

The Method for Forming the Health-Saving Component of Basic School Students' Digital Competence

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Abstract. The article describes the method for forming the health-saving component (HSC) of basic school students' digital competence that involves the purposeful acquisition of the ability to health-saving use of ICT in educational process. The basis for named method implementation is the author's training course, covering 12 academic hours and designed for 5-9 grades classes (10(11)-15 years old students). The training course can be conducted within the compulsory subjects or electives in groups of up to 15 students. In the article the named course tasks are defined, the content units, principles and methods are represented. The recommendations for the final control (group project) are given. An empirical study showed that in the experimental group that studied under the author's method, the number of students with a low level decreased significantly, while the number of students with average and high levels of HSC increased. These results are much ahead of those obtained in the control group. Consequently, the results of the experiment showed the effectiveness of the author's method for forming HSC of basic school students' digital competence.

Keywords: Basic School Students¹, Health-Saving Component, Digital Competence, ICT, Method, Experiment.

1 Introduction

Adjusting to current social demands, educational system of Ukraine has sustained remarkable changes during last years: updating of regulatory framework, content and educational standards, implementation of hardware devices that has facilitated expansion of the scope of teaching materials, appearing of new facilities for pedagogical systems upgrading. Besides the obvious advantages, modernization of educational domain is related to a range of factors, which produce a deleterious effect on psychophysical state and health of rising generation: informational overloads, stress-generating situations,

¹ Basic school in Ukraine covers 5-9 grades and involves 10(11)-15 years old students.

hypodynamy, insufficient natural lighting etc. All these factors create significant tension for child organism, which alongside with other negative factors leads first to diseases, functional disorders and later to development of organ pathology.

Major and one of the most forward-looking part of our society is constituted by adolescents. Adolescence is regarded as one of the most crucial periods in human life. The specificities of this age determine a specific state of organism, full social vulnerability, dependence of social environment's influence at biological and social and psychological levels. According to World Health Organization, deterioration of living conditions and decreasing of social stability in society determine growth of stress state in teenager population more than in other social strata, what leads to increase in disease. According to National Academy of Medical Sciences of Ukraine (as of 2016) adolescents display significant health deterioration during the period of their school studies. According to Ministry of Health of Ukraine (as of 2017) during the last years, the state of adolescents' health remains unsatisfactory with a negative tendency to deterioration.

One of the factors of influence on students' health state is use of modern ICT. Analysis of the results of studies in medicine, ergonomics, psychology, pedagogy (Balanskat A. [1], Dymova A. L. [2], Hainsworth A. [3], Hakala P. T. [4], Hun H. E. [5], Muhametzyanov I. Sh. [6], Polka N. S., Platonova A. H. [7]) proves that major part of negative consequences (such as reduction of long-term working capacity, decrease of efficiency and quality of learning, cognitive overload, growth of diseases of locomotor system, impairment of sight, etc.) are mostly determined by «human factor» and related to non-observance of ergonomic and pedagogic norms. Some researchers point out the risks of the harmful effects of ICT on the physical and mental health of children and adolescents, which is related to psychological overload, ergonomically unwanted use of equipment and furniture, violation of time standards for using ICT, etc. (Cicarelli M. [2], Hainsworth A. [3], Hakala P. T. [4], Zlamanski R. [13]).

That is why of the most dominant current problems is development of scientific and methodological foundation for health-saving use of ICT, formation and development of the relevant competences of educational process participants.

The purpose of our study is to substantiate the method for forming the health-saving component of basic school students' digital competence.

2 The presentation of main results

2.1 A forming the health-saving component of digital competence as a main condition for healthy use of ICT in teaching basic school students

Our study [6; 10; 11, etc.] allowed to establish a suggestion that the foundation for health-saving use of ICT in basic school (BS) educational process is systematic and dedicated formation of health-saving component (HSC) of BS students' digital competence. We define it as student's ability to apply consciously a range of developed measures of methodologically reasoned and safe use of ICT in educational process.

It was defined, that knowledge, abilities and skills of health-saving use of ICT should be considered within the scope of digital competence as one of its components, as for:

- Effective work with ICT is not possible without knowledge of observing the norms

and requirements on its safe health-saving use;

- Formation of competence about health-saving use of ICT has to precede the actual start of their application in educational process;

- Development of competence about health-saving use of ICT has to be exercised hand in hand with studies with use of ICT during the whole period of studies and mainly in the process of studying IT-disciplines.

