



ENVIRONMENTAL RESPONSIBILITY AMONG PEDAGOGICAL COLLEGE STUDENTS IN KAZAKHSTAN: AN ASSESSMENT OF ENVIRONMENTAL BEHAVIOR, SUSTAINABLE DEVELOPMENT COMPETENCIES, AND REGIONAL DIFFERENCES

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Abstract. The formation of environmental responsibility among future teachers is considered one of the key conditions for achieving sustainable development goals within modern education systems. However, insufficient attention has been paid to pedagogical college students in Kazakhstan as a specific group of future educators responsible for shaping ecological culture and environmentally responsible behavior among schoolchildren.

The purpose of this study is to assess environmental responsibility among pedagogical college students in Kazakhstan and to examine its relationship with participation in environmental initiatives and sustainable development competencies.

The study involved 190 pedagogical college students who completed an online questionnaire designed to assess environmental attitudes, environmental behavior, and sustainable development competencies. The research methodology combined quantitative and qualitative approaches, including an author-developed questionnaire based on the conceptual principles of the New Ecological Paradigm (NEP) and Environmental Behavior Inventory (EBI), as well as semi-structured interviews. Statistical data processing was carried out using correlation analysis and exploratory factor analysis methods in SPSS Statistics 26.0.

The results demonstrated generally positive environmental attitudes and moderate levels of environmental engagement among respondents. A statistically significant positive relationship was observed between environmental participation and sustainable development competencies. Behavioral activity was identified as the component most closely associated with sustainable development competencies and environmental responsibility. Gender and regional differences in environmental responsibility were also identified.

The scientific novelty of the study lies in empirically demonstrating that environmental behavior is more closely associated with sustainable development competencies than environmental attitudes, identifying regional and gender differences in environmental responsibility, and providing one of the first empirical assessments of environmental responsibility among pedagogical college students in Kazakhstan.

The practical significance of the study is related to the possibility of applying the obtained results in the modernization of teacher education programs, the integration of sustainable development principles into pedagogical curricula, and the development of educational policies aimed at strengthening environmental responsibility among future teachers.

Keywords: environmental responsibility, sustainable development, pedagogical college students, ecological behavior, environmental education, sustainable development competencies.

Introduction

The transition toward sustainable development has intensified the need to form environmental responsibility among younger generations, particularly among future teachers who play a key role in shaping ecological culture, environmental awareness, and sustainable behavioral patterns among schoolchildren. In the context of increasing environmental challenges, climate change, resource depletion, and ecological risks, educational institutions are becoming important platforms for promoting the principles of sustainable development and environmental citizenship.

In the Republic of Kazakhstan, issues related to environmental education and sustainable development are reflected in several national strategic documents, including the National Development Plan of the Republic of Kazakhstan until 2029, the Concept of Environmental Education and Awareness, and educational modernization programs focused on the development of ecological culture and responsible citizenship. These policy directions emphasize the importance of integrating sustainable development principles into teacher education and strengthening environmental competencies among future educators.

International research demonstrates that environmental responsibility represents a complex educational and behavioral phenomenon. Modern approaches to environmental education increasingly emphasize that environmental responsibility should not be limited to ecological knowledge alone but should also include practical participation, behavioral engagement, and value-based attitudes toward environmental protection.

Previous international studies have demonstrated the importance of environmental education in shaping sustainable behavior among students. Research based on the New Ecological Paradigm (NEP) scale and Environmental Behavior Inventory (EBI) confirms the relationship between ecological awareness, behavioral practices, and sustainable development competencies. At the same time, existing studies are primarily focused on school students or university students, while pedagogical college students remain insufficiently explored as a separate educational and professional group.

In the Kazakhstani context, research devoted to environmental competence mainly examines higher education institutions and future teachers at university level. However, insufficient attention has been paid to pedagogical college students who will later work within the school education system and directly influence the environmental values of younger generations. In addition, previous studies rarely combine cognitive, behavioral, and value-motivational dimensions of environmental responsibility within a unified empirical model.

Thus, a significant research gap exists regarding the assessment of environmental responsibility among pedagogical college students in Kazakhstan and the identification of factors influencing environmentally responsible behavior in the context of sustainable development.

Moreover, previous studies conducted in Kazakhstan have rarely focused specifically on pedagogical college students as a distinct group of future teachers. Existing research has primarily examined university students, leaving insufficient evidence regarding environmental responsibility formation at the college level.

