

# Assessment of Student's Competence in Physical Education: Approaches and Methodology

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**Abstract:** The competence in physical education (PE) is an assessment of a person's ability to lead a physically active lifestyle. The lack of an integrated approach to assessing the success of student's training in PE does not allow a systematic, transparent and effective monitoring of the dynamics of the development of the personality of a competitive specialist, establishing the causes of problems and developing forecasts for the future. The goal of study was to develop and justify a system for assessing the competence of PE of students studying at universities and colleges.

A survey of experts (N=82) was conducted to find out the importance of each of the structural elements of competence. The validity of proposed approaches was investigated.

Three domains ("Movement Activity and Attitude to It," "Physical Health and Fitness," "Knowledge, Skills, and Abilities") were distinguished in the structure of competence in PE, each of which was divided into 2-4 components. Designed assessment method covers all structural parts of the competence in PE, the goals of student learning, takes into account the list of necessary knowledge and skills in accordance with the requirements of the program, provides the formation of motivation for an active lifestyle, and maintains a level of physical activity sufficient for health. Developed method allows to determine the overall assessment of the formation of competence in PE, as well as a separate component, it gives an opportunity to calculate "critical" components, take into account interests and needs of students, teachers, and university / college administration.

**Keywords:** *competence; evaluation; physical literacy; physical education; physical activity; students; university.*

**How to cite:** Pavlova, I., Petrytsa, P., Andres, A., Khurtenko, O., Osip, N., Yednak, V., Naumchuk, V., & Mashtaler, I. (2020). Assessment of Student's Competence in Physical Education: Approaches and Methodology. *Revista Romaneasca pentru Educatie Multidimensionala*, 12(4), 338-356. <https://doi.org/10.18662/rrem/12.4/349>

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## 1. Introduction

The deep social, spiritual and economic shifts that are taking place in Ukraine require a significant transformation of education in the country for its entry into the world educational space. An intensive search is under way for improving the content, forms, and methods of ensuring fundamental education.

Education aims to lay the foundation for future professional activities. The necessary full-scope knowledge, skills and abilities, including practical work are important in this very process. However, competence is not the only set of personality traits (characteristics) that allow doing certain activities with high quality aimed at solving problems (tasks) in any field of activity. The following is also important in the process: formation of needs and opportunities to go beyond what has been studied, the ability to self-development, and continuous and flexible self-education throughout life (Tremblay, 2012). Also, competence is a process of becoming an individual. Competence involves the recognition by a person of his/her own aspirations for activity, needs and interests, desires and valuable orientations, motives for activity, ideas about his/her social role, the ability to independently evaluate personal qualities, and reflection (Cattuzzo et al., 2016; Logan et al., 2015). Education should contribute to the creative development of the individual and the right choice of an individual life program, taking into account the characteristics, needs and capabilities of each, in other words, to contribute to the formation of competencies.

The formation and development of competence in physical education (PE) is of great importance (Keegan et al., 2019; Larsson & Nyberg, 2017; Lloyd, 2016; Sum et al., 2016). This competency is an assessment of a person's ability to lead a physically active lifestyle. Experts define competence in PE as motivation and confidence, knowledge and understanding of the theory in the field of PE in an amount sufficient to appreciate and take responsibility for engaging in physical exercises throughout life (Whitehead, 2010). Despite the fact that the level of motor activity determines the state of human health (Brodani & Kovacova, 2019; Guntzwiller et al. 2017; Uher & Bukova, 2018), the development of such competencies does not lose relevance.

In some works, competence is equated with literacy (Delaney et al., 2008; Edwards et al., 2018; Lundvall, 2015; Tremblay, 2012). Exactly literacy of students in PE serves as a marker of the effectiveness of the process of PE at universities and colleges (UNESCO, McLennan, & Thompson, 2015).

