Professional Training of Lecturers of Higher Educational Institutions Based on the Cyberontological Approach and Gamification

Oleksii Silko, Lesia Kozubtsova, Ihor Kozubtsov, Oleksii Beskrovnyi

Kruty Heroes Military Institute of Telecommunications and Information Technology, Kyiv 01011, Ukraine

kozubtsov@gmail.com

Abstract: The subject of research in the scientific article was the theoretical and practical foundations of applying the cyberontological approach in the professional training of lecturers. To achieve the research purpose, the following tasks were solved: the current state of research and publications in the area was analyzed; theoretical, practical bases for applying the cyberontological approach in the professional training of lecturers were developed. Cyberontological approach is proposed as an innovative basis of psychological and pedagogical science-cyberpedagogy, which is designed to generalize and systematize scientific knowledge in the field of application of modern information and communication, computer, digital, electronic and Internet technologies in the education system. The paper substantiates the cyberontological model of functional dependence of components and the flow of the information processes in the educational activity of a lecturer-student. Based on the accumulated positive experience of using computer technologies in teaching students, the use of a cyberontological approach in the professional training of lecturers is proposed. Several examples of applying a cyberontological approach with elements of gamification in the training of cybersecurity specialists are considered. The scientific significance of the work is that for the first time a functional cybernetic model of the dependence between the components of the pedagogical system has been developed. The practical significance of its application in practice is that on the basis of the cybernetic model, game mechanics can be developed to increase student motivation in modern conditions. It is possible to use a computer game (gamification) as the basis for building a training complex for training military information and cybersecurity specialists.

Keywords: cyberontological approach; professional training; lecturer; ontology; gamification; higher education institution; cybersecurity; mathematical model.

1   Introduction

1.1   Problem statement

Both around the world and in our country, a person learns throughout his life. This is training in a general academic school, vocational school, or higher education institution. The state spends a lot of money on financing the education system, so the problem of improving the efficiency of the learning process is urgent. Its optimization requires not only improving the content and methodology of studying individual subjects, but also developing the theoretical foundations of didactics with the involvement of both the humanities (for example, Psychology) and exact sciences (Mathematics, Cybernetics). Now all over the world, when analyzing the educational process, the consideration of the "lecturer – student" system from the point of view of management theory is based. Almost all educational institutions have shifted their academic activities to digital platforms due to the recent COVID-19 epidemic [1].

Given the above, the cybernetic approach is also relevant for the higher education system.

1.2   Literature review. Analysis of recent research and publications

In the scientific research of V. Pleshakov [2; 3] formed and acquired further formation in the works of N. Voloshyn, O. Mukohorenko, L. Zhohin [4], K. Meteshkin, O. Morozov, L. Fedorchenko, N. Khairov [5] the definition of cyberontology as the existence and / or life activity of a person in an innovative alternative reality of cyberspace (cyberreality), determined by the level of development of self-consciousness and motivational needs of the individual, as well as by the complex of objective and subjective micro -, macro -, meso- and megafactors of society. Based on the analysis of human interaction with computer, electronic, digital technology, a cyberontological approach to education is built, according to which, training and upbringing of a person is determined by the conditions of its existence, life activity and interaction with computer technology, with other people and the world as a whole, based on the integration of two spaces: real and virtual.

According to V. Bespalko [6], N. Voloshyn [4], A. Ihibaev, A. Toleukhanov [7], I. Kozubtsov [8], R. Maier [9], V. Pleshakov [10], the cyberontological approach is nothing more than a phenomenon of psychological and pedagogical science. It begins the foundations of cyberpedagogy, which is designed to generalize and systematize scientific knowledge in the field of application of modern information and communication, computer, digital, electronic and Internet technologies in the education system.

1.3   Highlighting aspects that are understudied

The analysis of recent studies has established that the chosen object of study "cyberontological approach" attracted the attention of foreign scientists, but the description of the functional cyberontological model of dependence and the flow of the information processes in human educational activities is not sufficiently reflected.

Based on the above, this current research area was chosen.

1.4 Purpose of the article

To review the theoretical foundations and practical success in applying the cyberontological approach with elements of gamification in the professional training of lecturers of higher educational institutions (HEI).

1.5. Research objectives (goals)

To achieve this purpose, the following objectives are set:

1. Analyze the current state of research and publications on the keywords of the terms "cyberontological approach", "cyberpedagogy".

