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A SYSTEM OF EFFECTIVE TASKS IN BLENDED LEARNING ON THE BASIS OF BLOOM'S TAXONOMY

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Abstract. *The article substantiates the choice of B. Bloom's taxonomy as a psychological and pedagogical basis for the selection and creation of a system of the effective tasks for the formation of methodical and informative competence of the future teacher of primary classes. Focusing on the fact that in the hierarchy of the thought processes, the goal is not evaluation, but synthesis, as a way of creating a new idea, the article describes the step-by-step filling of the "Matrices for the creation of a system of learning tasks" with the appropriate tools, followed by the demonstration of samples in the proposed LMS author's "Methodology for teaching computer science in elementary classes". In the article a reasonably sufficient number of educational tasks to achieve educational goals, proved the effective feedback as a necessary component of blended learning instruction, and also noted the balance between the tasks performed in on-line and off-line modes.*

Keywords: Bloom's taxonomy, Digital Competence, a teacher of primary classes, educational tasks.

INTRODUCTION

The process of reformation of education in Ukraine requires from pedagogical community revising, improvement and updating of both educational programmes and didactic and methodical support of their implementation. Involving the achievements of classic theory, modern pedagogical research is connected with the development of flexible teaching technologies that could assure higher quality of education at any level. The indicators of this quality according to quantitative data are competences, the results of education, will to perform professional duties.

Ukrainian law on education provides clear definitions of 'results of education' and 'competences'. Thus, the former is defined as 'knowledge, skills, ways of thinking, viewpoints, values, other personal characteristics acquired in the process of education, upbringing and development, that can be identified, arranged, valued, measured and demonstrated by the person after accomplishment of a teaching programme or separate educational components. In its turn, the latter stands for a dynamic combination of knowledge, skills, ways of thinking, viewpoints, values and other personal qualities that define the ability of a person to socialize, conduct professional and/or further educational activity.

In view of the above, one can state that the results of education predict, devise and implement an appropriate methodological system or teachers' technologies, and competences as personal formations are created due to mastering of the results by the subjects of education.

As a forming element of the pedagogical system is goals of education that interpolate in expected results, teachers' top priority is given to providing a definite structure and strict description of the results of education. They define the progress of the subjects of education on each stage, the level and ways of representation of the given progress. Expected and real results give the opportunity of generalization and determination of qualification limits for different levels of education. They determine the progress of subjects of education at each stage, the level and ways of representing this progress. Expected and actual results provide an opportunity to summarize and determine the limits of qualifications for different levels of education.

Programmed learning outcomes are focused on creating tools, for example, a set of typical tasks that can be used both to achieve results and their qualitative assessment and measurement (Bakhrushin 2019).

In response to this, the problem of creation of a system of effective tasks becomes scientifically relevant. The fulfilment of them will allow future teachers to form their professional competences on the highest level (in our case digital competence).

Background studies. The issues connected with the formation of methodical and IT competence of a primary school teacher, as 'a fundamental personal quality, that represents his knowledge and skills in the sphere of information and communication technologies, in computer science studying and organization of educational work at primary school, important attitude to his own professional activity, motivation to self-development and professional growth' (Sagan 2016), are treated by scientists in different aspects. So, investigating the IT or digital component of this competence, focus on knowledge, skills and mastering in the sphere of ICT technologies and the ability of their usage during professional activity (Sukhovirsky 2005, Ovcharuk 2018, Pietukhova 2009, Tataurov, Shushkina 2011, Smyrnova–Trybulska 2018); point to the methodological

aspect of the given phenomenon (Vember, Morze 2013, Kolomiiets 2008, Sagan 2016, Skvortsova, Haran 2017).

In recent years the attention of the scientists is focused on the agreement between educational programmes and European structure of teachers' digital competence (DigCompEdu) that defines the requirements concerning the level of a teacher's competence formation in the digital sphere. The frame of teacher's digital competence DigCompEdu specifies six basic areas in which the investigated competence is expressed: professional involvement, digital means, studying and teaching, evaluation, expanding of pupils' opportunities, assistance in acquiring digital competence. Confirming a certain methodological system, scientists face the problem of development and effective testing of means of forming, checking and controlling of teacher's professional competence level, in particular its digital component.

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Our study is being implemented as part of the course "Methodology of Informatics Education in Primary Schools", the purpose of which is to formulate methodological and informative competence of primary school teachers, as 'a fundamental personal quality, that represents his knowledge and skills in the sphere of information and communication technologies, in computer science studying and organization of educational work at primary school, important attitude to his own professional activity, motivation to self-development and professional growth' (Sagan 2016).

The objectives of the course are the formation of a future teacher of general (instrumental, interpersonal, systemic) and professional (subject-methodological) competences (Tuning, 2009). Comparative analysis of DigCompEdu and the studied entity indicates that digital competence is a component of the teacher's methodological and informational competence. Because in our understanding learning outcomes are formulated in terms of competences, the content component of the system is described as a correlation between learning outcomes and relevant competences.