## **2. Problem statement**

One of the tools for the formation of a high-quality educational model is the assessment of the quality of education, and the knowledge of students comes there first. Thus far, it has been customary for Ukraine's higher education system to evaluate the effectiveness of PE by the dynamics of the qualitative parameters of physical fitness. Nowadays, scientists recommend to take into consideration not only the physical fitness of students when assessing the PE, but also indicators of their physical health, level of knowledge, skills, the frequency of independent physical exercises, etc. (Bodnar et al., 2019; Chen et al., 2014). In order to do this, it is necessary to form an integrated system for evaluation the competence of students in PE. Today, there are few studies regarding individual indicators of a student's physical literacy (Barnett et al., 2019; Corbin, 2016); in fact, there is no scientific data on the number, weight, and significance of the components of this competence for students studying at universities and colleges. Currently, the lack of an integrated approach to assessing the success of student's training in PE does not allow a systematic, transparent and effective monitoring of the dynamics of the development of the personality of a competitive specialist, establishing the causes of problems and developing forecasts for the future. Scientific research in this direction is socially important and this problem is particularly relevant in the context of reforming the system of Ukrainian education. The goal of study was to develop and justify a system for assessing the competence of PE of students studying at universities and colleges.

## **3. Research Methods**

The study involved several stages. At the first stage, a search was made in the Scopus, Web of Science, and Google Scholar databases in order to analyze publications containing empirical studies of competence in education, theoretical studies of the concept of student's competence in PE; at the same time, Ukrainian-language publications were analyzed regarding aspects of assessing student's performance in PE. The objective of this stage was to find out the competence structure of the PE of a student studying at a university or college.

At the second stage, a survey of experts (N=82) was conducted to find out the importance (in %) of each of the structural elements of competence. The survey involved teaching staff from six Ukrainian universities accredited to issuing master's degree (Ternopil Volodymyr Hnatiuk National Pedagogical University, National Pedagogical

Dragomanov University, Vasyl Stefanyk Precarpathian National University, Lviv State University of Physical Culture, Ternopil National Economic University, and Taras Shevchenko Regional Humanitarian Pedagogical Academy of Kremenets). The field of expertise of experts was the following: physical culture and sports, PE, youth sports, educational programs in PE. All experts had at least 5 years of working experience at the university, including 71.9% of individuals with more than 10 years of working experience; 65.9% had a scientific experience (candidates of science, doctors of science), or academic title (associate professor, professor). This group of experts has been involved in: (1) establishing a coefficient of importance for each of the components of the competency (assessing in percentage the contribution of each indicator to the overall level of competence; when calculating the average, values that fell out of the data sample were rejected); (2) establishing a list of topics necessary for the formation of the component “Level of Knowledge on Physical Education” (the importance of topics was determined on a 5-point scale); (3) establishing a list of skills related to competence in education (the importance of skills was evaluated on a 5-point scale).

The third stage of the work was designed to develop a method for assessing the competence in PE based on the results obtained in the previous stages of work. The validity of the individual components of the method proposed in the study was checked in several ways. The validity of the first domain “Physical Activity and Attitude to It” was evidenced by the close correlation ( $r=0.96$ ) between the number of points for this domain and the results of the Framingham method. For this purpose, there were enrolled students ( $N=125$ , age – 18–21 years) who were in the first or second year of study at Ternopil Volodymyr Hnatiuk National Pedagogical University.

The validity of the third domain “Knowledge, Skills and Abilities” was confirmed by the results of a survey among experts. Experts ( $N=7$ ) were involved in testing the effectiveness of the proposed assessment method and had at least 10 years of experience in PE for students, they had an academic or scientific title, and had not participated in the second stage of this study. With a help of a 5-point scale experts assessed the relevance of the components, correspondence of physical education at universities to modern standards, the appropriateness, clarity, and complexity of tasks and test questions, the convenience and comprehensibility of assessment scales and general quantitative assessment of competence, the cost-effectiveness of the method, the fullness of coverage of PE curriculum with educational materials and tasks.

## 4. Results

### 4.1. The structure of student's competence in physical education

Three domains were distinguished in the structure of competence in PE, each of which was divided into 2–4 components (Table 1). The “Movement Activity and Attitude to It” domain includes 4 components that indicate the frequency of physical activity. The first three components should provide a minimum of physical activity necessary for health. Based on the analysis of the frequency of attending various forms of PE classes, it is possible to indirectly assess student's desire to perform physical exercises and their attitude to physical activity in general. However, we took into account the opinion of specialists (Inchley et al., 2011; Pavlyuk et al., 2019) who insist that the “activity” side of the attitude of young people to physical activity should be taken into consideration, therefore, we did not evaluate the declaration of a “positive attitude” to sports / classes / competitions, but the student's direct participation in fitness activities (the fourth component). This component provides for further increasing in the volume of motor activity of students, and also indicates their attitude to motor activity.