2. To review the theoretical foundations and practical success in applying the "cyberontological approach" in the professional training of future lecturers of the HEI.

2 Research methods

2.1 Research tools

The main means of scientific and theoretical research. A set of scientific methods that are comprehensively substantiated and consolidated into a single system. Basic research tools:

methods of theoretical analysis and generalization of scientific literature, on the topic of the research;

generalization to formulate conclusions and recommendations for effectiveness.

2.2 Reliability and accuracy of results

Reliability of the results of the study is ensured by the correctness of the use of mathematical apparatus and research methods.

2.3 Methodological basis of the study

The object of scientific and theoretical research is not just a single phenomenon, a specific situation, but a whole class of similar phenomena and situations, their totality. The methodological basis of the research is the ideas of L. Vyhotskyi, P. Halperin, Y. Babanskyi, S. Rubinshtein, (pedagogical psychology), N. Viner, K. Shennon, F. Rozenblatt, A. Kolmohorov, V. Hlushkov, (cybernetics), V. Maier, D. Novikov, (mathematical modeling of learning), V. Bespalko, Y. Mashbits, (cybernetic approach in pedagogy, programmed learning and automated training systems).

Thus, the basic theory for mathematical modeling is cybernetics.

3 Research results

3.1 Theoretical foundations of the "cyberontological approach", the"cyberpedagogy" component

With the advent of "cyberspace", a virtual dimension, a new environment of life activity and a factor of social change were formed (M. Chitosca [11], S. Petriaiev [12]). As a result, modern person lives and interacts with other people and the world as a whole in parallel in two socializing environments – classical objective (material) reality and alternative innovative reality of cyberspace (cyberreality) – that potentially and objectively affect the formation and transformation of subjective (phenomenon of the psyche) reality. In this regard, it is advisable to talk about the "parallel" existence of a person in cyberspace, about an alternative ontology of modern human civilization – cyberontology.

The types of indirect activities have become the main vectors of socialization (integration) of a person with cyberspace. According to some scientists O. Voinov [13], N. Voloshyn [4], V. Pleshakov [10], S. Petriaiev [12]) in particular:
1. Communication in cyberspace.
2. Leisure in cyberspace.
3. Knowledge in cyberspace.
4. Work in cyberspace.

To effectively solve the actual problems of human education and training, the need to apply a "cyberontological approach" in education and the beginning of an innovative branch of pedagogical science – cyberpedagogy (V. Bespalko [6], N. Voloshyn, L. Zhohin, O. Mukohorenko [4], K. Meteshkin, O. Morozov, L. Fedorchenko, N. Khairov [5]) is justified. At the same time, a new fifth vector of human socialization into education through cyberspace was identified.

So, the fifth vector is **the education of a person in cyberspace** – this is the process of human education, which is determined by the conditions of his life activity and interaction with oneself, with other people and the world as a whole in the context of the integration of classical objective (material) reality and innovative alternative reality of cyberspace (cyberreality), both of which potentially and objectively affect the formation and transformation of subjective (phenomenon of the psyche) reality. The main role of the cyberontological approach is to regulate the development of personality and human life activity in cyberspace, taking into account modern conditions and trends of education, as well as near and far prospects for the evolution of mankind.

Nowadays, the use of cyberspace as an educational environment, a channel of training and educational communications has become commonplace. The human educational process in cyberspace is interdisciplinary, as a result of which "Cyberpedagogy" shows positive and negative trends in education [14]. It was not without reason that the author Y. Mashbits expressed concern at the time: "will the widespread use of the computer lead to the oblivion of the past – our roots, to a less defined future, to the detriment of the cultural and spiritual values of our heritage? The habit of systematically using a computer can make a person neglect his own capabilities,

lead him to excessive dependence on the computer, cause atrophy of thinking, isolating a person from the world around them" [15].

A similar opinion was held by (V. Bespalko [6]), noting that a computer cannot effectively teach, relying on "human", expressed in verbal form, pedagogy that is understandable to a living lecturer who has an innate pedagogical intuition and an understanding of polysemous natural language. The computer needs special pedagogy, expressed in the unambiguous language of mathematics and formal logic, and which describes well-defined rules of action (algorithms) in well-defined pedagogical situations (tasks). The author offers the basics of such pedagogy "Cyberpedagogy" (from cybernetics and pedagogy). Cybernetics (V. Hlushkov) refers to the science of managing complex technical, biological, and social systems that can perceive, store, and process information. From the point of view of cyberpedagogy, the processes of teaching and upbringing can be reduced to managing the development of various personal qualities of students through purposeful and coordinated influences on the part of lecturers and parents (R. Mayer [9]). The purpose of training is to transfer a set of knowledge to students, to form skills and abilities, to develop their ability to observe, reason and effectively interact with the world around them.