The scientific novelty of the study consists in:

- identifying behavioral engagement as the most important component associated with sustainable development competencies;
- revealing regional and gender differences in environmental responsibility among pedagogical college students;
- providing one of the first empirical assessments of environmental attitudes, environmental behavior, and sustainability competencies among pedagogical college students in Kazakhstan.

The scientific contribution of the study lies in expanding theoretical and empirical understanding of the mechanisms influencing environmental responsibility formation among future teachers in the context of sustainable development.

Unlike previous studies that examined isolated components of environmental responsibility, the present study integrates cognitive, value-motivational, and behavioral dimensions into a single empirical framework and demonstrates that behavioral engagement is most closely associated with sustainable development competencies.

The purpose of this study is to assess environmental responsibility among pedagogical college students in Kazakhstan and to examine its relationship with participation in environmental initiatives and sustainable development competencies.

Research Questions:

What are the characteristics of environmental responsibility among pedagogical college students in Kazakhstan?

How does participation in environmental initiatives relate to sustainable development competencies among pedagogical college students?

What factors are associated with environmentally responsible behavior among pedagogical college students?

The practical significance of the study is related to the possibility of applying the obtained results in the modernization of teacher education programs, the integration of sustainable development principles into pedagogical curricula, and the development of educational policies aimed at strengthening environmental responsibility among future teachers.

Literature Review

The issue of environmental responsibility has become one of the central topics in contemporary educational and sustainability research. The growing ecological crisis, climate change, and global sustainable development challenges have intensified the need to develop environmentally responsible behavior among younger generations, especially future teachers who play an important role in shaping ecological culture within society.

International research demonstrates that environmental responsibility represents a complex educational and behavioral phenomenon. One of the most influential theoretical frameworks in this field is the New Ecological Paradigm (NEP) developed by Dunlap et al. (2000), which measures ecological worldview and environmental attitudes. The NEP scale has been widely used in studies examining environmental awareness and pro-environmental behavior among students and different social groups (Dunlap et al., 2000).

Behavioral approaches to environmental responsibility are reflected in the Environmental Behavior Inventory (EBI), which focuses on practical ecological actions and environmentally responsible habits. Gifford and Nilsson emphasize that pro-environmental behavior is influenced not only by ecological knowledge but also by personal values, social norms, motivation, and educational environments (Gifford and Nilsson, 2014). Morren and Grinstein (2016) additionally argue that environmentally responsible behavior is closely connected with sustainable development competencies and long-term civic engagement (Morren and Grinstein, 2016).

At the same time, several researchers criticize purely cognitive approaches to environmental education. According to Sterling and Tilbury, the transfer of ecological knowledge alone does not guarantee environmentally responsible behavior. These authors stress the importance of transformative and practice-oriented education aimed at changing students' values, attitudes, and everyday practices (Sterling, 2001; Tilbury, 2011). UNESCO also underlines that Education for Sustainable Development (ESD) should integrate critical thinking, active participation, and interdisciplinary learning approaches (UNESCO, 2017; 2020).

International research demonstrates that environmental responsibility represents a complex educational and behavioral phenomenon. Yasvin considers environmental responsibility as an integrative personality characteristic combining ecological knowledge, emotional involvement, and behavioral readiness. Stolyarenko (2020) highlights the role of pedagogical technologies and educational environments in developing students' ecological consciousness (Yasvin, 2020).

Kazakhstani researchers pay particular attention to the preparation of future teachers within the framework of sustainable development. Khasanova argues that environmental competencies should be developed through interdisciplinary integration, project-based learning, and student-centered educational strategies (Khasanova, 2022). Dlimbetova et al. emphasize the importance of volunteer activities and eco-projects in strengthening behavioral components of environmental responsibility and sustainable development competencies (Dlimbetova et al., 2023).

However, despite the growing number of studies devoted to environmental education, several important limitations remain. First, many studies focus primarily on university students or schoolchildren, while pedagogical college students remain insufficiently represented in empirical research. Second, previous studies often examine separate components of environmental responsibility without integrating cognitive, behavioral, and value-motivational dimensions into a unified analytical framework. Third, limited attention has been paid to regional and gender differences in environmentally responsible behavior within the context of Kazakhstan.

Another important limitation concerns the methodological aspect of existing studies. Many empirical investigations rely mainly on descriptive approaches and do not sufficiently examine relationships between environmental behavior and sustainable development competencies among future teachers. As a result, the mechanisms underlying the formation of environmental responsibility among future teachers remain insufficiently understood.

