



Formation of the Cognitive Component of Future Physical Education and Sports Specialists' Readiness for Educational Activities in Sustainable Development

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Abstract

Objectives. To determine the effectiveness of the author's methodological system for training future specialists in physical culture and sports for educational activities related to sustainable development, focusing on the formation of the cognitive component of readiness.

Materials and methods. The study involved 390 students from the faculties of physical education at T.H. Shevchenko National University "Chernihiv Colehium", the National University of Life and Environmental Sciences of Ukraine, Sumy State University, and Sumy State Pedagogical University named after A.S. Makarenko – future specialists in physical culture and sports. The participants, who were from various courses and were of both sexes, were divided into control and experimental groups. The methods used included surveys, testing, pedagogical experiments, analysis, synthesis, and generalization of information, and mathematical statistics methods.

Results. At the beginning of the study, 93.33% of the students in the control group and 86.67% of the students in the experimental group had low levels of cognitive readiness for educational activities related to sustainable development. The final test revealed a significant improvement in this indicator within the experimental group: 32.22% of the students had a low level of cognitive readiness, 48.89% had a satisfactory level, 17.78% had an average level, and 1.11% had a high level. Relevant improvements were observed across all criteria (content components) of readiness, including: knowledge of the history of the new paradigm of human development and international documents on sustainable development; understanding the essence of sustainable development; comprehension of ecological laws governing human existence; and knowledge and understanding of the ecological, economic, and social components of sustainable development, as well as the role of physical culture and sport in promoting sustainable development.

In the control group, no significant changes were observed in the levels of cognitive readiness for educational activities related to sustainable development by the end of the experiment.

Conclusions. The results of the pedagogical experiment confirm the positive impact of the developed methodological system on the formation of the cognitive component of future specialists' readiness in physical culture and sports for educational activities related to sustainable development.

Keywords: sustainable development, education, physical education, sports, physical education teacher, sports coach.

Introduction

Education is a priority for any country striving to develop (Kremen, 2001). After the signing of the EU-Ukraine Agreement (Uriadovyi portal, 2014), Ukraine's education sector began to adopt the experience of developed European countries. A new wave of reforms has started, incorporating best international practices, and resulted in another phase of standardization in Ukraine's education system, impacting all levels of education (Hlushko, 2017; Bakhrushyn, 2020;

Standartyzatsiia profesiinoi osvity, 2018). Higher education standards are being developed and approved. For instance, in 2019, the Ministry of Education and Science of Ukraine approved the higher education standard for the specialty 017 'Physical Culture and Sports' at the first (bachelor's) level of higher education. This standard includes the development of the following general competency in graduates: "The ability to exercise their rights and responsibilities as a member of society, to understand the values of a civil (democratic) society, and the need for its sustainable development, as well as the rule of law, and human and civil rights and freedoms in Ukraine" (Ministerstvo osvity i nauky Ukrainy, 2019).

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This is reflected in the educational and professional programs for training specialists in physical culture and sports at the first (bachelor's) level of higher education in the specialties 017 Physical Culture and Sports (Osvitno-profesiina prohrama «Fizychna kultura i sport», 2020) and 014 Secondary Education (Physical Culture) (Osvitno-profesiina prohrama Serednia osvita (Fizychna kultura), 2020). In accordance with these educational and professional programs, the development of this competency is integrated into the study of courses such as: "History of Ukraine", "Ukrainian Language", "Philosophy and Cultural Studies", "Jurisprudence", and "Tourism Work". A similar approach is used to develop this competency in other higher education institutions in Ukraine that offer bachelor's degrees in Physical Education and Sports and Secondary Education (Physical Education) (Tsyhura & Harkusha, 2020). It is worth noting that the competency of "awareness of the need for sustainable development of society" forms the foundation for future professionals in physical education and sports to cultivate key competencies in students, such as competence in natural sciences and technologies, social and civic competence, environmental literacy, and healthy living. Furthermore, each curriculum includes the following content areas: "Environmental Safety and Sustainable Development", "Civic Responsibility", and "Health and Safety" (Navchalna prohrama z fizychnoi kultury, 2022). Therefore, it is evident that the aforementioned general competency – "awareness of the need for sustainable development of society" – comprises the following components: understanding the essence of the new paradigm of human development and knowledge of the reasons for its emergence; understanding the ultimate goal that global society is striving towards; and knowledge of methods to achieve sustainable development and the application of this knowledge in both professional and personal contexts. However, courses offered in the educational programs alone cannot fully develop "awareness of the need for sustainable development of society", as confirmed by previous studies (Tsyhura, 2021).

