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Training future educators to develop ecological knowledge of preschool and school children

Capacitar a futuros educadores para desarrollar el conocimiento ecológico de los niños en edad preescolar y escolar

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Abstract

In the article, the basic principles of training future educators and teachers in the field of environmental education are discussed. Such a process requires mastering a set of innovative pedagogical knowledge on ecology to be aware of them in the future and integrate such knowledge into the profession of a teacher. This determined the relevance of the topic of this study. The article aims to determine the results of the effectiveness of the introduction of disciplines that increase the level of environmental knowledge and introduce innovative pedagogical methods in this area. It is equally important to determine the assessment of the usefulness of introducing new disciplines on methods of teaching environmental knowledge among students (attitude to innovations, anxious use of innovations, external barriers to the integration of innovations into pedagogical practice, readiness to use innovative pedagogical knowledge). A comprehensive approach to methodology was used in the study. The main method in the work is the method of pedagogical experiment. Moreover, descriptive, statistical, and theoretical methods are also applied. The methods of questionnaires and observation were employed to diagnose the effectiveness of innovative research, according to preschool teachers. The main hypothesis is the assumption that innovative environmental knowledge courses and self-education activities contribute to the competence and quality of teacher training significantly and provide for their integration into the work of school and preschool education. The result of this study is evidence that teacher training programs and new pedagogical methods related

to innovations in ecological education affect the ability to operate with new methods and modern knowledge in future professional practice. A further prospect is the development and implementation of effective methods for introducing innovative pedagogical knowledge into the training of teachers in the field of preschool and school education.

Keywords: Teacher education, ecological knowledge, ecological literacy, ecological awareness, eco-ethics.

Resumen

En el artículo se discuten los principios básicos de la formación de futuros educadores y docentes en el campo de la educación ambiental. Tal proceso requiere dominar un conjunto de conocimientos pedagógicos innovadores sobre ecología para ser consciente de ellos en el futuro e integrar dichos conocimientos en la profesión de docente. Esto determinó la relevancia del tema de este estudio. El artículo tiene como objetivo determinar los resultados de la efectividad de la introducción de disciplinas que aumentan el nivel de conocimiento ambiental e introducen métodos pedagógicos innovadores en esta área. Es igualmente importante determinar la evaluación de la utilidad de introducir nuevas disciplinas sobre métodos de enseñanza del conocimiento ambiental entre los estudiantes (actitud hacia las innovaciones, uso ansioso de las innovaciones, barreras externas para la integración de las innovaciones en la práctica pedagógica, disposición para usar el conocimiento pedagógico innovador). En el estudio se utilizó un enfoque integral de la metodología. El método principal en el trabajo es el método de experimento pedagógico. Además, también se aplican métodos descriptivos, estadísticos y teóricos. Los métodos de cuestionarios y observación se emplearon para diagnosticar la efectividad de la investigación innovadora, según los maestros de preescolar. La hipótesis principal es el supuesto de que los cursos innovadores de conocimiento ambiental y las actividades de autoeducación contribuyen significativamente a la competencia y la calidad de la formación docente y prevén su integración en el trabajo de la educación escolar y preescolar. El resultado de este estudio es evidencia de que los programas de formación docente y los nuevos métodos pedagógicos relacionados con las innovaciones en la educación ecológica afectan la capacidad de operar con nuevos métodos y conocimientos modernos en la práctica profesional futura. Otra perspectiva es el desarrollo e implementación de métodos efectivos para introducir conocimientos pedagógicos innovadores en la formación de maestros en el campo de la educación preescolar y escolar.

Palabras clave: Formación docente, conocimiento ecológico, alfabetización ecológica, conciencia ecológica, ecoética.

1. Introduction

Innovative pedagogical knowledge is an essential component of modern pedagogical competence. It allows for high-quality and modern work and learning. In today's world, innovative knowledge is most relevant in industries that are in crisis and require increased attention, the search for ways to eliminate threats and prevent them. This includes environmental education, which involves work on raising people's environmental awareness. The search for the most effective ways to introduce environmental education into the modern educational space determines the scientific issues of modern scientific research (Hadley & Belfiore, 2018). This also determined the relevance of our study.