Thus, the analysis of the literature demonstrates the necessity of conducting comprehensive empirical studies aimed at assessing environmental responsibility among pedagogical college students in Kazakhstan using integrated methodological approaches. The present study attempts to address these gaps by combining an author-developed questionnaire based on the NEP and EBI conceptual frameworks, statistical analysis, and contextual interpretation of sustainable development competencies among future teachers.

Methods

The study was conducted during 2024–2025 on the basis of four pedagogical colleges located in Almaty, Karaganda, Shymkent, and Uralsk. The study involved 190 pedagogical college students from different regions of Kazakhstan who voluntarily participated in an online survey conducted through Google Forms in 2025. The sample was formed using purposive sampling, considering regional, gender, and academic distribution in order to ensure representation of different educational contexts.

The sample included students from different regions and academic years, which allowed representation of diverse educational environments and contextual factors influencing environmental responsibility.

Participation in the study was voluntary. All respondents were informed about the purpose of the research and provided consent for the use of anonymized data for scientific purposes. Ethical principles related to confidentiality, voluntary participation, and academic integrity were observed throughout all stages of the study.

The methodological framework of the research is based on systemic, competence-based, and activity-oriented approaches. These approaches allowed environmental responsibility to be considered as a multidimensional construct, including environmental attitudes, environmental behavior, and sustainable development competencies.

The study applied a mixed-methods design combining quantitative and qualitative research approaches.

The following research methods were used:

- theoretical methods: analysis and synthesis of scientific literature, comparative analysis, systematization, and generalization;

- empirical methods;

The questionnaire was developed by the authors based on the conceptual principles of the New Ecological Paradigm (NEP) and Environmental Behavior Inventory (EBI) and adapted to the context of pedagogical colleges in Kazakhstan.

- statistical methods:

- descriptive statistics;
- correlation analysis;
- exploratory factor analysis (EFA).

The author-developed questionnaire underwent preliminary pilot testing involving 20 pedagogical college students prior to the main stage of the study. The content validity of the questionnaire was additionally assessed by three experts in environmental education and pedagogy. Based on expert recommendations, several items were revised to improve clarity and contextual relevance for the Kazakhstani educational environment.

Structure of the Author-Developed Questionnaire

The questionnaire consisted of 13 Likert-scale items grouped into three dimensions: Environmental Attitudes (5 items), Environmental Behavior (5 items), and Sustainable Development Competencies (3 items). Responses were measured using a five-point Likert scale ranging from 1 to 5. The internal consistency of the questionnaire was assessed using Cronbach’s alpha coefficient ($\alpha = 0.57$), indicating acceptable reliability for an exploratory study.

Table 1. Structure of the Author-Developed Questionnaire

Dimension	Items
Environmental Attitudes	5
Environmental Behavior	5
Sustainable Development Competencies	3
Total	13

Table 1 presents the structure of the author-developed questionnaire used to assess environmental responsibility among pedagogical college students. The instrument consisted of 13 Likert-scale items grouped into three dimensions: Environmental Attitudes, Environmental Behavior, and Sustainable Development Competencies. The distribution of items reflects the multidimensional nature of environmental responsibility and provides the basis for subsequent statistical analyses.

Examples of questionnaire items include:

- Humans abuse natural resources;
- I try to save water and electricity whenever possible;
- Environmental education should be strengthened in teacher education programmes;
- I am willing to participate in environmental projects and sustainability initiatives.

Responses were measured using a five-point Likert scale ranging from 1 (“never”) to 5 (“always”).

Data collection was conducted during April–May 2025. Quantitative data processing was carried out using SPSS Statistics 26.0.

The internal consistency of the questionnaire was assessed using Cronbach’s alpha coefficient. The obtained value ($\alpha = 0.57$) indicates acceptable reliability for an exploratory study in the field of environmental education.

The obtained reliability indicators demonstrate acceptable internal consistency of the applied research instruments.

To identify latent factors influencing environmental responsibility, exploratory factor analysis (EFA) was conducted. The following statistical procedures were applied:

- Kaiser–Meyer–Olkin (KMO) test for sampling adequacy;
- Bartlett’s Test of Sphericity;
- Principal Component Analysis extraction method;
- Varimax rotation.

Prior to conducting Exploratory Factor Analysis (EFA), the suitability of the dataset was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett’s Test of Sphericity. The KMO value reached 0.63, indicating acceptable sampling adequacy for exploratory analysis. Bartlett’s Test of Sphericity was statistically significant ($\chi^2 = 680.63$, $df = 36$, $p < 0.001$), confirming the presence of sufficient correlations among the variables and supporting the application of factor analysis.