The problem of creating a system of tasks for the achievement of learning results was reflected in the works of Altshuller, Ball, Getty, Savchenko, Uman; general approaches to the use of competency tasks to ensure the formation of information competence have been investigated Morze, Kuzminskaya, Wember, Barna (2010); Isichko drew up the system of tasks on the basis of mathematical modelling (2013), Degtyareva – system of complex tasks in the process of computer science (2015); Zabolotsky - support system for e-Learning as a means of developing ICT competences (2018) etc.

Despite the different approaches to the creation of task systems, scientists are guided by the fact that the properties of such systems should be relevance, integrity, adaptability, dynamism, accessibility, and ability to model.

We approve of the idea of organization of mixed and combined education that allows extending the variety of educational means and optimizing the feedback between all subjects of educational process. The acquired experience and prospects are represented in works by Tryus (2014), Kukharenko (2015), Rashevska (2010), Smyrnova–Trybulska (2018), Skvortsova, Haran (2017). But in both traditional and mixed models of education the problem of creating a system of tasks that provide qualitative mastering of educational content remains relevant. The analysis of appropriate psychological and pedagogical works led to the use of B. Bloom's taxonomy, which includes three spheres of activity: cognitive, affective (emotional and evaluative) and psychomotor and allows creating an effective educational environment that is favourable for the development of interest in cognitive activity among subjects of education (Bloom 1956). So, the taxonomy formed the basis of the system of educational tasks in research by Vakalyuk (training teachers of computer science) (2013); for psychological and pedagogical substantiation when creating educational projects in computer science in the works of Morze, Dementievskaya (2007) and test design (Kuhar, Sergienko, 2010).

The aim of the article is to define the appropriateness of the use of B. Bloom's taxonomy for creating a system of effective tasks in a mixed course 'Methodology of information technology teaching at primary school'.

1. AN EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF THE SYSTEM OF EDUCATIONAL TASKS IN THE PREPARATION OF PRIMARY SCHOOL TEACHERS

The specificity of the result-oriented models lies in step-by-step procedures of achieving these results which optimize the educational process. Among their properties we distinguish:

- instrumental character (actions and operations that are carried out during the process of education);

- diagnostic essence (the ability to check progress in education);
- realistic nature (the willingness of the target audience, infrastructure availability, suitable conditions for implementation of educational process);
- attractiveness (consideration of needs, motives, prospects of realization of the acquired experience for social and (or) professional growth).

The significance of achieving progress in education is handling knowledge. B. Bloom suggested the system of cognitive actions, 6 levels of intellectual processes: from specific to a general one, from simple to a complicated one. While mastering the actions sequentially, the subject of education is acquiring knowledge. B. Bloom's taxonomy is a system of activity that gives a chance of creating algorithms of composing tasks which include all levels of cognitive actions (Table 1).

Table 1.

The system of cognitive actions

The levels of educational goals	Cognitive process	Results of education
knowledge	rendering, recognition	Memorizing and rendering of information
comprehension	interpretation, classification, comparison, giving of examples, explanation	Transformation of information into different types, interpretation, prediction of the results of actions
application	carrying out of specific actions	Use of educational material in different conditions (familiar and new), implementation of abstract knowledge in practical situations, evaluation of the correctness of the acquired results
Analysis	differentiation, research organization	The ability to structure the material, distinguishing some elements, principles, connections
Synthesis	creation of ideas, planning	The ability to combine elements aiming at getting a new structure

Evaluation	propositions based on criteria and standards, checking of the accordance to the standard	Propositions concerning the correctness and accuracy of the implemented actions

Source: Own work based on Bloom (1956)

According to the educational goals and B. Bloom's taxonomy, the results are divided into factual (the formation of knowledge about particular objects, their properties and connections), conceptual (the formation of a systemic view of the object due to generalization, theory, models etc), procedural (the ability to transform the objects, change their properties etc), metacognitive (defining of the level of adequacy of factual, conceptual, procedural knowledge application in new conditions). In other words, factual and conceptual results define the level of knowledge assimilation, procedural results regulate the level of formation of appropriate skills, and metacognitive results determine the ability to analyse and choose optimal mode of action.

To achieve the goals and get expected results in education we need a system of tasks, the creation of which is reasonable to agree with a modern version of B. Bloom's taxonomy proposed by his followers (Anderson, Krathwohl 2001). In scientists' opinion, in the hierarchy of mental processes the highest position is occupied not by evaluation, but synthesis as a means of creating new things. Thus, the system of tasks is represented in a form of matrix, the slots of which are built in accordance to the scheme: expected result – appropriate cognitive process (Table 2).

Table 2.