Based on the results of the work of experts for each of the components, the level of its importance was clarified. Attendance to academic and independent sessions and the level of practical and theoretical skills appeared to be the most significant ones.

**Table 1.** The structure student's competence in physical education

Domains	Components	Coefficient of importance, %	The maximum number of points for indicators of competence ( $C_{max}$ )
I. Movement Activity and Attitude to It	1. Attendance of physical education academic sessions	30	256
	2. Independent classes of healthful and recreational orientation	20	192
	3. Attendance of sports sections	5	192
	4. Participation in fitness activities	6	224
II. Physical Health and	5. Level of fitness	12	25
	6. Physical health	10	30

Fitness			
III. Knowledge, Skills, and Abilities	7. Level of developed skills and abilities	10	10
	8. Level of knowledge on physical education	7	10

#### ***4.2. Methodology for assessing the competence of students in PE***

When calculating the maximum number of points (Table 2) which students can get for participating in various forms of physical activity, we considered the fact that participation in an academic 90-minute lesson once a week is not sufficient for physical activity. Therefore, it was suggested that students should attend sports twice a week. Such number of classes has been chosen taking into account the fact that the healing effect of classes in the sports section once a week is absent, and more than 3 times a week – not confirmed (World Health Organization, 2007). The calculations were carried out taking into consideration the duration of the school year – that is 32 weeks.

Motor activity and attitude to it has been determined by the frequency, duration and intensity of student's motor activity during various forms of PE (Table 2). So, active vigorous-intensity physical activity (at the level of 7–8 points on a 10-point scale) for at least 30 minutes was rated at 4 points, moderate-intensity physical activity (at the level of 5–6 points lasting at least for 30 minutes) and active methodological activity (conducting a part or the whole lesson, an outdoor or sports game, or a set of exercises, warming up as a teacher / assistant teacher) was rated at 2 points. Daily morning hygienic gymnastics and procedures of conditioning yourself to the cold, daily physical exercises (the P.T. break) and daily participation in outdoor games and activities for at least 10 minutes during a long break (provided the intensity is 5–6 points on a 10-point scale (2008 Physical Activity Guidelines for Americans, n.d.) were rated at 1 point. Strength exercises (exercises with resistance to large muscle groups of the body and limbs) 3 or more times a week for up to 60 minutes per day have been rated at 3 points. Attending intensive classes in the sports section lasting for at least 30 minutes was evaluated at 4 points.

**Table 2.** Criteria for assessing the domain of “Motor Activity and Attitude to It”

No.	Component	$C_{max}$ , points
1	<b>Attendance of physical education academic sessions</b>	$C1_{max}=256$
	Vigorous-intensity physical activity for at least 30 minutes	128
	Moderate-intensity physical activity for at least 30 minutes	64
	Active methodological activity	64
2	<b>Independent classes of healthful and recreational orientation</b>	$C2_{max}=192$
	Daily morning exercises and cold-water treatment procedures (for at least 10 minutes)	32
	Daily physical exercising / PE minutes (lasting at least 10 minutes)	32
	Daily participation in outdoor games and fun during a long break (at least 10 minutes)	32
	Performing strength exercises (with resistance) on large muscle groups of the body and limbs at least 3 times a week for 45–50 minutes each	96
3	<b>Attendance of sports sections</b> (classes with high intensity for at least 30 minutes)	$C3_{max}=192$
	Once a week	64
	2 times a week	128
	3 and more times a week	192
4	<b>Participation in university / college physical fitness activities</b>	$C4_{max}=224$
	Participation in a sports festival (groups)	32
	Participation in health days	32
	Participation in hiking trips	64
	Participation in sports competitions	96

In order to assess the domain “Physical Health and Fitness” we used approaches tested by the Ministry of Education and Science of Ukraine, which had been discussed publicly and used for annual assessment of physical fitness of various groups of the population of Ukraine. They provide students with 5 test exercises aimed at determining the level of physical qualities (endurance, strength, speed, agility and flexibility) (Table 3). Test exercises are well known to students, and “sufficient” level standards are available for most students. Any of the students can choose and perform one of the two strength tests offered to him/her, which indicates the lability of the grading system.