Table 2. Reliability and Factorability Statistics

Indicator	Value
Sample size (N)	190
Cronbach's Alpha	0.57
KMO Measure	0.63
Bartlett's Test χ^2	680.63
Degrees of Freedom (df)	36
Significance (p)	< 0.001

The obtained indicators confirm acceptable internal consistency of the questionnaire and support the suitability of the dataset for exploratory factor analysis.

The interview guide included questions related to students' environmental motivation, participation in sustainability initiatives, perceived barriers to environmental engagement, and institutional support for environmental education. Interview transcripts were coded independently and subsequently grouped into thematic categories.

Examples of interview questions included:

- What motivates you to participate in environmental initiatives?
- What barriers limit student participation in environmental projects?
- How does your college support environmental education activities?

Qualitative interview data were analyzed using thematic content analysis. The analysis included three stages:

Open coding;

Axial coding;

Selective coding.

Four major themes were identified:

- environmental motivation;
- institutional support;
- educational barriers;
- sustainability practices.

All interview transcripts were coded manually. Initial open codes were grouped into broader categories and subsequently integrated into thematic clusters. Coding reliability was verified through repeated comparison of coded segments and thematic categories.

The analysis focused on identifying pedagogical strategies, institutional barriers, and educational practices influencing the development of environmental responsibility among future teachers.

The use of integrated quantitative and qualitative methods ensured the reliability, validity, and comprehensive interpretation of the obtained research results.

Results

The results of the empirical study are presented in accordance with the objectives of the research and reflect the quantitative and qualitative assessment of environmental responsibility among pedagogical college students in Kazakhstan.

Participation in Environmental Initiatives

The results of the author-developed questionnaire revealed varying levels of student participation in environmental activities and initiatives.

Among the respondents:

- 47% regularly participate in environmental initiatives at least once per month;
- 36% are involved in eco-clubs and educational environmental projects;
- 29% participate in Zero Waste campaigns and waste sorting practices;

- 25% take part in volunteer tree planting and environmental clean-up activities;
- 19% reported no participation in environmental initiatives.

Students actively involved in environmental practices demonstrated higher levels of environmental responsibility and stronger sustainable development competencies compared to students with limited participation.

Correlation Analysis

Correlation analysis revealed a statistically significant positive relationship between environmental participation and sustainable development competencies.

Correlation analysis demonstrated positive relationships between environmental attitudes, environmental behavior, and sustainable development competencies. Students who reported greater participation in environmental initiatives also tended to demonstrate stronger sustainability-oriented attitudes and higher willingness to engage in environmental education activities.

This result indicates a positive relationship between environmental activity and sustainable development competencies.

Exploratory Factor Analysis

Prior to factor extraction, sampling adequacy was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett’s Test of Sphericity. The KMO value was 0.63, indicating acceptable adequacy for exploratory factor analysis. Bartlett’s Test of Sphericity was statistically significant ($\chi^2 = 680.63$, $df = 36$, $p < 0.001$), confirming sufficient correlations among the variables.

Exploratory Factor Analysis (EFA) identified three major latent factors influencing environmental responsibility among pedagogical college students:

- Cognitive awareness — ecological knowledge and understanding of sustainable development principles;
- Emotional-value orientation — personal attitudes, ecological values, and emotional involvement in environmental issues;
- Behavioral activity — participation in environmental initiatives and environmentally responsible practices.

Table 3. Conceptual Interpretation of the Extracted Factors

Factor	Interpretation
Factor 1	Cognitive Awareness
Factor 2	Emotional-Value Orientation
Factor 3	Behavioral Activity

The factor structure generally corresponds to the theoretical assumptions underlying the questionnaire and confirms the multidimensional nature of environmental responsibility among future teachers.

The extracted factors correspond to the theoretical structure of environmental responsibility and support the multidimensional nature of the construct. Factor 1 reflects students’ ecological knowledge and understanding of sustainable development principles. Factor 2 represents environmental values and personal attitudes toward environmental protection. Factor 3 reflects practical participation in environmental initiatives and environmentally responsible behavior.

Table 4. Conceptual Summary of Factor Structure

Item	Factor 1	Factor 2	Factor 3
Living in harmony with nature	0.87	–	–
Environmental crisis concerns	0.60	–	–
Ecologically safe products	0.86	–	–
Waste sorting	–	0.75	–
Waste sorting (duplicate item)	–	0.80	–

Saving water and electricity	–	0.56	–
Reusable bags and containers	–	0.52	–
Participation in environmental actions	–	0.53	–
Public transport / walking	–	0.34	0.43
Abuse of natural resources	–	–	0.54
Waste reduction	–	–	0.54

The first three factors explained 61.3% of the total variance. Factor 1 reflects environmental awareness and ecological attitudes, Factor 2 reflects environmentally responsible behavior, and Factor 3 reflects personal environmental engagement and sustainability-oriented practices.