Matrix for creating the system of tasks

knowledge	**Cognitive processes**					
	remember	understand	apply	analyse	estimate	create
Factual	+	+	+	+	+	+
Conceptual	+	+	+	+	+	+
Procedural	+	+	+	+	+	+
Metacognitive	+	+	+	+	+	+
	Thinking of lower level			Thinking of higher level		

Source: Own work based on Anderson, Krathwohl (2001)

We will try to fill in the matrix using an appropriate instrumentation with further demonstration of the patterns in our elaborated LMS 'Methodology of information technology teaching at primary schools'. So, the instrument for creating task on memorizing and rendering is represented by tests, that include questions

with one or several possible correct answers to select from the given list (factual and conceptual knowledge); matching tasks (procedural knowledge); open cloze (metacognitive knowledge) etc. In the courses elaborated by the authors of this article in Moodle there are presented tests of all types and levels of complexity (Figure 1).

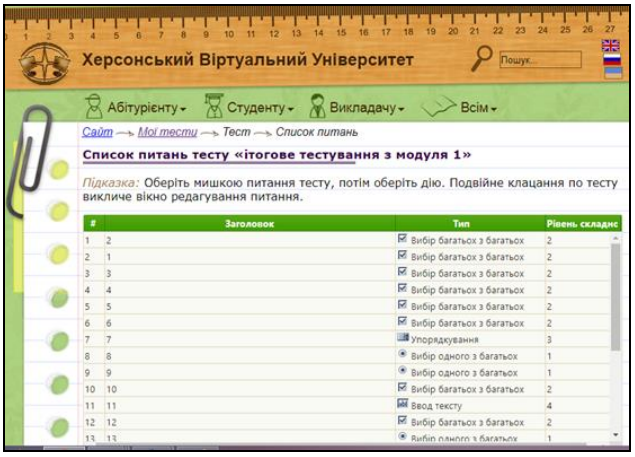


Figure 1. Screenshot of test's fragment

Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(Accessed on: March 04, 2019).

Figure 2. Screenshot of the game 'Data storage'

Source: Based on students' collaborative work https://learningapps.org/display?v=pv8uaxugn19. (Accessed on: March 04, 2019).

Any system of distance education possess the ability to make up tests (Moodle, WebTutor, iSpring Online), as well as the majority of e-learning software (iSpring Suit, Courselab), online-websites (Google Forms, ClassMarker,

EasyTestMaker). Memory games can be also created or used as ready-made on LearningApps or Hot Potatoes (Figure 2).

The next level of cognitive processes is the comprehension of facts and notions by the subject of education as a result of organization, comparison, transmission, description, eliciting the main idea. Actually, it means the transformation of the educational material from one form into another. B. Bloom suggested such procedures as transformation, interpretation, extrapolation for solving this problem.

The first one is implemented by means of such tasks as:

1) transformation of information into another form (into another language, from textual into graphical, numeral, combinational etc);

2) transformation of abstract information into specific one;

3) providing of the examples that illustrate and explain the theory.

The samples of such tasks in our course is creating didactic material according to the main themes in course of information technologies for primary school pupils: puzzles, crosswords, games, etc. Thus, future teachers become acquainted not only with possibilities of numerous mobile apps by means of WEB, but also acquire the skill of constructing various tasks for primary school pupils according to certain demands made for such products (sanitary, ergometric) etc.

Interpretation (‘explanation’) is achieved by means of tasks aiming at:

1) pointing out essential features of the subject of research;

2) classifying comparing, finding analogies;

3) searching mistakes.

Extrapolation (‘approximation, estimation’) lies in extension of a particular meaning of the notion or prospects of further problem exploration.

To our mind, the skills to transform information, predict the simplest results of realization of educational material, allow using multiple choice tests and open cloze tests together with traditional methods.

In the conditions of mixed education that we support heuristics has proved its effectiveness. In ‘Philosophical encyclopaedic dictionary” (Shynkaruk, 2002) it is stated that heuristics comes from Greek ‘find, discover’ and is the term used to denote subject area about creative activity, connected with searching of the ways of discovery of new information in propositions, ideas, modes of actions.

In a wide sense, heuristics is:

1) the organization of the productive creative thinking;

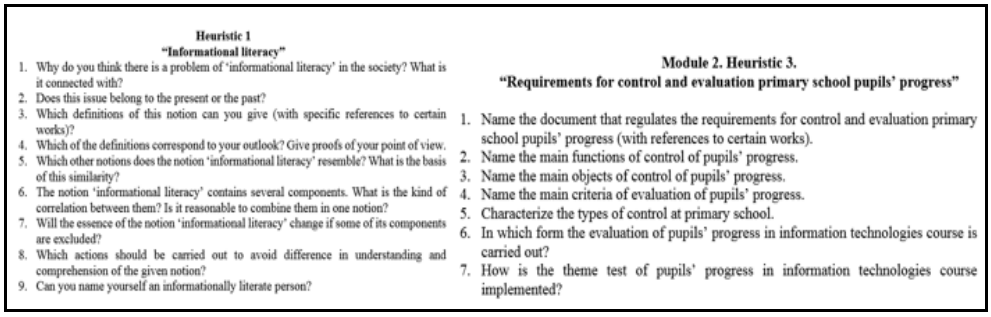
2) the science that study heuristic activity, the field science about thinking;

3) a specific method of education.

