, 19, 24
	Value orientation for a healthy lifestyle	**Determining the value of a healthy lifestyle**	Recognition, preference and certainty for leading a healthy lifestyle as a value	2, 3, 4, 7, 8, 9, 18, 21, 22, 25, 26, 27, 28

CHAPTER THREE
RESULTS OF THE PEDAGOGICAL EXPERIMENT AND THEIR ANALYSIS

1. Analysis of the summarized results according to the "Awareness of a healthy lifestyle" criteria and "Attitudes and dispositions towards a healthy lifestyle"

1.1.Analysis of the results of the preliminary experiment

During this stage of the pedagogical experiment we measure the level of competencies for healthy lifestyle according to the accepted criteria. We are conducting four tests for the criteria "Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy lifestyle".

Despite some similarities in the results on certain indicators in the three variants, we have found a trend for better performance of students in B_1 and B_2 compared to B_K (Figure 3.1). A similar trend has been identified and reported in the studies of Choi, Lim & Leem (2002), Şengel (2005), Kremenska (2011). In Figure 3.1. the abscissa shows the number of points, and the ordinate shows the number of students who achieved the corresponding result, expressed in points.

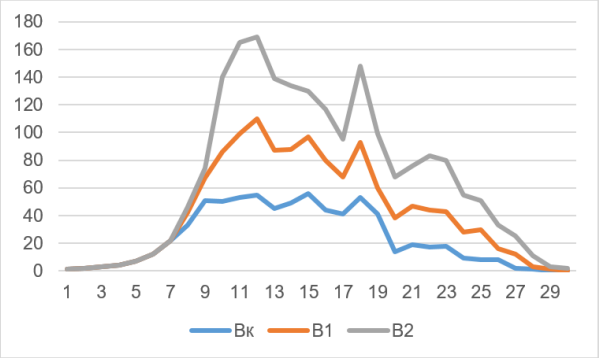

Figure 3.1. Summary data on the results of the two criteria - "Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy

In the main experiment this gives us reason to continue our research work without a control variant, focusing on:

- search for a statistically significant difference between the two options - B_1 and B_2;

- optimization of the methodology for their implementation;

- optimization of the tests' content.

1.2. Analysis of the results of the main experiment

To diagnose the results of the main experiment, we conducted four tests (T_1, T_2, T_3 and T_4) and a survey. The data have been systematized in tables and graphs. Their quantitative and qualitative analysis is presented in this item.

In Figure 3.2. through the summarized graph we show the results of the two criteria - "Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy lifestyle" for tests T_1 - T_4.

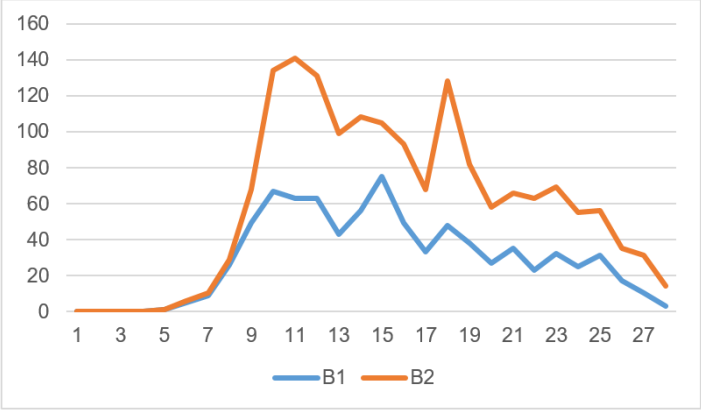

Figure 3.2. Summary data on the results under the criteria "Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy lifestyle" for tests T_1 - T_4

The summarized data from the main experiment and their comparative presentation are grounds for drawing some conclusions in our analysis:

- the search for differences in the application of the two variants according to our methodology is confirmed by a statistically significant difference in all criteria and indicators (with a few exceptions);
- we find efficiency in the diagnostic apparatus with which we obtain data that can be successfully subjected to statistical processing and that can correct our views on the used web-based resources and their variable application in the optimized model;
- we believe that the diagnostic apparatus and statistical models for processing the results are effective and can be applied in the final experiment.