Gender and Regional Differences

Female respondents demonstrated higher participation in environmental initiatives and environmentally responsible practices. Students from larger urban centers reported greater involvement in sustainability-related activities and environmental projects.

Qualitative Findings

Semi-structured interviews with teachers and academic supervisors confirmed that active participation in environmental projects contributes to the development of responsibility, teamwork, leadership skills, and ecological culture among students.

At the same time, respondents identified several barriers limiting the effectiveness of environmental education:

- insufficient methodological support;
- limited integration of sustainable development topics into curricula;
- lack of environmental educational resources;
- insufficient institutional support for eco-projects and student initiatives.

The qualitative findings support the quantitative results and emphasize the importance of practice-oriented environmental education within pedagogical college programs.

Discussion

The findings suggest that environmental responsibility among pedagogical college students is formed through the interaction of cognitive awareness, value orientations, and practical environmental activity. Behavioral engagement appeared to be the most prominent component associated with sustainable development competencies.

These findings extend previous studies on environmental education by demonstrating the importance of behavioral engagement within pedagogical college environments.

The results correspond with the theoretical approaches proposed by Sterling (2001) and UNESCO (2020), according to which sustainable development education should move beyond traditional knowledge transmission and focus on practice-oriented educational approaches, practical participation, and value-based educational strategies. Students actively involved in eco-volunteering, environmental campaigns, and sustainability projects demonstrated significantly higher levels of environmental responsibility and sustainable development competencies.

The identified positive relationship between environmental participation and sustainable development competencies supports previous findings emphasizing the importance of experiential and project-based learning in environmental education. Similar conclusions were reached in the studies of Dlimbetova et al. (2023), who emphasize the role of environmental projects and volunteer initiatives in strengthening ecological competencies among future teachers.

The obtained findings suggest that environmental initiatives serve not only as forms of extracurricular engagement but also as important educational mechanisms promoting experiential learning. Active participation enables students to transform environmental knowledge into practical competencies and sustainable behavioral patterns.

An important result of the study is the identification of behavioral activity as the component most closely associated with sustainable development competencies. This finding supports the position of Gifford and Nilsson

(2014), who argue that environmentally responsible behavior develops more effectively through active participation and social engagement than through theoretical instruction alone.

The study also revealed gender differences in environmental responsibility. Female students demonstrated higher levels of participation in environmental initiatives and everyday ecological practices compared to male students. These findings correspond with international studies indicating that women often demonstrate stronger ecological values, empathy toward environmental issues, and higher involvement in sustainable behavior.

These findings may also reflect differences in environmental socialization and participation patterns within educational environments, where female students tend to demonstrate higher emotional engagement in sustainability-related activities.

Regional differences identified during the research may be explained by unequal educational opportunities, varying levels of environmental infrastructure, and differences in institutional support for sustainability initiatives. Colleges located in larger urban centers demonstrated greater student participation in environmental projects and higher environmental responsibility indicators. This suggests that institutional environments and access to environmental initiatives significantly influence the formation of sustainable development competencies.

The identified regional differences may indicate unequal access to environmental infrastructure, sustainability projects, and institutional support mechanisms. Students studying in larger urban centers appear to benefit from a wider range of environmental initiatives, which may contribute to stronger environmental engagement and higher environmental responsibility indicators. This finding highlights the importance of institutional context in shaping sustainable development competencies among future teachers.

One possible explanation for these regional differences is the unequal availability of environmental projects, educational resources, and institutional sustainability initiatives across different regions of Kazakhstan.

However, the obtained findings should be interpreted cautiously, since environmental responsibility may also be influenced by socio-economic conditions, family background, and institutional educational resources that were not fully examined within the present study.

At the same time, the results demonstrate that environmental education within pedagogical colleges remains insufficiently systematized. Interviews with teachers and academic supervisors revealed limited methodological support, insufficient integration of sustainable development topics into educational programs, and a lack of interdisciplinary environmental modules. These factors reduce the effectiveness of environmental education and limit opportunities for students' practical environmental engagement.

The study contributes to the development of pedagogical approaches aimed at integrating sustainable development principles into teacher education. The obtained results demonstrate that environmental responsibility among future teachers should be formed through interdisciplinary learning, project-based educational models, eco-volunteering, and active participation in sustainability practices.