**Table 3.** Tests for assessing the level of physical fitness

No.	Test types	Sex	Standards, points			
			5	4	3	2
1	3000-metre run, min	M	13.0	13.3	14.2	15.3
	2000-metre run, min	F	10.3	11.15	11.5	12.3
2	Pulling on the bar, times	M	14	12	11	10
	Standing long jump, cm		260	240	235	205
	Flexion and extension of arms in a lying support, times	F	25	21	18	15
	Standing long jump, cm		210	200	185	165
3	100 m Run, sec	M	13.2	14.0	14.3	15.0
		F	14.8	15.5	16.3	17.0
4	Shuttle run 4×9 m, sec	M	9.0	9.6	10.0	10.4
		F	10.4	10.8	11.3	11.6
5	Trunk flexion forward from a sitting position, cm	M	13	11	9	6
		F	20	18	16	9
The sum of points for the five tests (C <sub>max</sub> )			<b>25–21</b>	<b>20–16</b>	<b>16–11</b>	<b>≤10</b>
Level			<b>High</b>	<b>Sufficient</b>	<b>Average</b>	<b>Low</b>

The level of physical health has been evaluated by the method of quantitative rapid assessment developed by Apanasenko & Popov (1998) (Table. 4). The overall assessment of physical health was determined by the sum of the points. This allows assigning all practically healthy individuals into five health levels corresponding to a certain level of aerobic energy potential (Apanasenko & Popov, 1998).

**Table 4.** Express-evaluation of physical health

Calculation of the indicator	Sex	Health levels				
		low	below the average	average	above the average	high
I <sub>1</sub> = Body weight, kg / (body length, m) <sup>2</sup>	F	≤16.9	17.0–18.6	18.1–23.8	23.9–26.0	≥26.1
	M	≤18.9	19.0–20.0	20.1–25.0	25.1–28.0	≥28

Points for I <sub>1</sub>		-2	-1	0	-1	-2
I <sub>2</sub> = Vital lung capacity, ml / body weight, kg	F	≤40	41–45	46–50	51–56	>56
	M	≤50	51–55	56–60	61–65	>66
Points for I <sub>2</sub>		-1	0	1	2	3
I <sub>3</sub> = (Hand held dynamometry x 100) / body weight, kg	F	≤40	41–50	51–55	56–60	≥61
	M	≤60	61–65	66–70	71–80	≥80
Points for I <sub>3</sub>		-1	0	1	2	3
I <sub>4</sub> = (Heart rate × systolic arterial blood pressure) / 100	F	≥111	95–110	85–94	70–84	≤69
	M	≥111	95–100	85–94	70–84	≤69
Points for I <sub>4</sub>		-2	-1	0	3	5
I <sub>5</sub> = Heart rate recovery time after 20 squats in 30 sec	F	≥3 min	2–3 min	1.30–1.59 min	1.0–1.29 min	≤59 sec
	M					
Points for I <sub>5</sub>		-2	1	3	5	7
Total points (I <sub>1</sub> + I <sub>2</sub> + I <sub>3</sub> + I <sub>4</sub> + I <sub>5</sub> )		≤3	4–6	7–11	12–15	16–18
Assessing the components of the physical health level, C <sub>max</sub>		<b>≤16.9</b>	<b>17.0–18.6</b>	<b>18.7–23.8</b>	<b>23.9–26.0</b>	<b>≥26.1</b>

Among the list of educational topics that are important for the formation of the component “Level of knowledge on physical education”, experts considered the following to be of great importance: 1. Elementary knowledge on determining the state of one's own body (the most important topic), 2. Knowledge of healthy lifestyle (daily routine, nutrition, and personal hygiene), 3. Knowledge of first aid basic techniques, 4. Knowledge of safety rules during physical exercising, 5. Rules of conduct in the gym (on the court), in the water, 6. Knowledge of cold-water treatment, 7. Knowledge of Ukrainian outdoor games (less important topic). The assessment of this component has been proposed to be carried out using test tasks (n=10), and the correct answer for each task has been estimated at 1 point.