Formation of HSC of digital competence of BS students provides their acquisition set of relevant knowledge, abilities and skills, persuasions and motivation aimed at preservation of physical and psychological well-being and health while use of ICT.

We have defined main components of HSC of digital competence structure:

1. *Value and motivational component*, which embraces a system of persuasions, value orientations and motivation of the person in preservation of his/her own health, interests and mindsets on implementation of health-protection measures.
2. *Cognitive component*, which envisages systematic acquisition of corresponding skills on safe exploitation of ICT in educational process: content of safety regulations of work with computer facilities; nature of potential threats while working with ICT; duration of recommended time limits of work with computer; ways of minimization of deleterious effects of computer techniques on organism etc.
3. *Operational and functional component*, which embraces ability to apply theoretical knowledge of health-saving use of ICT on practice, and envisages following of security regulations of work with computer; observing time limits of work with computer; ability to adjust his/her working place according to individual specifics and needs; self-analysis of own state before, during and after work with computer; self-control and self-regulation of correct posture in the working process; regular breaks on physical warm-ups to relieve the fatigue sustained by eyes, muscles, joints etc.

The degree of HSC advancement is attested by advancement of each of its component.

To evaluate the situation with health-saving use of ICT at lessons in BS a survey of 351 persons was conducted: 246 students from 5th to 9th grades and 105 teachers [11]. In particular, it was found that:

- Teachers and students regularly use ICT in educational process, specifically such devices as personal computer, laptop, tablet, e-book;
- Valid time limit recommended by state sanitary and hygienic regulations is not known to most of students and not observed by them. First, it proves the absence of adults' relevant control, and second, the low current level of HSC of digital competence of interviewed teenagers;
- There are no coordinated actions of parents and teachers, what generates a collision: if time and conditions of work with computer is strictly regulated in with sanitary and hygienic standards at school, at home time limits are not regulated and could last 3 hours and more (!). We believe that defaults of coordination between the actions of teachers, parents and students could be liquidated by implementation of systematic teaching and education activities.

The above-mentioned activities require development of relevant methodical standards for forming HSC of BS students' digital competence.

2.2 The method for forming HSC of BS students' digital competence

While planning and exercising of health-saving teaching activity with BS students it is essential to take into consideration psychological specificities of their studies:

- Choose of methods and forms of studying, which emphasize teenagers' growing independence and their self-sufficiency;
- Formation of new motivations for studying: erudition, aspiration to self-fulfillment, needs for self-establishment and self-improvement;
- Knowledge become a value and allow to gain a certain status among their peers;
- Orientation on independent search of new knowledge;
- Accompaniment of the process of learning with intellectually filled emotions and selective approach to learning, based on the student's interest;
- Transforming grade into motivational and stimulating mechanism, which makes a benefit for work and defines a student's status in a team;
- Necessity of communication, participation in group activities, and self-recognizing.

As for school studies make a considerable part in teenager's life, it's important for teachers to pay special attention to those types of education activities, which are able to reveal their independence, responsibility and ability for self-organization, which makes them more adult according to their personal understanding, stimulates to interaction, expressing and justification of their own points of view, and self-representation. Independent forms of classes, where democratic teaching style persists, and teacher acts as tutor and counselor, gain more attraction in students' eyes.

It was proven as efficient to apply such interactive methods of studying as training exercise, business game, brain storming, problematic discussion, group studying and project activity etc., which strengthen teenagers' motivation, stimulate their intellectual and emotional activity, engage them to group creative activity and facilitate their ability to reveal their activeness and leadership.

Development of such psychological functions as attention, reflection, willpower and ability of self-management makes a ground for effective formation of HSC of digital competence. In this regard, in order to form HSC of BS students' digital competence it is useful to organize special educational events, which would take in consideration the specific features of this age category. Thus, we have designed a training course «Health-saving use of ICTs».

The purpose of the course is constituted by forming HSC of BS students' digital competence, particularly in acquisition and development of health-saving use of ICT, values and persuasions about usefulness of observing necessary measures and restrictions, motivations to do it.