Heuristics in education is represented by a system of educational questions, the successive answers to which allow a person:

- to make up a monologue (inner or outer) to search or structure information within a particular theme;
- to create a coherent description, arguments to prove or disprove a thesis, conclusions to the theme.

These questions are also called topics. We have elaborated topics (the list of questions) for each theme, so their successive implementation provides a chance for us to give answers to basic theoretical questions, and find confirmation in appropriate works, present our own point of view concerning the prospects of their realization (Figure 3).



Heuristic 1
"Informational literacy"

1. Why do you think there is a problem of 'informational literacy' in the society? What is it connected with?
2. Does this issue belong to the present or the past?
3. Which definitions of this notion can you give (with specific references to certain works)?
4. Which of the definitions correspond to your outlook? Give proofs of your point of view.
5. Which other notions does the notion 'informational literacy' resemble? What is the basis of this similarity?
6. The notion 'informational literacy' contains several components. What is the kind of correlation between them? Is it reasonable to combine them in one notion?
7. Will the essence of the notion 'informational literacy' change if some of its components are excluded?
8. Which actions should be carried out to avoid difference in understanding and comprehension of the given notion?
9. Can you name yourself an informationally literate person?

Module 2. Heuristic 3.
"Requirements for control and evaluation primary school pupils' progress"

1. Name the document that regulates the requirements for control and evaluation primary school pupils' progress (with references to certain works).
2. Name the main functions of control of pupils' progress.
3. Name the main objects of control of pupils' progress.
4. Name the main criteria of evaluation of pupils' progress.
5. Characterize the types of control at primary school.
6. In which form the evaluation of pupils' progress in information technologies course is carried out?
7. How is the theme test of pupils' progress in information technologies course implemented?

Figure 3. The examples of 'heuristics' as a sample of tasks to form knowledge on the level of 'understanding'

Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(accessed on:04 March 2019).

As the class time is not enough for students' mastering of the basic notions, and, moreover, controlling the formation of corresponding knowledge, we suggest practicing heuristics online in LMS with further evaluation of this work by the tutors (Figure 4).

On the next level of 'application' the subject of education demonstrates the ability to solve problems in new conditions, using acquired knowledge, methods, rules by different means. B. Bloom's followers proposed key words as a base for formulation of certain tasks, such as: render, accomplish, estimate, download, present graphically, investigate, prepare, build chart, carry out experiment, explain, etc. If to transform these words into particular types of activity, the tasks can be as follows: prepare a PowerPoint presentation, take part in a role-playing game, create a puzzle, make forum records, and demonstrate the information in the form of figures, schemes, charts.

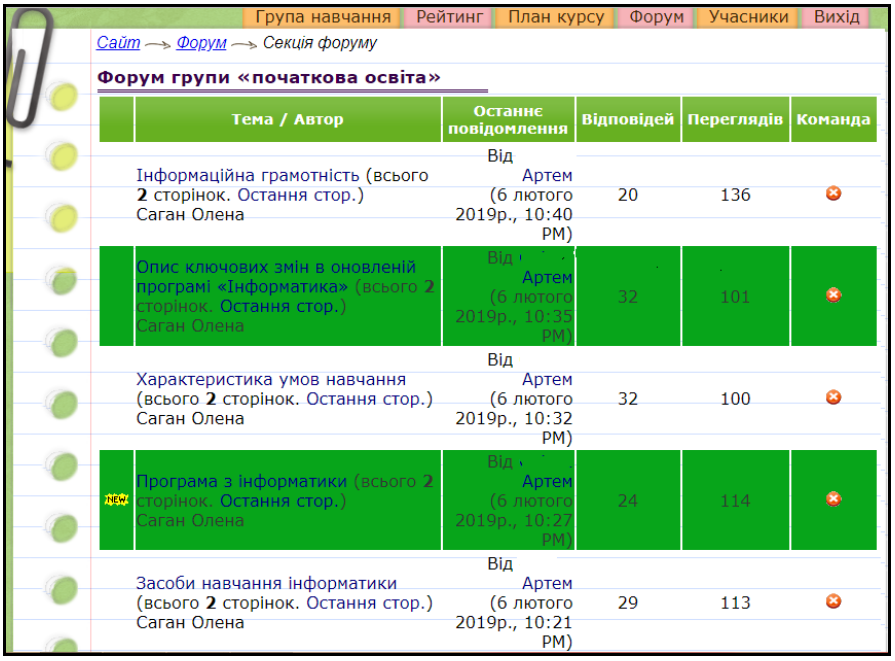


Figure 4. A fragment of a website of distance education forum

Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(accessed on:04 March 2019).

