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DIAGNOSTIC TOOLS FOR DETERMINING THE LEVEL OF FORMATION OF THE AXIOLOGICAL-MOTIVATIONAL COMPONENT OF SELF-EDUCATIONAL COMPETENCE OF FUTURE CYBERSECURITY SPECIALISTS

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The article is devoted to the problem of formation of axiological-motivational component of self-educational competence of future cybersecurity specialists. It is stated that the development of this component is of great importance not only for the professional success, but also for self-development in all other spheres. In this context it is necessary to identify the indicators, according to which it will be possible to measure the general level of the development of the component in question. The evaluation of the initial development level of the component in question is the first stage in the research work, the aim of which is to find the efficient ways of developing the axiological-motivational component in particular and self-educational competence in general, as only by comparing the data of the initial stage and the final stage the conclusion about the success of the experiment can be made. The article presents the grounding and choice of the diagnostic materials for determining the level of formation of each of the indicators (innovative and humanistic orientation of a personality, understanding of self-educational competence as a professional value, ability to emotionally experience the values of self-educational activity etc.) of the personal criterion (which corresponds to the axiological-motivational component). On the results of the initial stage measurements of this component the article states that the main problem connected with the development of the axiological-motivational component is the lack of theoretical knowledge about and practical skills of self-educational activity. This conclusion directs further research.

Key words: *Axiological-motivational component, self-educational competence, diagnostic tools, questionnaires.*

Problem statement in a general view and its connection with important scientific and practical problems. The primary task of higher education is to develop a specialist capable of self-education. Modern knowledge has become dynamic, therefore, it is impossible to provide students

with all the knowledge that they will need in their future professional career during their studies. This is especially true for information technology in general and cybersecurity in particular, where the technical knowledge base is developing very rapidly. Therefore, special attention should be paid to the effectiveness of the educational process in terms of self-education skills formation. For this purpose it is necessary to monitor changes in the level of formation of self-educational competence of future specialists. In this context, pedagogical diagnostics is necessary, which determines the development level of certain aspects of the studied phenomenon by using appropriate methods. According to Uruskiy (2012), pedagogical diagnostics should identify the biggest problems that arise during the formation of the phenomenon under study, the ways to overcome these problems, as well as achievements and ways to consolidate any success. The diagnostic specifies the course of the educational process, guides and directs it. The relevance of diagnostics of the axiological-motivational component of self-educational competence (SEC) of cybersecurity professionals is that motivation most influences the development of all components of this competence as a complex phenomenon, and the axiological attitude to self-education and ethical aspects should be leading in their future professional activity.

Analysis of the last researches and publications in which the decision of the problem has begun and on which the author grounds his research. There are many approaches to diagnosing the level of self-education competence of specialists in different spheres. It should be noted that scientists also have different views on the elements constituting this phenomenon. However, it should be emphasized that in all the works analyzed the motivational and axiological attitude towards self-education in one form or another is distinguished in the structure of self-educational competence. Scientists T. Voloshina (2018) (SEC of IT specialists), S. Kasyants (SEC of future economists), O. Kyselyova (2011) (SEC of future teachers), N. Kovalenko (2009) (SEC of students of rural schools), I. Mosya (SEC of future skilled workers), Yu. Pryshupa (SEC of future civil engineers), O. Shcholak (SEC of future specialists) in their research paid much attention to the development of a criterion-diagnostic apparatus for determining the level of formation of SEC of specialists of different profiles, but such tools for assessing SEC of future cybersecurity specialists have not been sufficiently developed. At the same time, we take into account the point of view of L. Borysenko, K. Kucheryava (2018) regarding the necessity of compliance of diagnostic methods with the following requirements: «to have an express character – the minimum necessary time for carrying out the diagnostic interpretation of the obtained results; to have scientific validity and their focus on measuring the

qualities important for self-educational activity, to provide the quantity assessment of the individual level of SEC development» (p. 84).

Setting of the unsolved parts of the shared problem to which the article is devoted. Thus, the results of the analysis of modern literature on the topic under research prove the insufficient character of scientific analysis on the selection of criterion-diagnostic tools for determining the level of formation of all components of the self-educational competence of cybersecurity specialists, which impedes the implementation of more efficient methods of professional training in this field.

Aim of the article is the analysis of a complex of diagnostic tools for determining the level of formation of the axiological-motivational component of the future cybersecurity specialists. Based on the aim of the research, the following tasks are outlined: having analyzed the publications on the topic of the present research, to ground the choice of diagnostic methods for assessing the level of formation of the axiological-motivational component of future cybersecurity specialists by indicators of the corresponding criterion and to analyze the results of the empirical research.