Scientists abroad are much more concerned with the transition to sustainable education (UNESCO, 2014; Laurie et al., 2016; Sengers et al., 2019) than those in Ukraine (Osvita dlia staloho rozvytku, 2007; Pometun, 2015; Koreneva, 2018). In their studies, they also highlighted the challenges of incorporating sustainable development into physical education. In particular, they emphasized the lack of knowledge and guidance for physical education teachers on how to implement such activities, as well as the limited time and resources available in school physical education for education related to sustainable development. However, physical education itself is positively regarded for its potential to foster attitudes and values necessary for sustainable development (Baena-Morales et al., 2022; Merma-Molina, 2023). Therefore, they argued that researchers should focus on exploring and deepening the ways in which the field of physical education and sports can contribute to the achievement of sustainable development goals (Baena-Morales & Ferriz-Valero, 2023).

The purpose of the study is to determine the effectiveness of the author's methodological system for training future physical education and sports specialists in educational activities related to sustainable development, specifically focusing on the formation of the cognitive component of readiness.

Materials and methods

Study participant

The study involved 390 students from physical education faculties – future specialists in physical culture and sports – who were divided into control and experimental groups. The control group consisted of students from T.H. Shevchenko National University "Chernihiv Colehium". The experimental group included students from T.H. Shevchenko National University "Chernihiv Colehium", the National University of Life and Environmental Sciences, Sumy State University, and Sumy State Pedagogical University named after A.S. Makarenko. Only students in physical education departments participated in the study. Both sexes and differ academic years were represented among the participants.

At the initial stage of the experiment, both the control and experimental groups comprised 90 students each. The control group consisted of 52 boys (57.78%) and 38 girls (42.22%), while the experimental group consisted of 55 boys (61.11%) and 35 girls (38.89%). At the formative stage of the experiment, the control group had 83 students, including 44 boys (53%) and 39 girls (47%), while the experimental group had 90 students, consisting of 49 boys (54.44%) and 41 girls (45.56%).

Study organization

The pedagogical experiment was conducted from 2019 to 2024, following relevant recommendations (Sysoieva & Krystopchuk, 2013). The study was carried out in stages. At the ascertaining stage, future physical education and sports professionals were tested to determine their initial readiness level for sustainable development. During the formative stage, participants in the experimental group were introduced to a methodological system developed for training students at the Faculty of Physical Education in these activities. At the control stage, the participants' levels of readiness for educational activities related to sustainable development was assessed.

The methods used in the study included: a pedagogical experiment, surveys, testing, analysis, synthesis, and of information, as well as mathematical and statistical methods.

To evaluate the formation of the cognitive component of future physical education and sports specialists' readiness for educational activities related to sustainable development, thematic tests were used. These tests were created using Google Forms. The test questions were based on the material provided to the students during their study of the author's course "Sustainable Development in Physical Culture and Sports" and were aligned with the indicators of cognitive readiness. The tests covered the following knowledge areas: historical origins and formation of sustainable development; problems of civilisation and ways to address them; fundamental ecological laws of life on the planet; the essence of sustainable development; the environmental, economic and social components of sustainable development and their interdependence; the role of the education and sports sectors in promoting sustainable development; and the role of physical education and sports specialists in fostering sustainable development. In addition, the tests assessed the impact of human activities on the environment.

Accordingly, the indicators of the cognitive criterion of readiness were as follows:

- Knowledge of the formation history of a new paradigm of human development and international documents related to the implementation of sustainable development;
- Knowledge and understanding of the essence of sustainable development;
- Understanding the ecological laws of human existence;
- Knowledge and understanding of the environmental components of sustainable development;
- Knowledge and understanding of the economic component of sustainable development;
- Knowledge and understanding of the social components of sustainable development;
- Knowledge and understanding of the role and involvement of physical culture and sports in the sustainable development of society;
- Systematic thinking on sustainable development issues.

Formation of the cognitive component of readiness for future specialists in physical culture and sports for educational activities related to sustainable development was assessed by converting the scores obtained by students into the ECTS scale used for evaluating the quality of educational achievements in higher education institutions: 0-59 points – low level; 60-74 points – satisfactory level; 75-89 points – average level; 90-100 points – high level. The same scale was used to assess each indicator (content component) of the cognitive component.