The main directions of "cyberpedagogy" according to (K. Meteshkin, O. Morozova, L. Fedorchenko, & N. Khairov [5]; D. Novikov [16]):

1. Analysis of the pedagogical system from the point of view of management relations and information flows exchanged between the management and managed subsystems.

2. Optimization of the learning process, finding such forms and methods of organizing the educational process in which the functioning of the education system would be most effective, that is, at the lowest cost, it would bring maximum benefit.

3. Practical use of electronic devices and automated training systems for managing the learning and testing process; programmed learning. Among the modern methods of research of pedagogical systems, a special position is occupied by methods of mathematical and simulation modeling. Their essence lies in the fact that the real pedagogical system is replaced by an abstract model – some idealized object that has the most essential qualities of the system under study. By changing the initial data and parameters of the model, it is possible to investigate the ways of development of the system, determine its state at the end of training [9]. This is the advantage of this approach in comparison with the method of qualitative analysis.

In order to clearly understand the "cyberontological approach", we have developed a functional cyberontological model of dependencies and the flow of the information processes in human educational activities (see fig. 1). Through "Threat agents", cybernetic destructive information influences on the trained individual are created in order to lead to the loss of "Assets" in the future. Assets include future knowledge, diploma, job, salary, and so on. The challenge is for the learner to understand the need for "Assets" and to make an effort in the game to form quasi-professional solutions that would neutralize the cybernetic destructive information influences created by "Threat agents".

3.2 Practice of applying the cyberontological approach in educational institutions

The practice of applying the cyberontological approach in education developed on an intuitive level, through gamification (N. Rybka [17]). With the advent of computer technology, the motivation of students and cadets to traditional teaching methods began to decline paradoxically rapidly. Game methods of teaching adults have reached the first milestone.

The phenomenon of the game is that, being entertainment, recreation, it is able to develop into learning, creativity, a model of the type of human relationships and manifestations in work. It is through the gradual introduction of the cyberontological approach into practice that this approach has contributed to the rethinking of the game from the point of view of the learning method. The pedagogical game has a clearly formed goal of teaching students (cadets) and its corresponding pedagogical results, which can be justified, highlighted in an explicit form and are characterized by an educational and cognitive orientation.
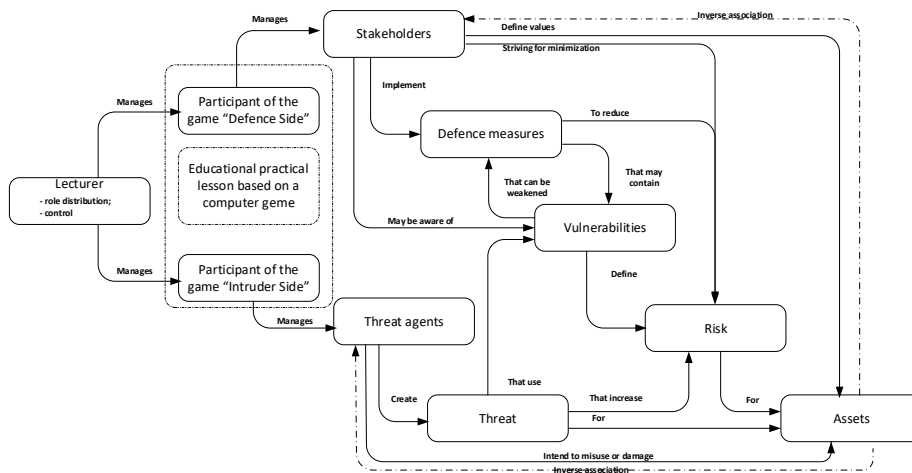

Fig. 1. Functional cyber ontological model of dependencies and the flow of the information processes in human educational activity

This is confirmed by the development of an innovative concept of independent training of Ground Forces cadets on training equipment by playing on a virtual computer [18] and methods of teaching electrical engineering disciplines [19].