1.3. Analysis of the results of the final experiment

To diagnose the results of the main experiment, we conducted four tests (T_1, T_2, T_3 and T_4) and a survey. In Figure 3.3 through the summarized graph we compare the results of the two criteria - *"Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy lifestyle" for tests T_1 - T_4.*

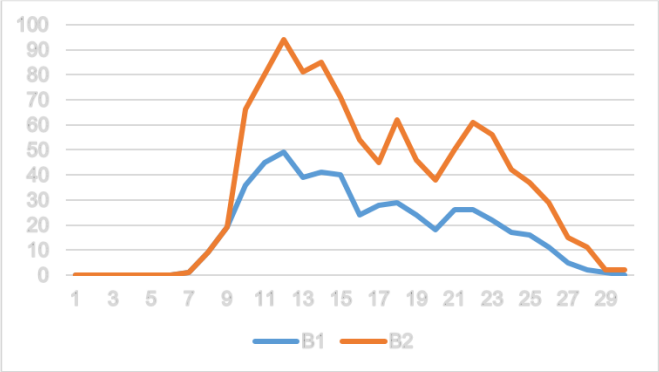

Figure 3.3. Summary data on the results under the criterion "Awareness of a healthy lifestyle" and "Attitudes and dispositions towards a healthy lifestyle" for tests T_1 - T_4

From the **summarized data for the final experiment** it is clear that:

- with few exceptions, there is a statistically significant difference between variant B_1 and B_2 in favor of the second variant;
- the cases of similar achievements in both variants are explained by the generally positive effect of the application of web-based educational resources, regardless of whether they are applied on their own or in combination;
- both variants are effective and their individual or combined application is determined by the didactic objectives, the nature of the topic and the type of resource.

The data from the overall experimental work confirm that the B_2 methodology, where the web-based educational resources are applied in combination, is more effective. This enriches the educational process, providing a greater variety of web-based resources and a varied methodology for their application.

2. Analysis of the summarized results by the criterion "Health conscious behavior"

The survey of ***the main experiment*** included 220 students (143 girls and 77 boys) from 8th and 9th grade, who study curriculum for 8th grade. The students are from four schools in two cities in the country - Ruse and Plovdiv. The survey presents questions that affect all components of a healthy lifestyle (Table 3.1)

Table 3.1. Components of a healthy lifestyle and questions from the survey, through which they are analyzed

Characteristics of a healthy lifestyle	Questions through which they are analyzed
General dispositions towards a healthy lifestyle	1, 2, 3, 4
Healthy nutrition	5, 6, 7
Vigorous physical activity	8, I, 10
Proper alternation of work, rest and sleep	11, 12, 13
First aid skills	14
Prevention of STDs, pregnancy and AIDS	15, 16, 17
Personal and public hygiene	18, 19
Non-use of psychoactive substances	20, 21, 22, 23, 24, 25, 26
Positive communication	27, 28

Some of the results of the surveys in the main and final experiment are presented in Table 3.2. All results of the two surveys can be viewed in Chapter 3, item 3.3, Table. 3.49 and Table. 3.51 of the dissertation.

Table 3.2. Results of the conducted surveys in the main and final experiment

Questions	Main experiment				Final experiment			
	B_1		B_2		B_1		B_2	
	% of all females in the group	% of all males in the group	% of all females in the group	% of all males in the group	% of all females in the group	% of all males in the group	% of all females in the group	% of all males in the group
If you had to rank your values, where would you put health in terms of importance?								
At the top	74,4	66,7	82,4	79,7	68,5	67,7	72,3	74,4
Second	14,4	14,5	15,4	11,9	24,1	23,5	26,8	25,6
Third	2,1	1,5	0	5,5	1,8	0	0,5	0
Close to the bottom	0	0,5	0	0	0	2,9	0	0
I can not answer	9,2	16,8	2,2	2,8	5,6	5,6	0,5	0
Do you eat healthy?								
Yes, whenever I can	16,9	29,4	14,3	22,7	12,9	26,5	13,3	28,7
Yes, but not always	24,1	24,2	37,1	38,2	25,9	23,5	36,6	27,8
I try	39,6	29,5	28,8	25,1	46,3	38,2	41,8	39,3
In most cases - no	15,0	14,4	17,6	12,1	14,8	5,9	8,4	2,8
No - health does not depend on diet	4,4	2,5	2,2	1,9	0	5,9	0	1,4
Do you do tourism?								
No	29,7	44,2	22,4	39,3	31,5	38,2	26,4	32,8
Sometimes - if I am in good company	25,4	16,8	27,8	20,8	20,4	17,7	21,4	16,2
Less than once a month	14,8	22,7	12,3	18,3	20,4	29,4	24,9	32,7
Yes - once a month	14,5	9,5	18,0	11,4	18,5	8,8	15,1	4,9
Every week	2,5	2,2	2,5	2,2	1,9	2,9	3,2	7,4
Whenever I have free time	13,1	4,7	16,2	8,0	7,4	2,9	9,1	6,0
What time do you go to bed at night?								
Before 10 pm	2,8	4,6	1,1	3,9	3,7	0	4,2	5,6
Between 10 pm and 11 pm	17,8	15,5	20,7	23,4	9,3	5,9	10,1	9,3
Between 11 pm and midnight	18,9	42,2	24,9	34,2	25,9	38,2	44,0	48,4
Between midnight and 1 am	26,3	21,6	29,9	27,1	35,2	26,5	32,1	24,4
Between 1 am and 2 am	22,8	12,2	16,8	9,5	11,1	14,7	3,4	8,2
After 2 am	11,3	4,0	6,5	2,0	14,8	14,7	6,2	4,2
If necessary, can you provide first aid for cardiac arrest?								
Yes	33,9	46,9	42,7	49,3	46,3	32,4	48,9	39,5
No	66,1	53,1	57,3	51,7	53,7	67,7	51,1	60,5
Do you think that at your age you should use condoms?								
Yes, always during sexual intercourse	90,2	82,7	93,7	89,2	83,3	73,5	90,6	89,2
Yes, in case of risky sexual intercourse	6,1	8,5	3,9	3,3	9,7	11,8	6,2	6,1
Yes, only during the "risk days"	0,9	0,5	0,7	0,5	5,6	2,9	3,2	2,5
No, I have faith in my partner	0,7	3,5	0,7	3,5	0	2,9	0	1,1
I have never used and will not use one	2,2	4,8	1,1	3,6	1,9	8,8	0	1,1