The practical significance of the study lies in the possibility of applying the obtained results to the modernization of pedagogical education programs, the development of environmental educational policies, and the strengthening of sustainable development competencies among future teachers in Kazakhstan.

Nevertheless, several limitations should be acknowledged. The study was conducted on a limited regional sample and relied primarily on self-reported data. Future research may expand the geographical coverage, apply longitudinal research designs, and examine additional socio-cultural factors influencing environmental responsibility among future educators.

An important contribution of the present study is that environmental behavior demonstrated a stronger association with sustainable development competencies than environmental attitudes alone. This finding suggests that practical engagement may play a more important role in competency development than cognitive awareness itself.

To the authors' knowledge, this study represents one of the first empirical investigations specifically focused on environmental responsibility among pedagogical college students in Kazakhstan. Unlike previous studies conducted primarily among university students, the present research demonstrates the importance of behavioral engagement in the development of sustainable development competencies at the college level.

Overall, the findings confirm that environmental responsibility represents an essential component of professional teacher training and should become an integral element of sustainable development strategies within pedagogical education systems.

Conclusion

The study examined environmental responsibility among pedagogical college students in Kazakhstan within the context of sustainable development. The obtained results confirmed that environmental responsibility represents a complex educational and behavioral phenomenon. The empirical analysis demonstrated generally positive environmental attitudes and moderate levels of environmental engagement among respondents. At the same time, a considerable proportion of students showed insufficient involvement in practical environmental activities, indicating the need to strengthen sustainable development education within pedagogical college programs.

The study identified a statistically significant positive relationship between participation in environmental initiatives and sustainable development competencies. Behavioral activity was identified as the component most closely associated with sustainable development competencies and environmental responsibility. These findings confirm the effectiveness of practice-oriented and experiential learning approaches in environmental education.

The research also revealed gender and regional differences influencing environmentally responsible behavior. Female students demonstrated higher environmental engagement, while students from colleges located in larger urban centers showed stronger participation in sustainability initiatives. These results highlight the importance of educational environments and institutional support in shaping ecological culture among future teachers.

The scientific contribution of the study lies in expanding empirical understanding of environmental responsibility formation among future teachers and demonstrating the central role of environmental behavior in the development of sustainable development competencies.

The practical significance of the research is related to the possibility of using the obtained findings in the modernization of teacher education programs, the integration of sustainable development principles into pedagogical curricula, and the development of environmental education policies at regional and national levels.

Based on the obtained results, the following recommendations may be proposed:

- strengthen the integration of sustainable development topics into pedagogical education programs;
- expand eco-volunteering and project-based environmental activities among students;
- introduce mandatory sustainability-oriented project activities for students, since 19% of respondents reported no participation in environmental initiatives and demonstrated lower levels of environmental responsibility;
- develop interdisciplinary educational modules related to environmental responsibility;
- improve methodological and institutional support for sustainability initiatives within pedagogical colleges;
- promote partnerships between educational institutions, environmental organizations, and local communities.

Despite certain limitations related to the sample size and regional coverage, the study contributes to the development of environmental education research and expands understanding of the factors influencing environmental responsibility among future teachers in Kazakhstan.

Future studies may focus on longitudinal analysis, cross-regional comparisons, and the investigation of socio-cultural and institutional factors affecting sustainable development competencies in teacher education systems.

Limitations and Future Research

Despite the scientific and practical significance of the obtained results, several limitations of the present study should be acknowledged.

First, the empirical research was conducted on the basis of four pedagogical colleges located in selected regions of Kazakhstan. Although the sample included respondents from different educational environments, the obtained findings cannot be fully generalized to all pedagogical colleges and teacher education institutions in the country.

Second, the study relied primarily on self-reported questionnaires and survey methods. Such approaches may involve elements of subjective evaluation and social desirability bias, since respondents may provide socially acceptable answers regarding environmentally responsible behavior and participation in environmental initiatives.

Third, the research had a cross-sectional design and reflected students' environmental responsibility at a specific period of time. The study did not examine long-term changes in ecological attitudes, behavioral patterns, and sustainable development competencies during the educational process.

Fourth, although the study analyzed cognitive, behavioral, and value-motivational dimensions of environmental responsibility, additional socio-economic, cultural, and institutional factors may also significantly influence environmentally responsible behavior among future teachers.

Another limitation concerns the use of a newly developed questionnaire that requires further validation in different educational contexts. Despite the acceptable reliability indicators of the scales, further validation and contextual adaptation of the instruments for the Kazakhstani educational environment may strengthen the methodological accuracy of future studies.