Objectives of the course:

- Create in students notions of health, health-saving, develop in them a careful attitude to their health as one of the most important life priorities;
- Create in student a concept of information technology, different kinds of ICTs, their

differences, their disadvantages and advantages, ways of their use for different studying, professional and everyday life tasks;

- Form awareness of risks of incorrect use of ICT and its negative consequences;
- Develop a motivation to safe, health-saving exploitation of ICT, persuade students it's necessary to protect a healthy sight, locomotor system, long-term working capacity with use of ICT;
- Form knowledge and skills of creating a safe working environment while use of ICT;
- Form habits of taking preventive measures on protection of health of sight, back and joints, correct posture and long-term working capacity while work with ICT;
- Create in students an idea of computer addiction as destructive phenomenon, dangerous for health, disease of XXI century; provide them with recommendations about ways of its prevention;
- Create in students an idea of cyberbullying as negative and dangerous social phenomenon, give them recommendations about the ways to avoid it.

The course is designed for 12 lessons and lasts 12 academic hours². The course is planned to be taught in grades from 5th to 9th.

The course could be taught as integral part of IT-subjects or health-protect- subjects, as well as elective classes. It would be advisable to teach classes in subgroups of students of average number 10-12 persons, up to 15 persons at maximum.

While planning this work a teacher should be guided with the following *principles*:

- Scientific principle – it determines a necessity to teach students contemporary scientific knowledge. It's appropriate to involve students in independent definition of topical problems and search for ways of their solution;
- Principle of systematicness and coherence – consistency in teaching and retention of learning material, consistent and continual transition from simple to difficult (rule of “concentric circles”) with taking to consideration the subject's logic and students' age specificity;
- Principle of consciousness and activity – based on understanding of particularities and patterns of people's cognitive activity, and realizing of the fact that knowledge couldn't be transferred, but could be only gained by conscious and active work;
- Principle of reinforcement of knowledge, abilities and skills is defined by necessity of their transforming into a part of students' mind, and a ground of their behavior habits. For teenagers the efficiency of skill acquisition directly depends on their comprehension of learning material and understanding of its personal significance. Implementation of this principle is revealed in students' ability to apply the newly acquired knowledge on practice;
- Principle of individualization determines taking into consideration student's individual features (age, intellectual, psychological, physical and other specificities), and support of individual, specific and special development of every person's potential.

We define the main following course *thematic clusters* recommended for studying:

- «Health as supreme value». Objective: create students' notions of concepts of

² 1 academic hour = 45 minutes

- «health», «health saving»; develop a caring attitude to one's health and life; create a sense of responsibility, intention to care for one's own health and its protection.
- «ICTs in modern teenager's life». Objective: form an idea about different kinds and advantages of modern ICT in everyday life; produce an awareness what useful opportunities for a person offers a use of these appliances.
 - «Influence of ICT on teenagers' health». Objective: form awareness about potential negative effects of ICT use on psychological and physical health of teenager.
 - «Making a healthy environment». Objective: create students' ideas about abilities to create a safe working environment while using ICT.
 - «Protecting eyesight and working capacity». Objective: create students' competencies in protection of healthy eyesight and preservation of long-term working capacities while working with ICT.
 - «Making a correct posture». Objective: create students' skills about keeping correct posture while working with ICT.
 - «Tantalizing virtual world». Objective: create students' knowledge of sense of dangers created by computer addiction and prevention of it.
 - «On the other side of Internet communication». Objective: create students' knowledge of sense of dangers created by cyberbullying and prevention of it.

Within the scope of the course it's recommendable to use *interactive teaching methods*, which have proved their efficiency in work with BS students, in particular: interactive mini-lectures, group studying activity, group didactic games, demonstration and discussion of video fragments, discussions, justification of own ideas, brainstorming and others, which are designed to develop knowledge, abilities, skills and attitudes on health-saving use of ICT.

Final control of the course is represented by group project, the execution of which foresees an application of acquired knowledge and skills from different thematic sections of the course. Sense of the project, tasks of the project, stages of its execution, evaluation criteria are reported to students at the first (introduction) training class.