Concerning the methods of organization of this activity, it is reasonable to use simulation, game, problem solving, constructing etc. In the conditions of mixed education, the students are offered not only tasks from practical lessons but also those which are fulfilled by means of web-apps. For example, in the process of mastering of main themes in the information technology course for primary school pupils – information, commands and performers, Internet, graphics, text – students are offered certain instruction materials that can be used during the stage of actualization of pupils' knowledge and motivation as well as for training the acquired knowledge among pupils. The key notions in the theme should be coded in the form of puzzles, riddles or represented in a shape of 'a cloud of words' etc., and the results of the work should be downloaded on the virtual platform Padlet (Figure 5).

'Revelation' of the results on such a platform allows students to estimate their own work and comment on it. Except of the formation of methodological competence future teachers master different apps: Tagxedo, Padlet Quiver, Pinterest, «Ребуси українською» (http://rebus1.com/ua) etc.

Tasks on the level of 'analysis' are oriented on the formation of students' skills to divide the material into components in order to observe its clear structure. Analysis as the ability to classify allows presenting information in a form of its constituent:

1) elements (assumptions, facts, hypothesis, conclusions, etc). Mastering of such an analysis type by the subject of education helps to form his skills of mistake identification, differentiation of objects components, distinguishing of common and different features;

2) connections (reason and consequences, assumptions and conclusions, etc) that change into the skill to correlate hypothesis with consequences, reconstruct events and relations, etc.;

3) principles of organization (form, model, material) that implies the skill to structure the activity.

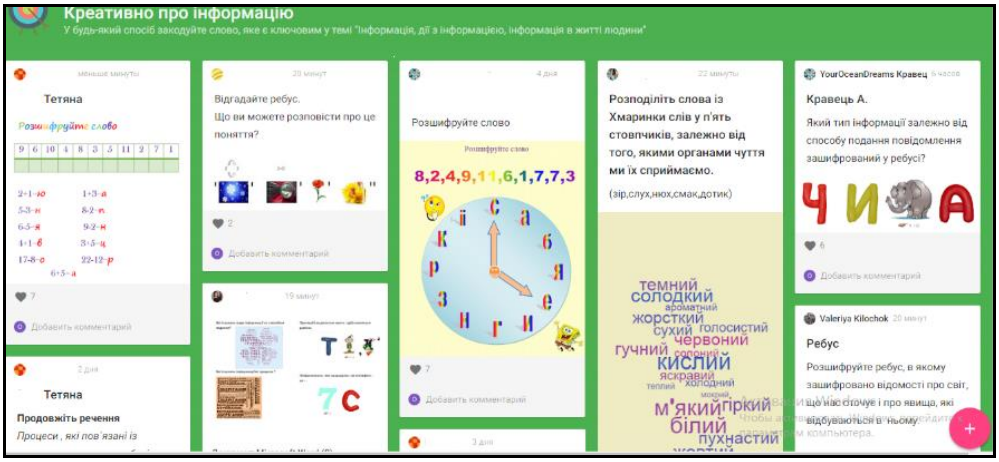


Figure 5. Fragment of the virtual platform 'Creatively about information'
Source: Based on students' collaborative work https://padlet.com/evsagan777/zb3c7hpm09xs. (accessed on: 04 March 2019).

The samples of such tasks in our course are represented by the analysis of schoolteachers' lessons. The program of any methodical discipline involves the formation of students' skills to analyse normative documents, make up a plan and synopsis of the lesson, choose didactic support etc. It is evident that observation and analysis of other teachers' lessons should precede their own practice. In particular, we use information from Youtube and a collection of video-lessons of teachers who participated in Global Teacher Award. To save class time students are provided with some references to lessons that should not be just watched but analysed according to a certain scheme (Figure 6).

In the first stage we use a standard scheme of lesson analysis, and then fix basic pupils' competences that are formed in each stage of this lesson. Taking into account the State Standard of Primary Education that has been in force since September, 2018, and defines 11 key competences as basic that appear in all forms of educational activity, the future teacher must define and differentiate each of them in order to select optimal methods and means of their formation.

The next step is discussion during the practical lesson of such questions as: the presence of methodological and organizing mistakes, successive methods, relevant means, keeping of sanitary norms, correspondence of the given aim and acquired conclusions; planning of our own lesson within discussed theme. Thus, observation, recognition and elementary analysis of the lesson are implemented by the student during his extracurricular activity using particular e-learning resources. Possessing knowledge that enables the student to memorize, understand and apply, with the help of teacher's supervision and working in group he can comprehend the material on a higher level ('analysis – synthesis – evaluation').