Future research may focus on expanding the regional sample and involving a larger number of pedagogical colleges and universities across Kazakhstan. Longitudinal studies may provide deeper understanding of the dynamics of environmental responsibility formation during professional teacher training.

Future studies may additionally apply structural equation modeling (SEM) and longitudinal research designs to investigate causal relationships between environmental responsibility, educational practices, and sustainable development competencies.

In addition, future studies may investigate the influence of digital technologies, environmental policy, institutional culture, and interdisciplinary educational practices on sustainable development competencies among future teachers.

In addition, the relatively limited sample size may affect the generalizability of the obtained findings.

Therefore, the findings should be interpreted with caution when generalized to all pedagogical colleges in Kazakhstan.

Comparative international studies may also contribute to identifying effective educational strategies and best practices for strengthening environmental responsibility in teacher education systems under conditions of global sustainable development.

Practical Recommendations

The proposed recommendations are based on the empirical findings indicating moderate student participation in environmental initiatives, identified gender and regional differences, and the positive relationship between environmental engagement and sustainable development competencies.

Based on the obtained research results, several practical recommendations may be proposed for improving environmental education and strengthening sustainable development competencies among pedagogical college students in Kazakhstan.

First, it is necessary to strengthen the integration of sustainable development principles into pedagogical education programs. Environmental responsibility should be incorporated not only into environmental disciplines but also into interdisciplinary educational modules related to pedagogy, psychology, social sciences, and civic education.

Second, pedagogical colleges should expand opportunities for students' participation in environmental initiatives, eco-volunteering, project-based learning, and community-oriented sustainability activities. Practical engagement in environmental campaigns, ecological projects, and social initiatives contributes significantly to the development of environmentally responsible behavior and sustainable development competencies.

Third, educational institutions should improve methodological support for environmental education by developing modern teaching materials, digital educational resources, and interdisciplinary methodological guidelines related to sustainable development and ecological culture.

Fourth, it is recommended to strengthen cooperation between pedagogical colleges, environmental organizations, local authorities, and public associations in order to create sustainable educational partnerships and increase students' involvement in real environmental practices.

Special attention should also be paid to the development of students' environmental leadership, ecological communication skills, and social responsibility through interactive educational approaches, teamwork, and experiential learning methods.

In addition, teacher training programs should include specialized courses and workshops devoted to environmental ethics, sustainable development, climate education, and ecological citizenship.

The results of the study additionally indicate the necessity of institutional support for environmental initia-

tives within pedagogical colleges. Educational institutions should create favorable conditions for student eco-clubs, environmental projects, volunteer organizations, and sustainability-oriented extracurricular activities.

At the policy level, it is recommended to strengthen the integration of sustainable development competencies into national teacher education standards and educational modernization programs in Kazakhstan.

Overall, the implementation of these recommendations may contribute to the development of environmentally responsible future teachers capable of promoting ecological culture and sustainable development principles within the education system and society as a whole.

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Conflict of interest

The authors confirm that there are no potential or actual conflicts of interest related to this study.

Contribution of the authors:

The preparation of this article was carried out collaboratively, with each author making a significant intellectual contribution, without which the completion of the research and writing of the article would not have been possible. The work included the development of the concept, data collection and analysis, interpretation of the results, writing and revision of the text, as well as approval of the final version for publication.

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**Қазақстан педагогикалық колледждері студенттерінің
экологиялық жауапкершілігі: экологиялық мінез-құлықты, тұрақты даму
құзыреттерін және өңірлік айырмашылықтарды бағалау**

Аңдатпа. Болашақ педагогтердің экологиялық жауапкершілігін қалыптастыру қазіргі білім беру жүйесінде тұрақты даму мақсаттарына қол жеткізудің негізгі шарттарының бірі болып табылады. Алайда Қазақстандағы педагогикалық колледж студенттері мектеп оқушылары арасында экологиялық мәдениет пен экологиялық жауапты мінез-құлықты қалыптастыратын болашақ педагогтердің ерекше тобы ретінде жеткілікті деңгейде зерттелмеген.

Зерттеудің мақсаты – Қазақстан педагогикалық колледждері студенттерінің экологиялық жауапкершілігін бағалау және оның тұрақты даму құзыреттерімен және экологиялық бастамаларға қатысуымен байланысын анықтау.