We define the following stages while preparing the group project:

4. Dividing students on mini-groups (3-4 people).
5. Choosing topic for each group.
6. Definition of objective, tasks, hypothesis, object and subject of the project, research methods.
7. Assortment and study of the material about the given issue.
8. Design of theoretical part of the project.
9. Design of questionnaire and conducting survey on research problem (among peers, younger grades students or others).
10. Analysis and design of the results of the survey.
11. Design of research project.
12. Creating visibility for presentation of the project.
13. Presentation of the project.

We offer to design the project according to the following structure:

1. Introduction (topicality of research problem, objective, tasks, hypothesis, object,

subject, research methods).

2. Main part (theoretic overview of problem; analysis of results of peers' interviews concerning the research problem).
3. Conclusions, recommendations.
4. Appendices.
5. List of used sources.

By way of example, we offer the next topics for research project, which could be chosen by students at their own wish:

- Human health in epoch of informatization.
- ICT device: benefit or harm?
- ICT devices in modern teenager's life.
- Influence of ICT devices on health of junior student.
- Influence of electromagnetic radiation on human organism.
- Influence of ICT devices on human eyesight.
- Computer games and human health.
- Influence of global network on child's mind.
- Cyberbullying as social phenomenon of our time.
- Conditions of safe work with ICT devices.

The finished projects should be presented at the end of the course. After every presentation, it is advisable to discuss it and evaluate by teacher and other students. The finished projects could be represented at contests of students' works, school and local exhibitions, festivals of science etc.

Diagnostic of levels of forming students' HSC is reasonable to be done at the beginning of training course and upon its end in order to reveal the dynamics of this competence's forming.

Evaluation of value and motivational component. In most cases in order to define motivation for healthy lifestyle, surveys, interviews and discussions are applied. In general, the student's motivation could be defined by his/her verbal expressions, which allow indicating presence or absence of motivation, and its extent fairly accurate. In order to evaluate the level of forming of value and motivational components of HSC it is reasonable to use a method of survey.

Evaluation of cognitive component. In order to define a level of forming of HSC cognitive component it is reasonable to apply a pedagogical testing.

Evaluation of operational and functional component. Defining to what extent the students observe the requirements of health-saving use of ICT, is quite a complicated task. We regard the following methods advisable: monitoring (during educational process at school) and conducting surveys (both of students and their parents are asked about the issue to what extent children observe health-saving rules at home).

The assessment methods for each component that we have developed are presented in our manual [8] in detail.

The level of forming of HSC of students' digital competence is calculated as arithmetical mean of all three components: value and motivational component, cognitive component and operational and functional component.

Having applied a diagnostic method, we can obtained two results:

1. Data on general formation level of student's HSC;
2. Data on formation level of each component of HSC, which allows in case of necessity to correct them.

The result of study at the author's training course should be a formed HSC of students' digital competence – their ability, knowledge, skills, attitude, and motivation to health-saving use of ICT during educational process.

In summary, forming HSC of students' digital competence allows creation of ground for safe use of ICT not only in educational institution, but also in extracurricular time, in private life and during leisure time. Implementation of purpose-oriented studying and educational events, coordinated interaction of all subject of educational process will facilitate preparation of young generation to conscious and responsible attitude to their own health, health-saving activity, also in aspect of use of ICT.

2.3 Empirical attesting of efficiency of author's method for forming the health-saving component of BS students' digital competence

In order to validate efficiency of author's method a research was conducted about the definition of formation level of HSC of students from control group (CG) and experimental group (EG) at the beginning and at the end of experiment.

CG and EG were formed as follows:

- the CG included students of 7-9 grades of the 157th Lyceum of Kyiv, Ukraine (143 persons). Students of the CG used ICT in the usual mode;
- the EG included students of 7-9 grades of the 157th Lyceum of Kyiv, Ukraine (137 persons). For EG-students a cycle of training course on the topic "Health-saving use of ICTs" was conducted.

Thus, the students from CG studied in ordinary conditions, while students from EG studied according to the specially designed method and for them special training course was organized.

At the end of the study, experimental data have shown positive changes in levels of forming of HSC components of students who belonged to EG compared to levels of HSC components of students who were in CG.