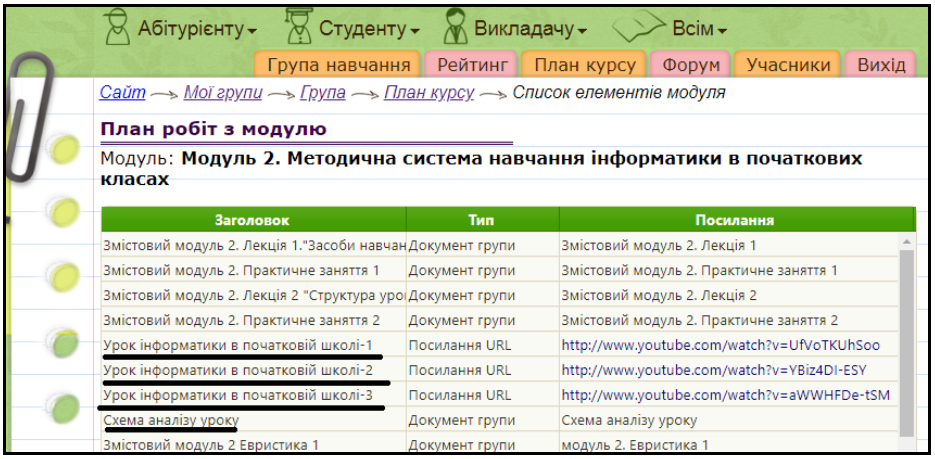


Figure 6. Screenshot of the website with references to information technology lessons at primary school

Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(accessed on: 04 March 2019).

Evaluation helps students to think of the reasons and ways of realization. It is suitable when working in pairs or groups: reviews about each other's work; collective projects. Synthesis as an ability to combine elements to get entity, creating of the new, is formed as the result of such procedures: planning, creation of ideas, practical application. As synthesis belongs to mental operations of the highest level, the tasks have creative constituent that can be presented in the form of composition, essays, report, speech, projects, instructions, nomination of hypothesis and providing its proofs.

If the tasks of lower level are easily graded according to the number of correct answers, the tasks of 'analysis – synthesis' level are distinguished by such criteria as individual fulfilment, creativity, etc. We use the open test form as an instrument in this case limiting the amount of the answers up to 4000 signs (Figure 7). According to our experience it is reasonable to restrict the students while expressing their points of view.

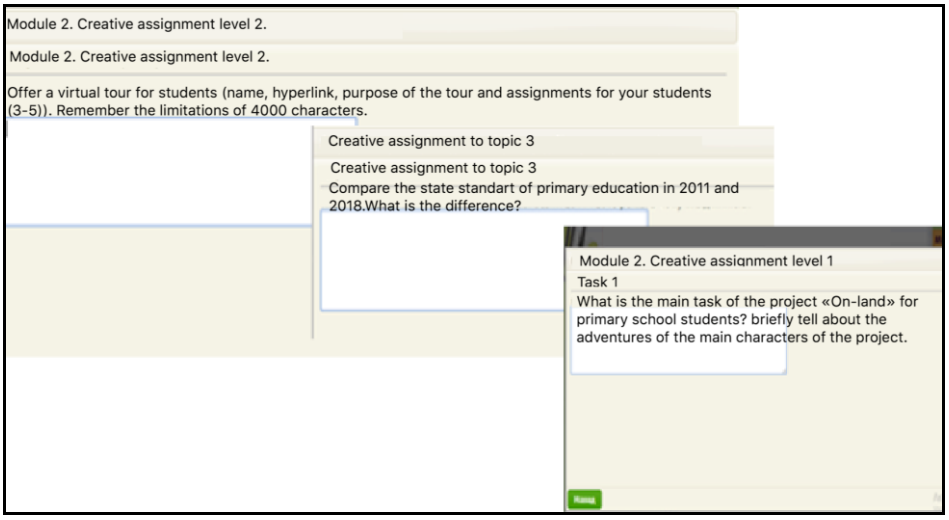


Figure 7. Screenshots of tasks of the 'analysis – synthesis – evaluation' level
Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(accessed on: 04 March 2019).

This method makes it impossible to copy a ready-made answer, causes critical attitude to expression of your thoughts, forces to choose convenient time for creative work implementation, to get personal feedback from the teacher etc. The most interesting variants become the subject of discussion during classes and a motivator for further creativity.

Therefore, while modelling the educational process, we concentrate on full knowledge assimilation in students' mind. This can be achieved as a result of creation of a system of effective tasks in mixed education that is characterized by redundancy and the ability to measure results of education on each stage, on each level of taxonomy. The dynamics of progress in the course and respectively the growth of the level of formation of future primary schoolteachers' professional competences, in particular digital one, are estimated according to such criteria as rating (Figure 8).

Apart from traditional evaluation of students' progress that is defined by the total sum of points for all the activities during the educational module, the teacher takes into consideration the comparative analysis of the ambitions and a real progress of a student during the whole course (the number of site visits and attempts to complete tasks).