Among the list of skills stipulated by the PE curriculum, those related to competence in education were selected according to experts' recommendations. There were pointed out 5 indicators that scored at least

4.5 points on a 5-point scale based upon expert evaluation: 1. Independent morning exercises, 2. Performing exercises to restore mental and physical performance, 3. Knowledge of exercises to form correct posture, 4. Self-organization of outdoor games, 5. Independent performance of the P.T. break. Skills were evaluated in a physical education lesson by means of observation. Students were offered to complete the task, the results of which determined the degree of formation of a particular skill. Each skill has been rated a maximum of 2 points.

### ***4.3. Calculation of a quantitative indicator of competence in PE***

To calculate the individual level of competence in PE, the following formulas (1–3) were proposed.

The level of formation of each component was calculated taking into account the maximum possible amount of points for it:

$$M_i = (C_i \times 100\%) \times C_{i_{max}}^{-1} \quad (1)$$

where:  $M_i$  – the level of formation of an individual component (in %);

$C_i$  – the amount of points received by the student for the component;

$C_{i_{max}}$  – the maximum possible amount of points for the component.

Assessment for a separate indicator of student's competence in PE was calculated considering the coefficient of its importance in accordance to formula 2:

$$P_i = (M_i \times A_i) / 100\% \quad (2)$$

where:  $P_i$  – the score for an individual component taking into account the importance coefficient;

$M_i$  – the level of formation of an individual component;

$A_i$  – the coefficient of importance of the component.

Points for the individual components have been added and a general assessment (in points) of the student's PE competence has been obtained.

$$CPE = P_1 + P_2 + P_3 + P_4 + P_5 + P_6 + P_7 + P_8 \quad (3)$$

where: CPE – student's competence in PE;

$P_1, P_2, P_3 \dots$  – scored for individual components, based on the importance coefficient.

The second group of experts highly appreciated the quality of the developed method for evaluating the competence in PE and, in their opinion, the proposed components were relevant for assessment (4,87 points), correspond to the current state of the educational process for PE at a university / college (4,66 points), the assessment scale is comfortable (4,72 points), effective (4.60 points), the proposed questions and tasks are informative (4,56 points), accessible (4,82 points), cover educational material (4,83 points), clear and comprehensible (4,65 points).

## 5. Discussion

Competence in PE is crucial for the formation of competitive university graduates, healthy, capable of working and active citizens (McKean, 2013; UNESCO et al., 2015). Some countries are critical as to the information content of PE competence indicators (Tyler et al., 2016). A number of countries (Australia, Kenya, South Africa, Great Britain, and Singapore) is used to assess student's performance and evaluate the effectiveness of the process of PE (Edwards et al., 2017; Keegan et al., 2019; Larsson & Nyberg, 2017; Lloyd, 2016; Tremblay & Lloyd, 2010); in other countries, the results of determining the competence in PE of children and youth are taken into account when analyzing the level of physical fitness and health (Oh et al., 2019). Specialists identify the competence in PE with the concept of physical fitness or the development of physical skills (Bélanger et al., 2016; McKee, Breslin, Haughey, & Donnelly, 2013), and physical literacy (Lloyd, 2016; Longmuir et al., 2015; Sheehan & Katz, 2012).

Because of the decreasing dynamics in the volume of physical activity and deterioration in the level of physical fitness of young people, the interest in the phenomenon of "Competence in Physical Education" has been growing rapidly recently. In our country, the introduction of the New Ukrainian School has just begun, and its educational programs provide for a competency-based approach, but today these reforms concern schoolchildren only. It can be argued that it is competence in PE that is the ultimate goal of PE; therefore, elucidation of the essence and components of this competence is a step towards the creation of high-quality and effective curricula (Sum et al., 2016). Designing an integrated assessment framework together with clarifying the structure of competence is really valuable.

Student's competence in PE can be interpreted as a set of human properties that one acquires in the process of PE and which can be expressed in the individual's active work aimed at comprehensively improving one's physical nature and leading a healthy lifestyle. In our opinion, the concepts of competence should cover such components as physical health and physical fitness, knowledge and skills in the field of PE, participation in various forms of PE, which in turn, determine the volume of physical activity. Our results are consistent with the results of Canadian scientists who define competency as motivation, commitment to physical activity, knowledge and understanding, so that students become aware of their responsibility for their health and exercise throughout their lives (Tremblay & Lloyd, 2010).