It is important to correctly identify the motivation of players and forward it in the direction of learning, and not to cybercrime (V. Leshchina, I. Kozubtsov, & L.Kozubtsova [20]), the consequences of which can be catastrophic (I. Kozubtsova, L. Kozubtsov, T. Tereshchenko, & T. Bondarenko [21]).

If the method of pedagogical game is turned into a pedagogical technology, then you can get a wide practical application. Given this circumstance, gamification began to be considered from the angle of game pedagogical technology in education, having a huge

potential for a positive impact on the effectiveness of the educational process, which began to attract more and more attention of researchers (K. Tseas, N. Katsioulas, & T.Kalandaridis [22, p. 25]; V. Bugaeva [23, p. 135]; S. Petrenko [24]; N. Rybka[17]).

Publication (D. Kaufmann [25]) confirms that the author has made significant progress in gamifying online higher education.

For the purposes of further practice of applying the cyberontological approach in education, software developers are invited to participate in the creation of a game cybersecurity strategy similar to that used in computer games. Its emulation, as a computer game, is rationally used in the training of military information and cyber security specialists to acquire practical skills in working out the settings of routers, firewalls, etc.on a conditional training information system [26].

As a result of virtual 3D modeling of educational experiments in a in game form, it is impossible for experimental equipment to come out of working order due to erroneous actions.

3.3 The problem in the use of higher educational institutions with specific learning conditions in the educational process.

Higher educational institutions with specific training conditions are equated with higher military educational institutions (HMEI) – an institution of higher education of state ownership that trains cadets (trainees, students), adjuncts at certain levels of higher education for further service in the positions of officers (Non-Commissioned Officers and Warrant Officers) in order to meet the needs of the Armed Forces of Ukraine, other military formations formed in accordance with the laws of Ukraine, central executive authorities with a special status, the Security Service of Ukraine, the Foreign Intelligence Service of Ukraine, other intelligence agencies of Ukraine, the central executive authority, what implements the state policy in the field of state border protection.

The result of using game technologies for training cadets in the HMEI confirmed high efficiency, especially in difficult conditions [18]. However, as practice has shown, the dynamic range of creative activity of a lecturer in higher military educational institutions is too small and is limited to the forms and methods of teaching. Organization and training of officers for the needs of the Armed Forces of Ukraine and the security and defense sector is carried out In accordance with the Order of the Ministry of Defense of Ukraine.

3.4 Discussion of research results

Gamification and a cyberontological approach can not be implemented for all academic disciplines of the educational component. Gamification is clearly prohibited in special professional academic disciplines during which information with restricted access for educational purposes circulates in the classroom.

An interesting combination is the cyberontological approach and gamification when creating a computer game "Become the Head of a field information and communication node" in the course of studying tactical and special disciplines [27].

Assessment and feedback mechanisms are essential components towards effective

teaching in higher education and are continuously monitored [28].

Gamification is a good alternative educational practice to promote programming teaching, it allows better engagement of students in their learning. Students acquire a reasonable level of abstraction and logic and develop reflections on various course concepts [29].

Further study and adequate discussion of the results is expected. A more comprehensive study could reveal additional dimensions of the survey and shed light on how students perceive assessment, evaluation and feedback in higher education in general. Demonstrate some important aspects of this and indicate that improved quality of assessment and feedback can have a positive impact on student satisfaction. A more comprehensive study could reveal additional dimensions of the survey and shed light on how students perceive assessment, evaluation and feedback in higher education in general.

As can be clearly seen from Table 1 the following learning methods are the most accepted for the formation of knowledge: didactic games; practical training; teaching others (mutual learning) and independent work [26].

Table 1. Comparative characteristics of different teaching methods

Teaching methods		knowledge	skills	thinking	memory	language	gaining experience
Verbal	(lecture)	5%	++	−	−	−	++	
	reading	10%						
	listening	20%						
Visually	Work with multimedia (audiovisual)	20%	+	++	+	+	−	
	Viewing the drawing	30%						
	Demonstration	30%	+	+	+	++	−	
	Video viewing	50%						
Practical	Working with a book (reading)	10%	+	+	+	+	+	
	Educational discussions	50%	++	−	++	+	++	++
	Didactic games	**70%**	++	−	++	+	++	++
	Practical training	75%	+	++	++	+	−	++
	Teaching others is the application of what has been learned	90%	++	−	++	+	++	++
Independent work		80%	++	++	++	+	+	
Oral and written control			++	−	+	+	++	
Note:	Note: ++ – solve very well; + – solve partially; − − solve poorly.							