The effective use of their knowledge of the subject, upbringing, education, training, and the latest educational technologies, as the introduction of the latest pedagogical research into the educational

process, requires future specialists in preschool and school education to acquire competence in the use of new knowledge and innovations (Zhernova, 2018). In other words, teachers should have adequate knowledge in the field of environmental education and be morally and professionally prepared to use such innovations and realize their necessity (Basyuk et al., 2019).

In the conditions dictated by the 21st century, effective education of children's ecological awareness relies on the need to educate members of an active civil society and professionals who have acquired functional and critical thinking skills, such as pedagogical, ecological, and digital literacies (Chorna, 2018).

Future specialists in the field of preschool and school education should receive guidelines and methods that teach the formation of environmental knowledge in children. Moreover, they should be interested in learning about the latest research, ideas, and approaches to environmental issues to meet their own professional needs and the needs of their students (Zhernova, 2018). An important aspect of such education is the readiness to change following the rapidly changing living and learning conditions of society. Accordingly, researchers Aydin and Zhu, (2017) found that it is important for a future teacher to have professional training in environmental education, and innovative pedagogical knowledge. What is more, teachers should also implement the practice of ecological awareness education in their professional activities systematically, as they must meet the needs of the child in the future.

The research aims to establish the results of the effectiveness of the introduction of disciplines that increase the level of ecological knowledge and introduce innovative pedagogical methods in this area, as well as to determine the students' assessment of the usefulness of introducing new disciplines' methods of teaching ecological knowledge.

Based on the goal, the following research tasks are planned to be performed:

- to study the combination of abilities and capabilities of future teachers and educators related to the integration of environmental education into teaching practice;
- determine the demographic and qualification characteristics of the students participating in the project;
- to identify students' attitudes towards innovative pedagogical knowledge in environmental education; to learn about their readiness to apply new scientific discoveries in the field of ecology and pedagogy in practice; to find out how future teachers assess their preparedness to educate ecological awareness in children.

2. Literature Review

Innovative measures that can make work in preschool education innovative are proposed in the latest research projects (Momot & Muraev, 2020). In many experimental studies, the following guidelines have been adopted as a basis for developing innovations and ways to introduce innovations in introducing environmental knowledge into education in the context of aggravation of ecological problems, the multiculturalism of their perception, and openness of the information space (Group P. A. C. T. E. et al., 2018; Unesco.org., 2016).

In this context, university education implements research programs that focus on finding methods and ways to form ecological knowledge in students and teach them how to disseminate this knowledge in their professional activities.

Among the main topics considered in modern pedagogical science are the following: the problems of introducing environmental knowledge for a modern child who is cut off from close communication with nature and awareness of the need to combat environmental losses (Chawla, 2020); analysis of the components of pro-environmental awareness on consumer behavior, the impact of environmental topics on the product image, pricing, and reasonable cost (Shen & Wang, 2022); introduction of positive education, positive psychology, and disciplines that teach well-being and environmental sustainability into the educational space (Seligman, 2018). Several studies have also addressed the problematic issues of the quite successful idea of positive education, where sometimes there are pressing discussions about individualism, the promotion of the idea of elitism, and the conditional novelty of this trend (O'Connor & Cameron, 2017; Wong & Roy, 2017).

The problems of introducing innovations into the educational space are also in the circle of interest of modern researchers. This is, primarily, the search for effective ways to acquire the necessary knowledge and skills to use information and communication technologies in professional activities (Dzvinchuk et al., 2020). The intensity of the integration of innovations into educational practice was studied (Arbol del, 2018). The degree of use of innovative technologies in the educational process, the impact of innovations on curriculum development, and the introduction of innovations in the educational process are also considered (Jayashree, 2017). There are studies devoted to the implementation of universal pedagogical technologies in pedagogical practice (Puranik, 2020). The rules and sequences of educational activities at all levels of pedagogical education are reviewed (Senthilkumar, Kannappa, 2017). Cross-cultural competencies for future teachers in terms of integration processes were studied and prepared (Borysenko, Sydorenko, Grytsenko, Denysenko & Yurina, 2022).