Statement of the basic research material with full substantiation of the received scientific results. The structure of the phenomenon of self-educational competence of future cybersecurity specialists was analyzed for the purposes of solving the problems of its diagnostics and effective formation. Emphasizing that there is no single terminological basis for the components that make up this competence, on the basis of the analysis of scientific views on the structure of SEC of different specialists, we agree with the structure proposed by O. Kyseliova (2011) and others and believe that the following components make up the structure of the SEC of cybersecurity specialists: axiological-motivational, procedural-informational, organizational and control-reflexive, each of which contains a scientifically grounded, systematic and structured set of theoretical expressions (knowledge) and corresponding types, forms, methods of activity (skills), which should ensure the effective implementation of each component in accordance with the professional sphere of a person (Adaryukova, 2018).

The axiological-motivational component's aim is to encourage students to self-educate, cultivate an axiological attitude towards professional self-education taking into account cybersecurity ethics, as well as form a system of values that enable future cybersecurity professionals to consider self-education as the key to professional success, the orientation in today's ever-changing professional environment. The motivational function of this component is to stimulate the student's self-educational activity. And the axiological function is to form the

readiness for continuous professional self-improvement, which is the basis of forming a steady interest in the professional growth in the future.

According to the report of the international project «Cybersecurity Education Programs 2017. Guidelines for Cyber Security Degree Higher Education Programs» (2017), one of the characteristics of any cybersecurity education program should be an emphasis on ethical behaviour and professional responsibility of the activities in this field (p. 18). The future specialist should reflect on the consequences of professional decisions, know the laws and standards, and ethical values of the social context of the professional sphere, be able to apply models of moral evaluation of ethical dilemmas, both at the individual and group levels. We believe that the moral and ethical aspect of the education of future cybersecurity professionals is of the utmost importance and should be taken into account when teaching all disciplines of this course.

In order to increase the efficiency of the formation of SEC of future cybersecurity specialists, it is necessary to evaluate the initial level of competence development according to the corresponding criteria. Each of the components of self-educational competence is characterized by the criterion that will indicate a certain level of competence. Understanding self-educational competence as a complex and systemic phenomenon, the most acceptable criteria for the formation of SEC of future cybersecurity specialists are the following: personal, pragmatic, organizational, reflexive (Adaryukova, 2018).

In order to diagnose the levels of development of future cybersecurity professionals' self-educational competence according to the personal criterion, we have identified the following diagnosing methods, evaluating the identified (Adaryukova, 2018) indicators. Table 1 presents the methodology for the study of the formation of the axiological-motivational component of SEC of cybersecurity students according to personal criterion and its indicators.

The empirical basis of the research was made up by the students of SHEE «Donetsk National Technical University» (Pokrovsk), Mariupol State University (Mariupol), Vasyl Stus Donetsk National University (Vinnitsa). The organization of experimental work requires a combination of quantitative and qualitative analysis of the data under study. Therefore, quantitative processing of the results during the ascertaining stage of the experiment is accompanied by their percentage and average group estimate.

An important factor for the formation of self-educational competence of a future a cybersecurity specialist is, in our opinion, the orientation at innovative activity. In order to identify the degree of manifestation of innovative orientation, the diagnostics of the need for impressions was used (M. Zuckerman). We consider this method appropriate because the innovative orientation of a personality, being a complex psychic phenomenon, is closely

linked to the innovation in all spheres of life. A specialist should seek innovation, have no fear of experimenting and have positive emotional experiences associated with this. The study found the following results (Table 2 below): a high level of the need for new impressions, which is inherent in people with unintentionally controlled attraction to something new and even risk, was noted in 9.6% of EG students and 7.4% of CG students; an average level of the need for new impressions, which characterizes a personality as open to the new and at the same time rather sensible, was recorded in 44.2% of EG students and 55.6% of CG students; a low level that characterizes students as inclined to favour stability and familiarity was diagnosed in 46.1% of EC students and 37% of CG students. Thus, such data indicate that slightly less than half of the students in both groups are characterized as open to everything new, but about the same percentage of students are not inclined to innovate, which, in terms of forming students as professionals, is negative and needs development.