Зерттеуге 190 педагогикалық колледж студенті қатысты. Олар экологиялық ұстанымдарды, экологиялық мінез-құлықты және тұрақты даму құзыреттерін бағалауға арналған онлайн сауалнаманы толтырды. Зерттеу әдістемесі сандық және сапалық тәсілдерді біріктірді, соның ішінде New Ecological Paradigm (NEP) және Environmental Behavior Inventory (EBI) тұжырымдамалары негізінде әзірленген авторлық сауалнама мен жартылай құрылымданған сұхбаттар қолданылды. Статистикалық деректерді өңдеу SPSS Statistics 26.0 бағдарламасында корреляциялық және факторлық талдау әдістері арқылы жүзеге асырылды.

Зерттеу нәтижелері респонденттердің экологиялық ұстанымдарының жалпы оң екенін және экологиялық белсенділіктің орташа деңгейін көрсетті. Экологиялық бастамаларға қатысу мен тұрақты даму құзыреттері арасында статистикалық тұрғыдан маңызды оң байланыс анықталды. Мінез-құлықтық белсенділік тұрақты даму құзыреттерімен және экологиялық жауапкершілікпен ең тығыз байланысты компонент ретінде айқындалды. Сонымен қатар экологиялық жауапкершіліктің гендерлік және өңірлік айырмашылықтары анықталды.

Зерттеудің ғылыми жаңалығы экологиялық мінез-құлықтың тұрақты даму құзыреттерімен ең тығыз байланысты компонент екенін анықтауда, экологиялық жауапкершіліктің гендерлік және өңірлік ерекшеліктерін айқындауда, сондай-ақ Қазақстан педагогикалық колледждері студенттерінің экологиялық жауапкершілігіне арналған алғашқы эмпирикалық зерттеулердің бірін ұсынуда көрінеді.

Зерттеудің практикалық маңыздылығы алынған нәтижелерді педагогикалық білім беру бағдар-

ламаларын жаңғыртуда, тұрақты даму қағидаттарын оқу бағдарламаларына енгізуде және болашақ педагогтердің экологиялық жауапкершілігін күшейтуге бағытталған білім беру саясатын әзірлеуде қолдану мүмкіндігімен байланысты.

Түйін сөздер: экологиялық жауапкершілік, тұрақты даму, педагогикалық колледж студенттері, экологиялық мінез-құлық, экологиялық білім беру, тұрақты даму құзыреттері.

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Экологическая ответственность студентов педагогических колледжей Казахстана: оценка экологического поведения, компетенций устойчивого развития и региональных различий

Аннотация. Формирование экологической ответственности будущих педагогов рассматривается как одно из ключевых условий достижения целей устойчивого развития в современной системе образования. Однако студенты педагогических колледжей Казахстана как особая группа будущих педагогов, формирующих экологическую культуру и экологически ответственное поведение школьников, изучены недостаточно.

Целью исследования является оценка экологической ответственности студентов педагогических колледжей Казахстана и выявление её взаимосвязи с компетенциями устойчивого развития и участием в экологических инициативах.

В исследовании приняли участие 190 студентов педагогических колледжей, заполнивших онлайн-анкету, направленную на оценку экологических установок, экологического поведения и компетенций устойчивого развития. Методология исследования объединила количественные и качественные подходы, включая авторскую анкету, разработанную на основе концепций New Ecological Paradigm (NEP) и Environmental Behavior Inventory (EBI), а также полуструктурированные интервью. Статистическая обработка данных проводилась с использованием корреляционного и факторного анализа в программе SPSS Statistics 26.0.

Результаты исследования показали в целом положительные экологические установки и умеренный уровень экологической активности респондентов. Выявлена статистически значимая положительная взаимосвязь между участием в экологических инициативах и компетенциями устойчивого развития. Поведенческая активность была определена как компонент, наиболее тесно связанный с компетенциями устойчивого развития и экологической ответственностью. Также были выявлены гендерные и региональные различия экологической ответственности.

Научная новизна исследования заключается в выявлении экологического поведения как компонента, наиболее тесно связанного с компетенциями устойчивого развития, в определении гендерных и региональных различий экологической ответственности, а также в представлении одного из первых эмпирических исследований экологической ответственности студентов педагогических колледжей Казахстана.

Практическая значимость исследования связана с возможностью использования полученных результатов при модернизации программ педагогического образования, интеграции принципов устойчивого развития в образовательные программы и разработке образовательной политики, направленной на укрепление экологической ответственности будущих педагогов.

Ключевые слова: экологическая ответственность, устойчивое развитие, студенты педагогических колледжей, экологическое поведение, экологическое образование, компетенции устойчивого развития.

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