3. Methodology

For the effective implementation of the pedagogical experiment, an integrated approach to the research methodology should be used. The descriptive method, such as analysis and synthesis, was used to describe and analyze theoretical research. In the course of the pedagogical experiment, empirical (diagnostic) methods were used, as well as a questionnaire (written form) and observation methods to determine the effectiveness of innovations and their evaluation by participants in the educational process. Statistical methods are used to evaluate the results of the experiment.

The method of the pedagogical experiment was used for one academic semester (6 months) in 2021-2022 (September 2021 - January 2022). The described course of implementation of new courses of innovative content is also considered from the point of view of observation. The observation method is empirical. Therefore, it is not possible to directly determine the effectiveness of introducing innovations in environmental education through new educational trends as a systematic change.

The experiment involved students of pedagogical universities (Hryhorii Skovoroda Kharkiv National Pedagogical University (Faculty of Primary Education, Faculty of Preschool Education), National Pedagogical Dragomanov University (Pedagogical Institute). The experiment involved a total of 74 2nd year students (first bachelor's degree), specialties 012 Preschool Education (34 people), 013 Primary Education (40 people). All respondents were divided into 4 groups, two groups in each institution: 2 control groups (CG-1 (Kharkiv) - 17 individuals and CG-2 – 20 individuals (Kyiv)) and 2 experimental groups (EG-1 – 17 individuals (Kharkiv) and EG-2 (Kyiv) – 20 individuals). The variable in the experimental group is the introduction of 2 new courses "Innovative Knowledge: Context of Pedagogical Education" and "Methods of Teaching Ecological Knowledge" to the system of disciplines

approved in the curriculum from 2021. Control groups studied the traditional curriculum but were informed about the availability of new courses in the experimental groups.

Stage 1. The research team conducted a questionnaire to determine the demographic and qualification characteristics of the respondents who participated in the pedagogical experiment. Teaching and methodological materials for the new courses were prepared, and preliminary consultations were held with the teachers who teach these courses.

Stage 2. At this stage, in parallel with the new academic disciplines, the experimental and control groups are surveyed on the respondents' attitude to the introduction of innovations into practice and the level of perception and assessment of the need to develop ecological awareness as an important component of education, as well as the readiness to implement innovations in practice.

Stage 3. At the final stage, a second survey was conducted in the experimental groups and the control groups on the level of perception and evaluation of innovations, methods of teaching environmental education, and progress monitoring.

All participants of the pedagogical experiment voluntarily agreed to participate in the experiment and gave their written consent. The research team received permission from the faculty administration to conduct the research and guaranteed the respondents' anonymity and privacy.

As for the difficulties faced by the researchers during the survey, the following should be mentioned: the need for time (1 semester - 6 months), and it is impossible to identify the reasons for the change in respondent's assessments since it was not possible to conduct a qualitative in-depth study.

4. Results

Experimental groups within the new academic disciplines "Innovative Knowledge: Context of Pedagogical Education" and "Methods of Teaching Ecological Knowledge" studied innovative teaching strategies of modern pedagogy, defined by the Stanford Research Institute International (The Open University, 2023). The courses presented the designated innovations with in-depth explanations and examples of each environmental education strategy in action.

At the initial stage (Stage 1), respondents were surveyed on their gender and professional characteristics, including information on age, experience, gender, and previous education.

Table 1.

Demographic and qualification characteristics of respondents (author's development)

		CG-1	EG-1	CG-2	EG-2
Age	18-23	10	12	16	14
	24-30	7	5	4	6
Gender	Female	17	17	19	20
	Male	0	0	1	0
Receiving a second diploma		3	4	1	3
Experience in teaching (if any)	1-3	5	4	2	5
In total		17	17	20	20

According to the demographic situation, the vast majority of students are women. The groups are formed in such a way that all age categories are represented, with the majority being 18 to 23 years old (52 people) and the minority being 23 to 30 years old (22 people). There are students with little experience in teaching. In total, there are 16 people.

At stage 1, competencies, abilities, and capacities were also identified, which showed the presence and level of necessary and important abilities of the future teacher. These personality traits were to be purposefully developed through training in the use of innovations and their implementation in practice.