Table 1

The diagnostic methodological tools for determining the level of the SEC axiological-motivational component by the indicators of the personal criterion

Criterion	Indicator	Diagnostic methodological tools
Personal	Innovative and humanistic orientation of a personality	Diagnostics of the necessity in new impressions (M. Zuckerman); Diagnostics of the ability to accept others (V. Fey)
	Understanding self-educational competence as a professional value	Methodology of identifying axiological orientations (M. Rokych)
	Ability to emotionally experience the values of self-educational activity	Methodology of determining emotiveness (V. Suvorova); Methodology of assessing the emotional and volitional characteristics
	Formation of motives of professional self-development by means of self-education	Questionnaire «Motivation of success» (T. Ehlers); Diagnostics of motivation to professional activity by K. Zamfir's methodology (in A. Rean's modification)
	Presence of orientation at self-educational activity to acquire cybersecurity skills and knowledge	Test «Readiness for self-development» (T. Ratanova, N. Shliakhta)
	Axiological attitude to the ethical element of self-educational activity of cybersecurity specialists	Questionnaire «Hacker – a hero or a villain?»; expert assessment; Test «Moral and ethical codex of a cybersecurity specialist»

The core of a person's attitude to people, to themselves, and to the world, according to O. Lysenko (2008), is moral relationships, with a person being the highest value. We consider it one of the key directions of formation of SEC of cybersecurity students, because such orientation can provide their self-educational and professional activity on the basis of values of humanism: goodness, justice, responsibility, honour. In order to estimate the level of manifestation of humanistic orientation, the technique «Diagnostics of the ability to accept others» (V. Fey) was used. Acceptance of others meant the conscious acceptance of other people's activities, understanding these activities and a certain (correct) way of responding. According to the diagnostic results (Table 2 below), 25% of EG students and 27.8% of CG students have high levels of acceptance of others (60 points or more), i.e. conscious adherence to moral and humanistic norms in different situations of interaction. The low acceptance rate of others (30 points or less) was recorded in 11.5% of EG students and 13% of CG students. The results of the diagnostics of the humanistic orientation of future cybersecurity specialists made it possible to make a conclusion about a small percentage of cases of conscious orientation towards humanistic values in different situations of interaction and the potential for the development of this orientation. To calculate the indicator of *innovative and humanistic orientation of a personality*, we calculate the arithmetic mean of the two methods' data. The results are presented below in Table. 2.

Sustainable continuous self-improvement is impossible without an understanding of self-education as a professional value. The testing method by M. Rokych is appropriate for identifying axiological orientations. At the ascertaining stage of the experiment, the interpretation of the results showed that the priority values of future cybersecurity specialists are mainly the interest in personal well-being, and the main focus in the life of the respondents is the focus on the material and entertaining aspects of life. Professional, social and spiritual groups of axiological orientations of future cybersecurity specialists were taken into account during the processing of the results. For this purpose it was necessary to determine how certain value orientation was ranked by students. The analysis of the diagnostics results (Table 2) at the ascertaining stage showed that the system of professional values of students of future cybersecurity specialists is insufficiently formed. A bigger number of students with low and average levels indicate their overwhelming orientation at external personal factors (money, image), which signifies the lack of internal motivation to perform professional activity and the low awareness level of the value of self-education for professional success.

Realization of the need for self-education requires a high level of ability to emotionally experience the values of self-educational activity. It is difficult to

overestimate the importance of the emotional sphere in achieving the planned results of the educational process. Scientists' research in the field of psychology and pedagogy have shown that the most important means of transmitting to students some axiological orientations is to create their adequate emotional experiences, that is, values can be acquired only as a result of their emotional cognition. In turn, emotions depend on the assessment of the situation. To identify the integral index of emotionality, the method of «Determining emotiveness» by V. Suvorova was applied. In addition, the realization of values and the functioning of the emotional sphere largely depend on the mechanisms of volitional regulation. Volitional qualities have a positive or negative colour depending on the values of an individual. As S. Maslov (2000) points out, without the development of the will, the axiological orientations of the individual are not manifested in the necessary degree. Volitional efforts directly depend on the level of the value awareness. The same close relationship exists between volition and emotion. According to S. Rubinstein (1998), «a volitional act, proceeding from urges and needs, is more or less emotionally expressed» (p. 602). In this connection, we consider it appropriate to diagnose the indicator of the *ability to emotionally experience the values of self-educational activity* also with the help of «Assessing the emotional and volitional characteristics» (by V. Shapar, A. Tymchenko, V. Shvydchenko). The obtained ratios by two methods were reduced to arithmetic mean. The results of the two diagnostic methods are presented in Table 2.