4 Summary and Conclusion

Thus, cybersocialization of the individual affects all segments of society, people of different ages, social positions and statuses. The degree of socialization depends on the individual characteristics of people. At the moment, the socialization of people is

actively developing in five vectors. Given the accumulated positive experience of using computer technologies in the training of people of different ages, it is considered appropriate to use a cyberontological approach in the professional training of future lecturers.

Cyberontological and game approaches in education aim to create such educational conditions that a person, learning in the course of a computer game, does not even suspect that learning is taking place, obtaining new knowledge. In a computer game, there is no source of knowledge that is easily learned by students. The learning process develops in the language of actions as a result of active contacts with each other, unobtrusively.

4.1 Expanding the boundaries of the scientific field

The scientific result obtained in the work expands the scientific boundaries of pedagogical sciences in the field of application of game mechanics in the preparation of higher education students in conditions of low motivation. Thus, the expansion takes place in the systemic unity of the philosophy of education and the theory and methodology of vocational education.

4.2 Scientific novelty. Scientific justification

For the first time, a functional cyberontological model of dependencies and the flow of the information processes in the educational activities of a lecturer of a higher education institution is proposed, that allows us to find out all the interdisciplinary connections of others in cyberspace and the assets of students.

4.3 Practical use

It is possible to use a computer game (gamification) as the basis for building a training complex for training military information and cybersecurity specialists.

4.4. Prospects for further research and study

The research is expected to bring more academic and applicable value. To do this, you need to pay extra: clarification of current problems of applying the gamification of training in higher military educational institutions.

Acknowledgment

References

1. Nyme Ahmed, Dip Nandi, A. G. M. Zaman. Analyzing Student Evaluations of Teaching in a Completely Online Environment [J]. International Journal of Modern Education and Computer Science (IJMECS). 2022, 14, 6: 13-24. DOI: 10.5815/ijmecs.

2. Pleshakov V.A. Gerontology and psychology of information sphere security: aspect of human cybersocialization in the social networks of the Internet environment [J]. Bulletin of the Orthodox St. Tikhon's University for the Humanities. Series IV. Pedagogy. Psychology. 2010, 4 (19): 131-141 (in Russian).

3. Pleshakov V.A. Prospects of the cyberontological approach in modern education [J]. Bulletin of the Moscow City Pedagogical University. Series: Pedagogy and psychology. 2014, 3 (29): 1-18 (in Russian).

4. Voloshina N.M., Zhogina L.M., Mukogorenko, O.S. on the issue of cybersocialization of Ukrainian society [C]. Military education and science: present and future: XIII international scientific and practical conference (Kiev, 24.11). VIKNU. 2017: 126-127 (in Ukrainian).

5. Meteshkin K.A., Morozov O.I., Fedorchenko L.A., Khayrova N.F. Cybernetic pedagogy: ontological engineering in teaching and education [M]. Kharkiv: HNAGH. 2012: 207 (in Russian).

6. Bespalko V.P. Cyberpedagogics. Pedagogical foundations of computer-controlled learning (E-Learning) [M]. Moscow: T8RUGRAM / Public Education. 2018: 240 (in Russian).

7. Igibaeva A.K., Toleukhanova A.D. Cyber pedagogy – as an innovative branch of pedagogical science[J]. Bulletin of KazNPU named after Abai, series "Pedagogical sciences". 2020, 68, 4: 12-17 (in Russian).

8. Kozubtsov I.N., Kozubtsova L.M. Cyber pedagogy as a new trend in education of the XXI century: problems and risks [C]. International Scientific and Practical conference: "Pedagogical education in the XXI century: priorities and searches" (Astana, 2022, 7.10). 2022: 402-409 (in Russian).

9. Mayer R.V. Cybernetic pedagogy: Simulation modeling of the learning process [M]. Glazov: GGPI. 2013: 138 (in Russian).

10. Pleshakov V.A. Cybersocialization as an innovative socio-pedagogical phenomenon [C]. Teacher of the XXI century. 2009, 3, 1: 32–39 (in Russian).

11. Chitosca M.I. The Internet as a socializing agent of the "M Generation" [J]. Journal of. Social Informatics. 2006, 5: 3-21.