How many times a day do you brush your teeth?								
Once	17,2	18,8	20,4	16,1	1,9	23,5	0	8,2
Twice	16,0	15,8	19,4	21,0	62,3	56,8	71,0	80,2
Three times	12,6	13,4	15,3	18,4	25,9	5,6	22,2	7,2
More than three times	9,6	9,5	8,5	12,5	6,2	4,2	4,5	2,2
After each meal	0,5	2,5	0,5	0,5	3,7	2,9	2,4	1,1
Sometimes I forget to brush them	44,1	40,0	35,8	31,6	0	5,9	0	1,1
I do not brush them	0	0,5	0	0	0	1,1	0	0
What is your opinion on passive smoking?								
It is not as harmful as active smoking.	12,8	15,4	10,4	9,8	14,8	8,8	5,6	5,6
It is as harmful as active smoking.	59,4	52,5	69,2	76,4	64,8	61,8	86,0	87,3
I can not answer.	27,8	32,1	20,4	13,8	20,4	29,4	8,4	7,2
What would you do if you were offered to try a drug at a party with friends?								
I will accept - trying it once will not harm me	3,8	7,5	0,5	2,5	1,7	1,4	1,1	0,4
I will not accept under any circumstances	77,3	78,1	85,1	83,0	78,7	80,9	92,7	93,1
I might possibly try it	3,7	1,0	2,2	0,5	5,6	4,9	2,4	1,1
It depends on who offers it to me	9,2	9,3	4,9	2,7	7,4	5,8	1,1	2,8
That would depend on the drug	12,7	24,1	5,5	16,1	6,7	6,5	2,6	2,4
It would not worry me - I have already tried that	1,9	2,2	1,9	2,2	0	0,5	0	0,1
How do you think emotions affect health?								
They have nothing to do with health.	3,2	8,7	3,7	5,6	1,9	8,8	0,5	2,8
They improve your health if they are positive.	89,8	78,8	90,9	83,8	90,7	79,4	97,2	93,5
I find it difficult to answer	7,0	12,5	5,4	10,3	7,4	11,8	2,3	3,7

When comparing the results between the two options - B_1 and B_2, there is a tendency towards better results in B_2 compared to B_1. This gives us reason to believe that as a result of the application of a combination of web-based resources in the process of web-based learning, B_2 students have developed a more health conscious behavior in many aspects of the healthy lifestyle, compared to B_1 students.

The survey of ***the final experiment*** included 132 students from 9th grade (85 girls and 47 boys). The students are from two schools in Ruse - "Friedrich Schiller" German Language School and "Baba Tonka" High School of Mathematics

The results of the survey confirm the trend that emerged during the main experiment - B_2 students have a more health consious behaviour towards the aspects of a healthy lifestyle than B_1 students. We believe that this is due to the application of a combination of web-based educational resources that help to shape this behavior to a greater extent than the application of only one web-based resource.

The hypothesis accepted at the beginning of the experimental work is confirmed by the experimental data from all three stages of the experiment. They are expressed in the following:

- in the preliminary experiment B_1 and B_2 have a much higher growth in the results compared to $B_к$. This difference is also statistically important;

- in the main experiment a significant part of the students who worked on the experimental variants achieve optimal results;

- the trend found in the main experiment is convincingly confirmed in the final stage of the experimental work.

- Survey data convincingly demonstrate that the use of a variety of web-based educational resources in the learning process leads to the formation of health conscious behavior in many aspects of a healthy lifestyle.