The tests, created using Google Forms, were distributed through Google Classroom, which also contained all the educational and methodological information for the course “Sustainable Development in Physical Culture and Sports.”

Statistical analysis

The systematization of the materials and mathematical processing were performed using Microsoft® Excel 2010. The non-parametric Pearson's χ^2 criterion was applied to compare the results of the study at a significance level of $p < 0.05$ (Herych, Syniavska, 2021).

Results

Here, we present results related to the cognitive component of physical education for future physical education and sports specialists' readiness for educational activities that promote sustainable development.

At the ascertaining stage of the pedagogical experiment, the level of formation of the cognitive component in both the control and experimental groups was not significantly different and was predominantly low (Fig. 1). This comparison is supported by the calculation of Pearson's criterion: $\chi^2_{\text{empirical}} < \chi^2_{\text{critical}}$ ($2.22 < 3.84$, $p < 0.05$). Specifically, 93.33% of students (84 individuals) in the control group and 86.67% of students (78 individuals) in the experimental group had a low level of readiness; 5.56% (5 individuals) and 12.22% (11 individuals) of students in the control and experimental groups, respectively, had a satisfactory level; and 1.11% of respondents (1 individual) in each group exhibited an average level of cognitive readiness for educational activities related to sustainable development.

Upon analyzing the data from the final test, we observed a significant improvement in the formation of this component in the experimental group. Pearson's criterion calculation after the formative stage of the experiment revealed a notable difference between the control and experimental groups: $\chi^2_{\text{empirical}} < \chi^2_{\text{critical}}$ ($65.97 > 5.99$, $p < 0.05$). In the control group, 91.57% of students (76 individuals) remained at a low level, 7.23% (6 individuals) achieved a satisfactory level, and 1.2% (1 individual) demonstrated an average level of this component (Fig. 1). In contrast, in the experimental group, the percentage of students with a low level of cognitive readiness decreased by 2.7 times compared with the initial data, resulting in a decrease of 32.22% (29 individuals). Meanwhile, the number of students with a satisfactory level increased to 48.89% (44 individuals); 17.78% (16 individuals) achieved an average level, and 1.11% (1 individual) reached a high level of cognitive readiness for educational activities related to sustainable development (Fig. 1).

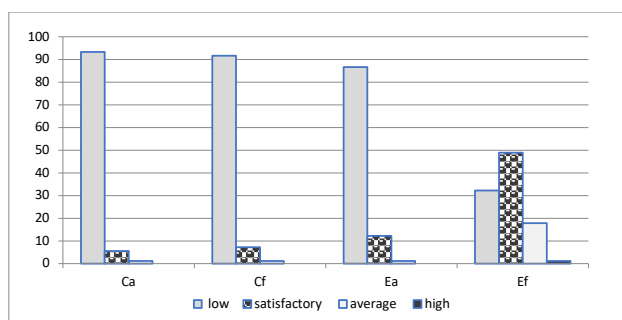


Fig. 1. Diagram showing the levels of cognitive readiness for sustainable development among future physical education and sports specialists (% of students): Ca – Control group, ascertaining stage of the experiment, Cf – Control group in the formative stage of the experiment, Ea – Experimental group, ascertaining stage of the experiment, Ef – Experimental group, formative stage of the experiment

Similar designations are used in the other diagrams.

The cognitive component of physical culture and sports specialists' readiness for sustainable development has specific content. Therefore, it is important not only to observe changes in the levels of this component among different student groups but also to analyze how well the student groups' specific content elements correspond to the indicators of the cognitive criterion.

As shown in Figures 2, 3, and 4, at the beginning of the experiment, over 80% of students in both groups exhibited a low level of knowledge across most content components. However, the distribution of knowledge levels before the experiment varied across indicators, such as “knowledge and understanding of the economic components of sustainable development” (Fig. 4). At the outset, the control and experimental groups performed relatively better in this area: 26.67% and 14.44% of students, respectively, had a satisfactory level of knowledge; 14.44% and 20.0% had an average level; and 5.56% and 20% demonstrated a high level of knowledge. By the end of the study, this indicator improved significantly in the experimental group: the number of students with medium and high levels of knowledge increased by 1.4 and 2 times, respectively, while the number of students with low levels decreased by nearly three times. Positive changes were also observed in the control group (Fig. 4).