Another indicator, *the formation of motives of professional self-development by means of self-education*, was analysed with the help of the questionnaire «Motivation for success» by T. Ehlers (Rožanova, 1999), on the basis of which it can be concluded that the overwhelming majority of students are characterized by an average level of orientation to success in the educational process (Table 2). The results indicate that the future cybersecurity professionals are not motivated to achieve professional success, which prevents them from their further personal and professional development. In addition, the study of the motivation of self-educational activity by the method of K. Zamfir (in the modification of A. Rean) (Mironova, 2006) was conducted, which is based on the concept about outer and inner motivation. The analysis of the test results shows that among the future cybersecurity professionals, professional motives (44.3% of both groups) and social motives (27.8%) prevail, while cognitive motives make up 12.5%. Such data demonstrate the potential to form motivation to pursue independent learning activities for the purpose of professional development.

The presence of orientation at self-educational activity to acquire cybersecurity skills and knowledge was diagnosed with the help of T. Ratanova

and N. Shlakhta's (Ratanova, Shlakhta, 1998) test «Readiness for self-development», which identifies it in two directions: readiness to know oneself and readiness to improve oneself. The analysis of the respondents' answers shows that the majority of future cybersecurity specialists (68% of both groups of students) belong to Square D, that is, their desire to know themselves is higher than their self-education skills, which can, of course, be explained by the initial stage of training and lack of skills in the organization of independent work. Only 23% of students belong to Square A, i.e. they have more possibilities for self-development than readiness for cognitive and search activity.

Axiological attitude to the ethical component of self-educational activity of cybersecurity specialists was assessed using the anonymous questionnaire «Hacker – a hero or a villain?» developed by the author (Adaryukova, 2018). Responses were analysed by the teachers of professional disciplines, and on the basis of this analysis an expert evaluation was provided that defined the level of axiological attitude to professional ethics as high, average and low. One fourth part of respondents, both in the CG and in the EG, have an idea of what a cybersecurity specialist should and should not do, although they do not have a clear understanding of the illegal character of such actions as using someone else's content as their own, using pirate copies of anything, etc. Most of the interviewees have an average level of axiological understanding of ethical issues of their professional activities. Sometimes the characteristics of the term «Hacker» included such words as «hero», «rich» and others that highlight a positive attitude to the phenomenon. A small number of students – 16.7% in CG and 11.5% in EG – have, unfortunately, a low level of understanding of the need for ethics. They showed a positive attitude towards using professional knowledge for revenge or some kinds of illegal activity. Additionally, the qualitative diagnostic of knowledge of cybersecurity ethics was conducted by means of an anonymous test «The moral and ethical complex of a cybersecurity specialist» (Adaryukova, 2018). The test has shown that most cybersecurity students have an average or low level of professional ethics knowledge. Unfortunately, this demonstrates a fairly loyal attitude to such basic principles of activity of any IT specialist, as observance of the confidentiality principle, respect of intellectual property and understanding of the devastating consequences of illegal professional activity.

The combined results of the diagnostics of self-educational competence of cybersecurity students by personal criterion at the ascertaining stage of the experiment are presented in table. 2.

Generally, the analysis of the findings shows that most future cybersecurity professionals have all the indicators of the personal criterion at average or low levels. This signifies that the axiological-motivational sphere of

future cybersecurity professionals is not formed completely, which will impede the implementation of self-educational activities for the purpose of professional development in the future.

Table 2

The distribution of the experiment members by the levels of formation of SEC by personal criterion at the ascertaining stage of the experiment (%)

Group	Level	Indicators of SEC formation					
		Innovative and humanistic orientation of a personality	Understanding self-educational competence as a professional value	Ability to emotionally experience the values of self-educational activity	Formation of motives of professional self-development by means of self-education	Presence of orientation at self-educational activity to acquire cybersecurity skills and knowledge	Axiological attitude to the ethical element of self-educational activity of cybersecurity specialists
CG	High	17,6	18,52	17,6	16,67	16,67	24
	Average	57,5	37,96	37,9	42,59	29,62	59,3
	Low	25	43,52	44,4	40,74	53,7	16,7
EG	High	17,3	20,19	20,19	18,27	13,46	25
	Average	53,9	37,5	37,4	43,27	30,77	63,5
	Low	28,8	42,31	42,3	38,46	55,7	11,5

Conclusion and prospects of the further investigations in the given direction. The results of this study revealed the typical problems associated with the formation of SEC in the process of professional training of the cybersecurity students. One of the main problems is their insufficient theoretical and practical training on issues of self-education. The overwhelming number of students have a low level of axiological-motivational attitude towards self-educational activity, which leads to a low level of development of basic self-education skills. The main reason for the difficulties associated with the motivational and axiological sphere is the lack of skills to solve the problems of self-education and, as a consequence, the lack of satisfaction from the process and results of self-educational activities. This determines the direction of further research.