12. Petryaev S.Yu "Cybersocialization" – A ≠ A [J]. Information and law. 2014, 3(12): 25-30 (in Ukrainian).

13. Voinova O.I., Pleshakov V.A. Cyberontological approach in education [M]. Norilsk: Research Institute. 2012: 244 (in Russian).

14. Kozubtsov I.M., Beskrovny O.I., Kozubtsova L.M., Palaguta A.M., Mironenko O.V. Trends in the educational and scientific space: problems and risks [J]. Bulletin of the Mikhail Ostrogradsky Kremenchug National University. 2022, 1(132): 40-48 (in Ukrainian).

15. Mashbits E.I. Psychological and pedagogical problems of computerization of education [M]. Moscow: Pedagogy. 1988: 192 (in Russian).

16. Novikov D.A. Theory of educational systems management [M]. Moscow: Public Education. 2009: 416 (in Russian).

17. Rybka N.M. Graization and experience of using computer games in teaching philosophy in technical institutions of Higher Education [J]. Information technologies and training tools. 2018, 67, 5: 213-225 (in Ukrainian).

18. Kozubtsov I.M. The concept of independent training of cadets of the ground forces on training facilities by playing on a virtual computer [C]. Prospects for the development of weapons and military equipment of the ground forces. collection of abstracts of the second All-Ukrainian scientific and technical conference (Lviv, April 28-29). 2009: 77 (in Ukrainian).

19. Kozubtsov I.N. Teaching electrical engineering disciplines by virtual computer game method [C]. Electrical technologies, electric drive and electrical equipment of enterprises: collection of scientific papers of the II All-Russian Scientific and Technical Conference. Ufa: USNTU Publishing House. 2009, 2: 107-110 (in Russian).

20. Leshchina V., Kozubtsov I., Kozubtsova L. Role of motivative characteristics in cyber security ontology [J]. Scientific and Practical Cyber Security Journal (SPCSJ). 2022, 6(1): 15-23.

21. Kozubtsova L.M., Kozubtsov I.M., Tereshchenko T.P., Bondarenko T.V. On the cyber security of military personnel playing geolocation games while staying at departmental facilities of critical information infrastructure [J]. Electronic professional scientific publication "Cybersecurity: Education, Science, Technology", 2022, 1, 17: 76-90 (in Ukrainian).

22. Tseas K., Katsioulas N. Kalandaridis T. Gamification in higher education [M]. M.S. Thesis, Dept. Electrical and Computer Engineering, University of Thessaly. Volos, Greece. 2014. http://dx.doi.org/10.4102/hts.v73i3.4527.

23. Bugaeva V.Yu. Gamification as a way of forming active professional behavior of future IT industry specialists [J]. Pedagogy and psychology. 2018, 56: 129-135. https://doi.org/10.5281/zenodo.577567 (in Ukrainian).

24. Petrenko S.V. Gamification as an innovative educational technology [J]. Innovation in education. 2018, 2, 7: 177-185 (in Ukrainian).

25. Kaufmann D.A. Reflection: Benefits of Gamification in Online Higher Education [J]. Journal of Instructional Research. 2018, 7: 125-132.

26. Kozubtsova L.M., Kozubtsov I.M., Lishchina V.A., Shtanenko S.S. Concept of the educational and training complex for training military specialists in information and cybersecurity on the basis of computer games (gamification) [J]. Electronic professional scientific publication "Cybersecurity: Education, Science, Technology". 2022, 2, 18: 49-60 (in Ukrainian).

27. Ponomarev O.A., Pivovarchuk S.A., Kozubtsov I.M. On the use of the computer game "Become the head of a field information and communication node" in the course of studying tactical and special disciplines [C]. Collection of reports and abstracts of materials of the II international scientific and technical conference " communication, informatization and cybersecurity systems and technologies: current issues and development trends "(Kiev, December 1, 2022) VITI. 2022: 174-175 (in Ukrainian).

28. Rigopoulos G. Assessment and Feedback as Predictors for Student Satisfaction in UK Higher Education [J]. International Journal of Modern Education and Computer Science (IJMECS). 2022, 14, 5: 1-9. DOI: 10.5815/ijmecs.

29. Ibrahim Ouahbi, Hassane Darhmaoui, Fatiha Kaddari. Gamification Approach in Teaching Web Programming Courses in PHP: Use of KAHOOT Application [J]. International Journal of Modern Education and Computer Science (IJMECS). 2021, 13, 2: 33-39.