At the conclusion of the pedagogical experiment, students in the experimental group showed the greatest improvement in understanding the “essence of sustainable development” and its “environmental component.” For these indicators, the number of students with low levels of knowledge decreased by 3.8 and 2.7 times, respectively (Figs. 2 and 3). Additionally, 37.78% and 44.45% of students reached a satisfactory level of knowledge, 33.33% and 10.00% achieved an average level, and 14.44% and 2.22% demonstrated a high level of knowledge about sustainable development and its environmental components, respectively.

Regarding the indicator “knowledge of the history of the formation of a new paradigm of human development and international documents on sustainable development” (Fig. 2), the results were somewhat different: approximately one-fifth of the students in the experimental group attained high, medium, and satisfactory levels of knowledge. The most challenging indicator to master was “knowledge and understanding of the ecological laws of human existence,” with 61.12% of respondents still exhibiting a low level of knowledge by the end of the study (Fig. 3).

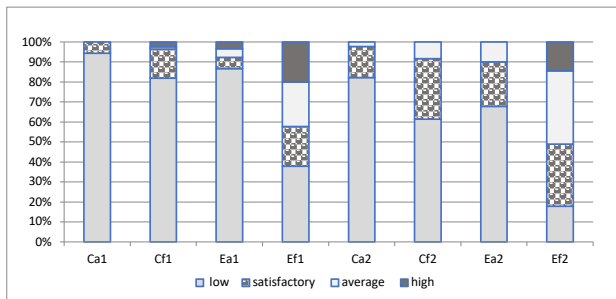


Fig. 2. Diagram showing the levels of formation of content components 1 and 2 of the cognitive component of future physical education and sport specialists' readiness for sustainable development (% of students): 1 – knowledge of the history of the formation of a new paradigm of human development and international documents on the implementation of sustainable development; 2 – knowledge and understanding of the essence of sustainable development

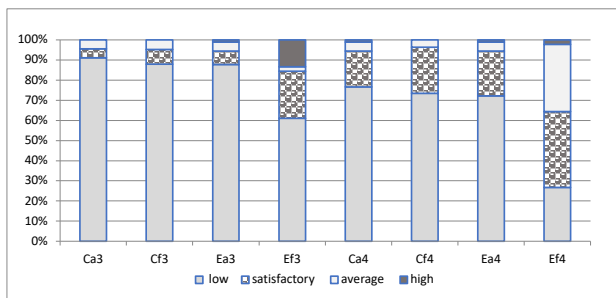


Fig. 3. Diagram showing the levels of formation of content components 3 and 4 of the cognitive component of future physical education and sport specialists' readiness for sustainable development (% of students): 3 – understanding of the ecological laws of human existence; 4 – knowledge and understanding of the environmental components of sustainable development

In terms of content components such as “knowledge and understanding of the social component of sustainable development” (Fig. 4) and “knowledge and understanding of the role and involvement of physical culture and sport in the

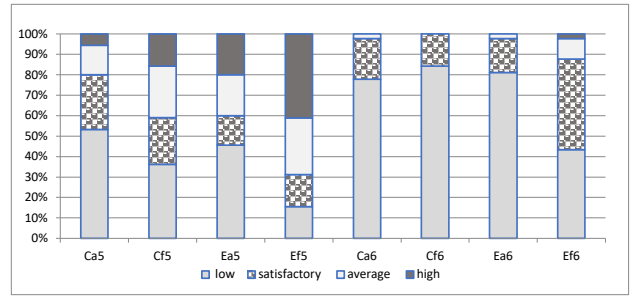


Fig. 4. Diagram of the levels of formation of content components 5 and 6 of the cognitive component of future physical education and sports professionals' readiness for sustainable development (% of students): 5 – knowledge and understanding of the economic components of sustainable development; 6 – knowledge and understanding of the social components of sustainable development