Control group. Analysis of the results has shown that CG has *low (reproductive) level* of value and motivational component in 40 % of students at the beginning of experiment, and 33 % of them had it at the end of the experiment. Low level of cognitive component and knowledge of safe use of ICT in educational process at the beginning of the experiment 63 % of students had and 54 % of them had such level at the end of experiment. Low level of operational and functional component, abilities and skills of safe use of ICT had 70 % of students at the beginning and 68 % of students at the end of experiment.

Mediocre (constructive level) of value and motivational component of HSC at the beginning of experiment was diagnosed in 43 % of students and in 47 % of students at the end of experiment. Mediocre knowledge of safe use of ICT in educational process 28 % of students had at the beginning, and 36 % of them at the end of experimental work. Mediocre level of abilities and skills in students about safe use of ICT during the

learning process was found in 22 % of students at the beginning and in 23 % of them at the end of experiment.

High (productive) level of forming of value and motivational component, positive motivation and value orientation of students about health-saving use of ICT at the beginning of experiment was found in 17 % of students, in 20% of students at the end of experiment. High level of cognitive component, knowledge about safe use of ICT in learning process at the beginning of the experiment was found in 9 % of students and in 10 % of students at the end of experiment correspondingly. Advanced level of operational and functional component, abilities and skills in students about safe use of ICT were detected at the beginning of the experiment in 8 % of students and in 9 % of students at the end of experiment correspondingly.

Experimental group. There is a *low (reproductive)* level of value and motivational component in EG, which makes a ground for forming HSC in students: at the beginning of experiment, it was diagnosed in 41 % of students, and in 17 % of students at the end correspondingly. Low level of expertise about safe use of ICT in educational process was diagnosed in 60 % of students at the beginning of the experiment, and in 29 % of students at the end. Low level of abilities and skills of safe use of ICT in the process of studies was revealed in 67 % of students at the beginning of the experiment, and in 42 % of students at the end of experiment.

Mediocre (constructive) level of formation of value and motivational component of HSC at the beginning of experiment was displayed in 44 % of students, and 58 % showed it at the end of the experiment. Mediocre level of knowledge about safe use of ICT in studying process was revealed in 31 % of students at the beginning of the experiment, and in 46 % of students at the end. Mediocre level of abilities and skills of safe use of ICT in the process of studying was diagnosed in 23 % of students at the beginning of the experiment, and in 40 % of students at the end of experiment.

High (productive) level of value and motivational component of HSC, positive motivation and value orientations in students about health-saving use of ICT at the beginning of the experiment was revealed in 15 % of students, and in 25 % of them at the end of experiment. High level of cognitive component and knowledge about safe use of ICT in educational process was demonstrated by 9 % of students at the beginning of the experiment, and by 25 % of students at the end of experiment. High level of operational and functional component, abilities and skills of safe use of ICT in the process of studies was diagnosed in 10 % of students at the beginning of experiment, and in 18 % of students at the end of experiment.

Thus, as a result of the experiment we obtained a remarkable growth of indicators of high and average levels, and also reduction of indicators of low level of formation of all HSC components in students from EG in comparison with students from CG.

In table 1 a comparative characteristics of levels of formation of HSC in students from EG and CG at the beginning and at the end of experiment are represented.

The analysis of the results provided in table 1 and figure 1 displays that in **control group** *high (productive) level* of forming of HSC (altogether in accordance to all its components) at the beginning of the experiment was found in 11 % of students, at the end of experiment it was found in 13 % of students; *mediocre (constructive) level* was found in 31 % of students at the beginning of the experiment and in 35 % of students at the end of the experiment; *low (reproductive) level* was diagnosed in 58 % of students at the beginning of the experiment and in 52 % of students at the end of the experiment.

In **experimental group** *high (productive)* level of forming of HSC (together in accordance with all its components) at the beginning of the experiment was revealed in 11 % of students, and in 23 % of students at the end of experiment correspondingly; *mediocre (constructive)* level was found in 33 % of students at the beginning of the experiment and in 48 % of students at the end of the experiment; *low (reproductive)* level was found in 56 % of students at the beginning of experiment and in 29 % of students at the end of the experiment.