The proposed in study method allows to determine the overall assessment of the formation of student's competence in PE, as well as an assessment for each individual component, and therefore, to manifest factors and phenomena critical for competence. Students who scored 576 points for the academic year (32 weeks of study) have got a good mark, this level of competency is sufficient to ensure a lower limit of health. The average level (268 points, the rating is satisfactory) has been available for most (75%) students.

The advantage of our method is its higher objectivity in assessing physical activity due to the absence of self-estimation by students of their daily physical activity, the ability to track the scores daily, since both the student and the teacher can use the methodology. This approach enhances further student's motivation and understanding of the importance of leading a healthy lifestyle. The strengths of the proposed method of assessment is that it allows to change the number of indicators (at the discretion of the teacher or university administration), for example, by adding tests from the section of professionally applied physical training. The component "Movement Activity and Attitude to It" has got the highest importance coefficient, similar to the CAPL physical literacy assessment developed by Canadian scientists (Longmuir et al., 2015, 2018). We are convinced that attitudes toward PE should be determined not by student responses, but in organized be universities forms of PE, independent physical exercising etc.

The express health assessment system takes into account physiological patterns, which are manifested depending on the degree of development of general endurance (economization of functions and expansion of physiological reserves). It was proved that the higher the level of somatic health is, the less likely occurrence of somatic pathology and colds takes place (Apanasenko & Dolzhenko, 2007). The advantages of this

health assessment system are its simplicity and speed of measurement (Bodnar et al., 2019; Dukh et al., 2019; Pavlova et al., 2018).

The level of formation of skills and abilities can be assessed during the lesson by teachers' observations of students. For example, a student is given a task of dividing a group into three teams and holding a relay-race with them. The following criteria are being evaluated: the student's ability to divide a group, his/her explanation of the relay-race rules, his/her actions during the relay-race and in the process of determining the winners. Obviously, when considering the list of knowledge, abilities and skills, it is necessary to take into account the requirements of national programs, and therefore the concept of competence may contain a certain cultural context.

## **Conclusions**

In order to assess the effectiveness of the existing PE program and monitor the dynamics of student performance, a special tool and constant monitoring are required. Studies are dedicated to finding an integrated approach to assessing the success of student's training in physical education that is socially important and relevant. Our proposed method for assessing the competence in PE meets these tasks and can be used in the educational process.

The assessment method covers all structural parts of the "Physical Education Competence" hierarchy, the goals of student learning, takes into account the list of necessary knowledge and skills in accordance with the requirements of the program, provides the formation of motivation for an active lifestyle, and maintains a level of physical activity sufficient for health. The advantages of the developed assessment method are that it allows to determine the overall assessment of the formation of competence in PE, as well as a separate component, it gives an opportunity to calculate "critical" components, take into account interests and needs of students, teachers, and university / college administration. The approaches proposed in the methodology are objective, quick in measuring, and do not require much time and financial resources.

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## **Acknowledgement**

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This article is the result of teamwork. Iuliia Pavlova provided leadership in the development of the article and the presentation of its findings (the main idea and concept of investigation, planning of investigation, management of data collection, analysis, and interpretation of all results, participation in the writing of all parts of the article). Petro Petrytsa conducted data collection

(survey of experts, the survey of students according to Framingham method), and development of the structure of students' competence in physical education, and criteria and formulas for quantitative evaluation of competence in physical education, helped in the writing of all parts of the article. Andrii Andres participated in data collection (survey of experts), development of the structure of students' competence in physical education, criteria and formulas for quantitative evaluation of competence in physical education, participated in the writing of the article. Oksana Khurtenko provided a search in Scopus, WoS, and Google Scholar databases to analyze publications containing empirical studies of competence in education, theoretical studies of the concept of student competence in Physical Education. Nataliia Osip assisted in data collection (survey of students according to the Framingham method), participated in creating criteria for assessing motor activity. Valeriy Yednak provided search in Scopus, WoS, and Google Scholar databases to analyze publications containing empirical studies of competence in education, theoretical studies of the concept of student's competence in physical education. Volodymyr Naumchuk assisted in data collection (survey of experts) and was involved in creating and testing of criteria for assessing the domains of competence in physical education. Iryna Mashtaler was involved in creating and testing of criteria for assessing the domains of competence in physical education.

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