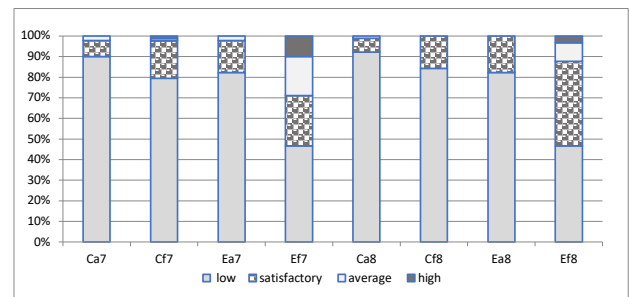


Fig. 5. Diagram of the levels of formation of content components 7 and 8 of the cognitive component of future physical education and sport specialists' readiness for sustainable development (% of students): 7 – knowledge and understanding of the role and involvement of physical culture and sport in sustainable development; 8 – systemic thinking

sustainable development of society” (Fig. 5), the number of students with a low level of knowledge at the end of the experiment decreased by 1.8 times, amounting to 43.33% and 46.67%, respectively. Meanwhile, 44.45% and 24.44% of students reached a satisfactory level; 10.0% and 18.89% achieved an average level, and 2.22% and 10.0% reached a high level of knowledge, respectively.

All these changes were reflected in the indicator “systemic thinking on sustainable development issues,” which also significantly improved among the students in the experimental group by the end of the experiment. The decrease in the number of students with a low level of “systemic thinking” corresponded with an increase in the number of students at the satisfactory level, reaching 37.78% (up from 22.22% at the baseline stage of the study). Additionally, 33.33% of students achieved an average grade level, and 2.22% reached a high grade level.

In the control group, no significant changes were observed in the components identified for physical education and sports specialists' readiness for educational activities related to sustainable development. However, there was a positive trend towards improvement.

Discussion

The study hypothesized that students in physical education faculties – future specialists in physical culture and sports – have a low level of cognitive readiness for sustain-

able development. It was found that at the beginning of the pedagogical experiment, on average, 92.45% of students had a low level of this readiness. Analyzing knowledge levels on content components of cognitive readiness for sustainable development provided further insights and revealed key features of its formation.

It was unexpected but understandable that at the beginning of the experiment, only 49.45% of participants had a low level of knowledge about the “economic component of sustainable development.” This result is plausible given that many modern Ukrainian students live in contexts in which managing finances is a pressing issue for almost every family (Statystychnyi shchorichnyk Ukrainy, 2022). In contrast, a higher percentage of students had a low level of knowledge in other content areas, ranging from 67.78% to 94.44%. Specifically, the high percentage of students with low knowledge in areas such as “knowledge and understanding of the environmental component of sustainable development” and “knowledge and understanding of the social component of sustainable development” was surprising, with 74.45% and 79.45% of students, respectively. This is particularly unexpected given that environmental and social issues are prominent in the education sector of most developed countries (Safranov et al., 2022). At the current stage of Ukraine’s development, social and environmental issues are extremely relevant due to the negative impact of the ongoing conflict with the Russian Federation on various aspects of life, including environmental quality and public health (Ekolohichni naslidky viiny, 2022; Nevydymi naslidky viiny, 2023; Sotsialno-ekonomichni ta humanitarni naslidky rosiiskoi ahresii, 2022). Therefore, we anticipated higher levels of student knowledge and understanding of the environmental and social components of sustainable development at the start of the experiment.

The results from the beginning of the experiment underscore the necessity of preparing future physical education and sports specialists for educational activities related to sustainable development. They also align with the findings of international research, which highlighted the challenges of integrating sustainable development into physical education and sought ways to engage the field of physical culture and sports in achieving sustainable development goals (Merma-Molina et al., 2022; Baena-Morales, 2023). Our research addressed this gap by developing the course “Sustainable Development in Physical Culture and Sports” and a methodological system for training future specialists in physical culture and sports for educational activities related to sustainable development.

By the end of the experiment, students engaged in sustainability-related work in their professional fields showed significant improvements across all content components of cognitive readiness for sustainable development, as reflected in the overall indicator. The most notable improvements were observed in the following components: the history of the formation of a new paradigm of human development and knowledge of international documents on sustainable development; knowledge and understanding of the essence of sustainable development; and knowledge and understanding of the environmental component of sustainable development. The number of students with a low level of these components decreased by 2.3 to 3.8 times (i.e., by 45.56% to 50%), whereas the number of students at satisfactory, medium, and high levels increased accordingly. The smallest changes were

observed in the component of understanding the ecological laws of human existence, which can be attributed to the fact that grasping these laws requires strong systemic thinking.