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ДІАГНОСТИЧНИЙ ІНСТРУМЕНТАРІЙ ДЛЯ ВИЗНАЧЕННЯ РІВНЯ СФОРМОВАНOSTІ ЦІННІСНО-МОТИВАЦІЙНОГО СКЛАДНИКА САМООСВІТНЬОЇ КОМПЕТЕНТНОСТІ МАЙБУТНІХ ФАХІВЦІВ З КІБЕРБЕЗПЕКИ

Л. Б. Адарюкова

Стаття присвячена проблемі формування ціннісно-мотиваційного складника самоосвітньої компетентності майбутніх фахівців з кібербезпеки. Стверджується, що розвиток цього складника має велике значення не тільки для професійного успіху, але й для саморозвитку у всіх інших сферах. У цьому контексті необхідно визначити показники, за якими буде можливо виміряти загальний рівень розвитку цього складника. Оцінка вхідного рівня сформованості цього складника – це перша стадія дослідження, метою якого є знайти ефективні шляхи розвитку ціннісно-мотиваційного складника зокрема та самоосвітньої компетентності у цілому. Адже тільки завдяки порівнянню даних початкового та фінального етапів можна зробити висновок про успіх експериментального дослідження.

Стаття надає обґрунтування та вибір діагностичного матеріалу для визначення рівня сформованості кожного з показників (інноваційно-гуманістична спрямованість особистості, усвідомлення самоосвітньої компетентності як професійної цінності, здатність до емоційного переживання цінностей змісту самоосвітньої діяльності тощо) особистісного критерію, який відповідає ціннісно-мотиваційному складнику. На основі результатів визначення показників цього критерію на початковому етапі у статті зазначається, що основна проблема, пов'язана із розвитком ціннісно-мотиваційного складника, – це недостатність теоретичного знання та практичних навичок самоосвітньої діяльності. Цей висновок і спрямовує подальше дослідження.

Ключові слова: ціннісно-мотиваційний складник, самоосвітня компетентність, діагностичні інструменти, опитувальники.

ДИАГНОСТИЧЕСКИЙ ИНСТРУМЕНТАРИЙ ДЛЯ ОПРЕДЕЛЕНИЯ УРОВНЯ СФОРМИРОВАННОСТИ ЦЕННОСТНО-МОТИВАЦИОННОЙ СОСТАВЛЯЮЩЕЙ САМООБРАЗОВАТЕЛЬНОЙ КОМПЕТЕНТНОСТИ БУДУЩИХ СПЕЦИАЛИСТОВ ПО КИБЕРБЕЗОПАСНОСТИ

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Статья посвящена проблеме формирования ценностно-мотивационной составляющей самообразовательной компетентности будущих специалистов по кибербезопасности. В статье утверждается, что развитие этой составляющей имеет большое значение не только для профессионального успеха, но и для саморазвития во всех других сферах. В этом контексте необходимо определить

показатели, по которым будет возможно измерить общий уровень развития этой составляющей. Оценка входного уровня сформированности этой составляющей – это первый этап исследования, целью которого является найти эффективные пути развития ценностно-мотивационного компонента в частности и самообразовательной компетентности в целом. Ведь только благодаря сравнению данных начального и финального этапов можно сделать вывод об успехе экспериментального исследования.

Статья предоставляет обоснование и выбор диагностического материала для определения уровня сформированности каждого из показателей (инновационно-гуманистическая направленность личности, осознание самообразовательной компетентности как профессиональной ценности, способность к эмоциональному переживанию ценностей содержания самообразовательной деятельности и т.д.) личностного критерия, который соответствует ценностно-мотивационной составляющей самообразовательной компетентности. На основании результатов определения показателей этого критерия на начальном этапе в статье отмечается, что основная проблема, связанная с развитием ценностно-мотивационного компонента, – это недостаточность теоретического знания и практических навыков самообразовательной деятельности. Этот вывод и направляет дальнейшее исследование.

Ключевые слова: ценностно-мотивационный компонент, самообразовательная компетентность, диагностические инструменты, опросники.

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