Apart from traditional evaluation of students' progress that is defined by the total sum of points for all the activities during the educational module, the teacher takes into consideration the comparative analysis of the ambitions and a real progress of a student during the whole course. For instance, in the process of studying the discipline 'Methodology of information technology teaching at primary

school', that consists of 4 modules, the frequency of website attendance in the 4th module has increased by 28% in comparison with the 1st module; the students' attempt to fulfil the task of the highest level ('analysis-evaluation-synthesis') has increased by 35%; the quality of knowledge has faced a 16% increase.

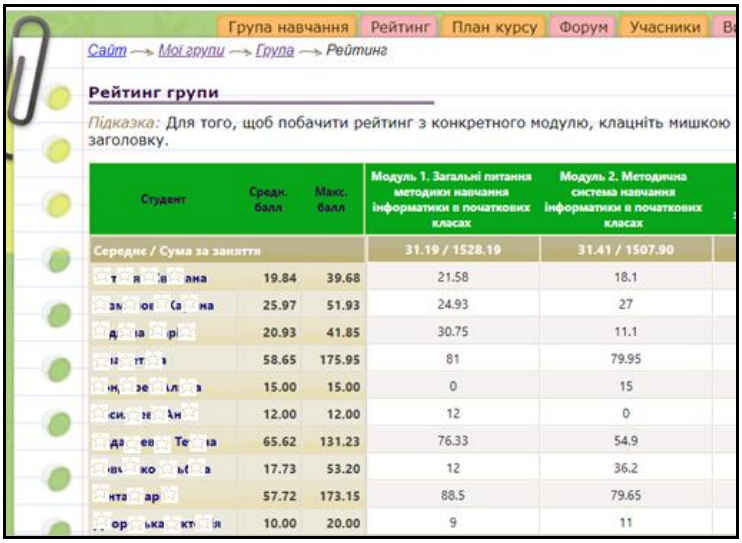


Figure 8. Screenshot of the fragment of rating in academic group
Source: Own work http://dls.kherson.ua/DLS/MyGroup/GroupDetails.aspx(accessed on:04 March 2019).

The testing of the course using the task system is carried out throughout 2017-2019 with second year students. Since the formation of methodological and informational (and digital as its component) competence continues in the process of further training of students, both at the undergraduate and graduate levels, we will be able to present more stringent results that allow us to evaluate the studied competency using methods of mathematical statistics later. The study used a set of theoretical (analysis and synthesis of Ukrainian and European scientific, pedagogical, methodological sources of the given research and regulatory documents of Ukraine and the EU) and empirical (Fit-bec students) methods, as well as analysis of the results obtained.

2. CONCLUSIONS AND PERSPECTIVES

Acquired results of the implementation of the system of effective tasks in the conditions of mixed education prove the relevance of our scientific and methodological research and allow drawing some conclusions that enable total assimilation of such tasks in terms of the eLearning specificity:

1) The number of tasks should be enough to achieve the educational goals.
2) Educational tasks must reflect a real activity.
3) A necessary condition is providing effective feedback.
4) There should be a balance between online and offline components of tasks.
5) It is reasonable to provide a step-by-step transition from examples to practice.

The involvement of students in educational environment by means of the system of effective tasks had a positive influence on the rate of formation level of motivational component within the investigated competence. This is proved by Feedback results that are arranged by the educational and methodical department at the university, by the growth of the number of students on webinars, online courses, web-schools, that are held by educational portals for primary school teachers.

The perspective of further investigation lies in the improvement of the system of tasks for mixed courses, stating their universal nature for a wide range of disciplines, extension of our experience resulting from the accessibility of elaborate resources.

REFERENCES

Anderson, L.W., Krathwohl, D.R. (2001). *A taxonomy for learning, teaching, and assessing*. New York: Longman.

Bakhrushin, V. (2019). *Competences and learning outcomes in the new standards of higher education.* Retrieved from http://education-ua.org/ua/articles/702. 2019. (accessed 04 March 2019).

Bloom, B.C. (1956). *Taxonomy of educational objectives: The classification of educational goals.* New York: Longman.

Degtyareva, N. (2015). *Method of use the complex tasks in the process of computer science teaching in senior school*. The dissertation for scientific degree of the Candidate of Pedagogical Sciences in the specialty. National Pedagogical University named after M.P. Dragomanov. Kyiv [in Ukrainian]

Dementievska, N., Morze, N. (2006). ICT for teacher's professional development. *Information Technology and Learning Tools*, 1(1). Retrieved from http://lib.iitta.gov.ua/160/1/dement_morze_E_zb1_2006.pdf (accessed 04 March 2019). [in Ukrainian]

Digital Competence Framework for Educators (DigCompEdu). Retrieved from https://ec.europa.eu/jrc/en/digcompedu. (accessed 04 March 2019).