Table 1. Dynamics of levels of formation of HSC in students from EG and CG at the beginning and at the end of experiment

Item No.	Level	Number of pupils in CG, n=143					Number of pupils in EG, n=137				
		Pedagogic experiment									
		start		end		difference in %	start		end		difference in %
		in absolute terms	in % of general number	in absolute terms	in % of general number		in absolute terms	in % of general number	in absolute terms	in % of general number	
1	High (productive)	16	11	19	13	+2	15	11	31	23	+12
2	Mediocre (constructive)	44	31	50	35	+4	45	33	66	48	+15
3	Low (reproductive)	83	58	74	52	-6	77	56	40	29	-27

Having compared the results we have defined that indices in both groups have increased in all levels. In particular, high (productive) level of HSC has grown: by 2% in CG, by 12 % in EG; the number of students with mediocre (constructive) level of HSC has grown: by 4 % in CG, and by 15 % in EG. The number of students with low (reproductive) level of HSC has decreased instead: by 6 % in CG, and by 27 % in EG.

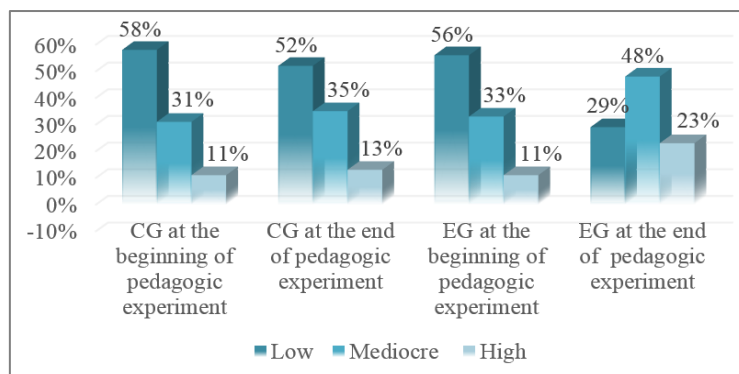


Fig. 1. Dynamics of levels of formation of HSC of students' digital competence in EG and CG at the beginning and at the end of the pedagogic experiment

The results obtained have testified that for the period of conducting forming stage in EG the number of students with low level of HSC has decreased significantly (from 56 % to 29 %), at the same time the number of students with mediocre (from 33 % to 48 %) and high (from 11 % to 23 %) levels of HSC has grown, what outruns significantly the results obtained in CG.

The validation of data differences for three criteria, obtained in EG and CG according to Pearson's chi-squared test $\chi^2_{em} = 20,79$ ($20,79 > 5,99$), allows to make a conclusion about significance of these differences at the level of 95 % value and it generally attests efficiency of the offered method for forming HSC in students of BS.

Final analysis of the data obtained as a result of experiment has allowed to confirm a hypothesis that growth of level of HSC of BS students' digital competence is possible by means of author's method implementation.

3 Conclusions and discussion

On the current stage of development of the society one of the dominant problems is design of methods of students' health-saving in conditions of digitally oriented educational, safe use of ICT in learning process. The research of this problem bears an interdisciplinary character and requires application of knowledge from different scientific domains: pedagogic, psychology, ergonomics, informatics, medicine etc. Health-saving, ergonomically and pedagogically balanced use of ICT in educational process will facilitate the increase of efficiency and quality of didactic material retention, preservation of optimal working capacity level and functional state of students' organisms.

Forming of HSC of students' digital competence can produce a positive effect of reaching one of the principal objectives of studies with employment of modern devices – formation of healthy and competitive members of informational society, able to orient themselves in flows of information apply technologies at high and competent level.

It is defined that option of health-saving use of ICT is appropriate to be considered within the scope of digital competence as one of its components – a health-saving component of digital competence. Forming of student's HSC envisages acquisition by him/her of the set of corresponding knowledge, abilities and skills, attitudes, persuasions, motivations, focused at preserving of physical and psychical well-being and health while use of ICT. For this purpose, the author's method was designed. The outcomes of the experiment have attested an efficiency of the developed method, thus it could be recommended for implementation in BS educational process.

We find prospective lines of further research in defining organizational and pedagogical conditions of health-saving use of ICT, determination of special features and ways of forming and development of HSC of digital competence in other subjects of educational process, teachers in particular.

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