The decrease by the end of the experiment of only 35.55% in the number of students with a low level of “knowledge and understanding of the role and involvement of physical culture and sport in the sustainable development of society” can be attributed to several factors. The primary reason is the lack of Ukrainian-language resources on this topic that allow students to independently study under the current conditions of education in Ukraine (since 2019, distance or online learning has become predominant in Ukrainian higher education institutions). Information on the involvement of physical culture and sports in sustainable development is scarcely reported in Ukrainian-language sources – it is not available in the media, on the internet, or in teaching materials. As we have previously noted (Tsyhura, 2023), even the Ukrainian-language website of the International Olympic Committee lacks information on sport’s role in sustainable development. In contrast, the English-language website features a dedicated “Sustainability” page with extensive information and guidelines for athletes and sports organizations on sustainable development activities (IOC, 2024).

In the control group, no significant changes were observed in the indicators of cognitive readiness for educational activities related to sustainable development at the end of the pedagogical experiment. However, there was a positive trend in some content components, which can be attributed to the availability of environmental and social sector material in the Ukrainian information space, the high level of attention paid to the sustainability of the country’s economic sector and business structures, and the involvement of international partners in Ukraine’s recovery from the consequences of the Russian war (Suspilne.media, 2024).

Conclusions

The results of the pedagogical experiment confirm the positive impact of the developed methodological system on the formation of the cognitive component of future physical education and sports specialists’ readiness for educational activities related to sustainable development. At the beginning of the experiment, 86.67% of respondents had a low cognitive readiness level, 12.22% had a satisfactory level, and 1.11% had an average cognitive readiness level for educational activities related to sustainable development. By the end of the experiment, the number of students with low levels decreased by 2.7 times (to 32.22%), and the number of students with satisfactory and average level increased to 48.89% and 17.78%, respectively.

Conflict of interest

The authors declare that there is no conflict of interest.

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Формування когнітивного компонента готовності майбутніх фахівців фізичної культури і спорту до освітньої діяльності для сталого розвитку

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 7 с., 5 рис., 30 джерел.

Мета дослідження – виявити ефективність авторської методичної системи підготовки майбутніх фахівців фізичної культури і спорту до освітньої діяльності для сталого розвитку на формування когнітивного компонента готовності.

Матеріали та методи. У дослідженні брали участь 390 студентів факультетів фізичного виховання Національного університету «Чернігівський колегіум» імені Т.Г.Шевченка, Національного університету біоресурсів і природокористування України, Сумського державного університету та Сумського державного педагогічного університету імені А. С. Макаренка – майбутні фахівці фізичної культури і спорту. Учасники дослідження представлені обома статтями різних курсів, з яких було сформовано контрольну та експериментальну групи. Використані методи опитування, тестування, педагогічний експеримент, аналізу, синтезу та узагальнення інформації, методи математичної статистики.

Результати. На початку дослідження 93,33 % студентів контрольної групи та 86,67% студентів експериментальної групи мали низький рівень когнітивного компонента готовності до освітньої діяльності для сталого розвитку. Завершальне тестування показало істотне покращення досліджуваного показника в експериментальній групі: студентів з низьким рівнем когнітивного компонента досліджуваної готовності було 32,22%, із задовільним рівнем – 48,89%, із середнім рівнем – 17,78%, з високим – 1,11%. Відповідні зміни простежуються за усіма критеріями (змістовними складниками) готовності: знання історії становлення нової парадигми розвитку людства та міжнародних документів щодо реалізації сталого розвитку; знання і розуміння сутності сталого розвитку; розуміння екологічних законів існування людства; знання і розуміння екологічної складової сталого розвитку; знання і розуміння економічної складової сталого розвитку; знання і розуміння соціальної складової сталого розвитку; знання і розуміння ролі та причетності фізичної культури і спорту для сталого розвитку суспільства; системне мислення.

У контрольній групі на завершення експерименту достовірних змін щодо рівнів когнітивного компонента готовності майбутніх фахівців фізичної культури і спорту до освітньої діяльності для сталого розвитку не виявлено.

Висновок. Результати педагогічного експерименту підтверджують позитивний вплив розробленої методичної системи на формування когнітивного компонента готовності майбутніх фахівців фізичної культури і спорту до освітньої діяльності для сталого розвитку.

Ключові слова: сталий розвиток, освіта, фізичне виховання, спорт, вчитель фізичного виховання, спортивний тренер.

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