Digital Competence Framework for Educators. Retrieved from http://dystosvita.blogspot.com/2018/04/digcompedu.html#more. (accessed 04 March 2019).

Isichko, L. (2013). *Use of the system of educational tasks with elements of mathematical modelling in the course of general physics. Scientific notes* [Kirovohrad State Pedagogical University named after Volodymyr Vynnychenko]. Series: *Problems of Methods of Physical-Mathematical and Technological Education*, 4 (2), (pp. 124-128). Retrieved from http://nbuv.gov.ua/UJRN/nz_pmfm_2013_4(2)__34. (accessed 04 March 2019). [in Ukrainian]

Kuhar, L., Sergienko, V. (2010). *Designing tests. Course of lectures. Retrieved from* http://moodle.ndu.edu.ua/pluginfile.php/889/mod_page/content/1/ kt.pdf (accessed 04 March 2019). [in Ukrainian]

Kukharenko, V. (2015). Systematic approach to blended learning. In O. Spivakovskiy (Ed.), *Information technology in education: Scientific journal.* Kherson: Kherson State University, 24, 53-67 [in Ukrainian]

Morze, N., O. Kuzminskaya, V. Barna, O., Vember, V. (2010). *Competence Tasks as a Means of Building Informatics Competence Under Continuous Education*. In O. Spivakovskiy (Ed.), *Informational Technologies in Education: Scientific journal.* Kherson: Kherson State University, 4, 48-62 [in Ukrainian]

Rashaevska, N. (2010). *Blended learning as a psychological and pedagogical problem.* Bulletin of Cherkasy University. Series «Pedagogy Sciences», 191, 89-96 [in Ukrainian]

Sagan, O. (2016). *The Concept of Professional Preparation of the Future Teacher of Elementary Schools for Teaching Informatics*. In O. Spivakovskiy (Ed.), *Information Technologies in Education: Scientific journal.* Kherson: Kherson State University, 28, 44-52 [in Ukrainian]

Sagan, O. (2016). *The structure of methodological and informational competence of the elementary school teacher. Proceedings from the III International Congress "Global challenges of pedagogical education in the university space"*, K. Ushynskyi South Ukrainian National Pedagogical University, Odesa, ISBN 978-966-916-275-5. [in Ukrainian]

Shynkaruk, V. et al. (2002). *Encyclopedic Dictionary of Philosophy* / NAS of Ukraine, Institute of Philosophy of G. S. Scovoroda; [Ed. V. Shynkaruk (Chairman), etc.]. - Kyiv: outline, 2002 . - VI, 742 p. [in Ukrainian]

Skvortsova, S., Haran, M. (2017). *Training for primary school teachers in teaching mathematics using information technologies*. In E. Smyrnova-Trybulska (Ed.), *Effective Development of Teachers' Skills in the Area of ICT and E-learning*, "E-learning", 9, (pp. 419-436), Katowice-Cieszyn: Studio

Noa for University of Silesia, ISSN: 2451-3644 (print edition) ISSN 2451-3652 (digital edition) ISBN 978-83-60071-96-0, 497 p.

Smyrnova–Trybulska, E. (2018). *Technologie informacyjno-komunikacyjne i e-learning we współczesnej edukacji* [Information and Communication Technologies and E-learning in Contemporary Education]. Katowice: Wydawnictwo Uniwersytetu Śląskiego [University of Silesia Press]. 572 s. ISSN 0208-6336 ISBN 978-83-226-3070-9 (print version) ISBN 978-83-226- 3071-6 (digital version).

Tryus, Y., Kachala, T. (2014). *Cloud Technologies In Management and Educational Process Of Ukrainian Technical Universities*. In O. Spivakovskiy (Ed.), *Informational Technologies in Education: Scientific journal.* Kherson: Kherson State University, 19, 22-33. [in Ukrainian]

Tuning. Official site of the project: Retrieved from http://www.unideusto.org/tuningeu/publications.html. (accessed 04 March 2019).

Vakalyuk, T. (2013). *Preparation of future teachers of informatics for the development of logical thinking of high school students: theoretical and methodological aspect: Monograph*. Zhytomyr: Publishing house of Zhytomyr State University of Ivan Franko, 236 p. [in Ukrainian]

The Law Nr 2145-VIII, *The Law of Ukraine «On education»*. Verkhovna Rada of Ukraine. (2017, September 5). Retrieved from https://zakon.rada.gov.ua/laws/show/2145-19. (accessed 04 March 2019). [in Ukrainian]

Zabolotsky, A. (2018). *The E-Learning Support System as a Development of ICT Competence of Workers of Centers of Distance Education of Universities*. The dissertation for scientific degree of the Candidate of Pedagogical Sciences in the specialty *13.00.10-information and communication technologies in education. Superviser Burov O.* National Academy of Pedagogical Sciences of Ukraine. Kyiv [in Ukrainian]