INFERENCES AND CONCLUSIONS

The following **important inferences** emerge from our overall experimental, research and innovation activities:

1. The developed **conceptual model** for the formation of competencies for a healthy lifestyle, of web-based learning, confirmed its effectiveness in school practice regarding the possibilities for:

- realization of web-based learning in the BHE lessons for 8th (9th) grade;
- formation of competencies for a healthy lifestyle with the help of web-based educational resources;
- diagnostics of the results of the pedagogical process with the developed diagnostic apparatus - a system of criteria, indicators and their respective toolkit.

2. The developed **methodological model** for the formation of competencies for a healthy lifestyle through the use of various web-based learning resources has led to:

- raising the awareness of the students about a healthy lifestyle;
- positive change in their attitudes and dispositions towards a healthy lifestyle;
- formation of health conscious behavior among them.

3. The knowledge about health and the skills acquired by students as a result of the applied technology are a prerequisite for mastering and understanding the scientific foundations of a healthy lifestyle, helping to internalize its norms and transform them into attitudes, beliefs, dispositions and responsible behavior.

The results of our study show that better opportunities for the formation of competencies for a healthy lifestyle among students is provided by:

- the application of web-based learning resources in the lessons of BHE for 8th (9th) grade - the results of B_1 and B_2 are better than the control variant ($B_к$);
- the combined application of web-based learning resources compared to their independent use - B_2 data are higher than B_1.

4. The diagnostic apparatus developed for the objectives of the experiment - a system of criteria and indicators, as well as a toolkit for their reporting (partly based on the learning environment "Уча.се") provides very good opportunities for diagnosing the competencies for a healthy lifestyle.

5. The conceptual model developed in the pedagogical research and experimentally tested:

- enriches the theory and practice of the methodology of teaching Biology and Health Education;

- it can be applied in other educational content and educational degree;
- provides opportunities for enrichment and adaptation according to specific educational objectives and technological opportunities.

The research accomplished is meant to identify some problems **for further research and development:**

1. Development and improvement of students' competencies for a healthy lifestyle in the biological cycle of subjects 9th - 12th grade.
2. Enriching the website "Знам за 7" with new materials - presentations, videos, links, test tasks, etc.
3. Sharing experience in specialized pedagogical forums and magazines.

CONTRIBUTIONS TO THE DISSERTATION RESEARCH

The results of the presented dissertation give grounds to formulate the following contributions:

On a theoretical level

1. An attempt has been made to define the place of web-based learning in the e-learning system.
2. A conceptual model for the formation of competencies for a healthy lifestyle has been created in the conditions of web-based learning in Biology and Health Education for 8th grade.

At the practical/application level

1. The content of the concept "*Competences for* a healthy lifestyle" has been determined and is based on the regulatory documents (curriculum in Biology and Health Education for 8th grade and Regulation 15 on the civil, health, environmental and intercultural education) its components have been determined;
2. A methodological model has been developed for building the concept of *"Healthy lifestyle"* in the conditions of web-based learning in 8th grade, which enriches the Methodology of Teaching Biology and Health Education from a modern perspective;
3. The educational website *"Уча.се"* has developed lessons and tests in Biology and Health Education for 8th grade, some of which are in the context of a healthy lifestyle;
4. The site *"Знам за 7*" was created as an educational repository of modern web-based resources in Biology and Health Education for 8th grade and in particular aimed at a healthy lifestyle;
5. A three-year pedagogical experiment was conducted, which shows the advantages and disadvantages of the individual methodological variants and proves the didactic possibilities for the formation of competencies for a healthy lifestyle, in the conditions of web-based learning in Biology and Health Education for 8th grade;
6. Didactic tests, relevant criteria and indicators for diagnosis of competencies for a healthy lifestyle, formed in the process of teaching Biology and Health Education for 8th grade, have been developed and tested in the teaching practice;
7. Some parts of the present dissertation research have been reported at national scientific conferences and published in specialized pedagogical publications.

PUBLICATIONS ON THE TOPIC OF THE DISSERTATION

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2. Stanislavov, B., Vakleva, Z. & Panayotova, M. (2019). *A conceptual model of web-based education for healthy lifestyle.* Scientific works of the Union of Scientists in Bulgaria - Plovdiv. Series A. Social Sciences, Arts and Culture, 5, 139-143, ISSN 1311-9400

3. Panayotova M., Vakleva, Z. & Stanislavov, B. (2021). *Essence and content of the term "healthy lifestyle" and its place in the curriculum of Biology and Health Education in 8th grade.* Scientific Papers of the Union of Scientists in Bulgaria - Plovdiv, Series B - Natural and Human Sciences, Volume XXI, 4 - 8, ISSN 2534-9376 (Online)

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