Figure 1. A set of necessary and important abilities that should be developed in future teachers and educators (author's development).

A high level of communicative competence (the ability to communicate successfully) makes it possible to easily establish contact with children and adults, clearly articulate thoughts, explain, and communicate following the requirements and needs of the audience. A teacher's creativity implies the presence and continuous development of creative abilities, which allows them to present educational material in a non-standard and interesting way and teach children creativity. Organizational skills determine the teacher's ability to build processes of interaction with a group, team, or personality, explain ways of environmental interaction in society, create an effective communication structure, and influence the work on the formation of environmental awareness. The ability to reflect forms the basis of the teacher's eco-ethics, allowing him or her to analyze the educational process and the results of work. The teacher's flexibility makes it possible to quickly respond to the needs of students in certain aspects of ecological knowledge and to correct the child's behavior.

At stage 2, in parallel with the introduction of new courses in EG-1 and EG-2, a survey was conducted for all participants in the groups. Under the scheme presented above, a questionnaire

was drawn up and respondents were interviewed to assess the preliminary implementation of new courses with an increased component of environmental knowledge.

Table 2.

The level of perception and evaluation of the implementation of innovative pedagogical knowledge on ecology by students

	Nº	Yes	No	Partially
Perception of innovations in teaching methods of environmental education	EG-1	7	4	6
	CG-1	6	5	9
	EG-2	9	2	6
	CG-2	6	7	7
Perception of innovations to be implemented in practice	EG-1	6	4	7
	CG-1	4	7	9
	EG-2	7	3	7
	CG-2	8	3	9
Anxiety about using environmental education innovations in work with children	EG-1	5	3	9
	CG-1	4	5	11
	EG-2	6	3	8
	CG-2	7	4	9
Barriers and complexes associated with environmental personality education programs	EG-1	7	1	9
	CG-1	8	3	9
	EG-2	6	2	9
	CG-2	7	2	11
Previous experience in innovation activities	EG-1	2	13	2
	CG-1	3	15	2
	EG-2	3	12	2
	CG-2	2	13	5
Perception of innovation-related courses	EG-1	8	2	7
	CG-1	8	3	9
	EG-2	5	2	10
	CG-2	10	1	9
Integrating innovations into teaching practice	EG-1	8	2	7
	CG-1	6	3	11
	EG-1	5	3	9
	CG-2	9	1	10
My negative attitude to innovations in ecological education can be changed	EG-1	6	1	10
	CG-1	8	1	11
	EG-2	4	0	13
	CG-2	6	1	13

(author's development)

In general, most respondents have a positive attitude toward innovations, but only 20 out of 72 respondents answered positively about their implementation. 38 pedagogues are partially ready to implement innovations in practice. Twenty-four people can fully change their attitude to the introduction of the latest pedagogical knowledge, and 36 people can partially change their attitude.

At the final stage (Stage 3), after completing the courses, the respondents also took a survey to assess their perception of innovative pedagogical knowledge.

As is evident, at the final stage, the changes in the control groups are insignificant, within the statistical variance, amounting to 3% in total. The small amount of experience in the practice of

innovation has led to minimal changes in the views of environmental education as innovative. The greatest change in attitudes was observed with categorical negative answers (no), which decreased in all groups. However, in EG-1 and EG-2, 8% more students have a positive attitude towards innovations and the need for environmental knowledge, but in CG-1 and CG-2 this decrease was insignificant - 3%.

Table 3.

The level of perception and evaluation of the implementation of innovative pedagogical knowledge by employees of preschool education

	Nº	Yes	No	Partially
Perception of innovations in environmental education teaching methodology	EG-1	9	2	6
	CG-2	7	3	10
	EG-1	10	1	6
	CG-2	6	6	8
Perception of innovations to be implemented	EG-1	6	3	8
	CG-1	4	7	9
	EG-2	8	1	8
	CG-2	10	1	9
Anxiety about using environmental education innovations in work with children	EG-1	5	1	11
	CG-1	4	4	12
	EG-2	8	1	8
	CG-2	10	2	8
Barriers and complexes related to environmental personality education programs	EG-1	10	1	6
	CG-1	9	2	9
	EG-2	8	0	9
	CG-2	7	1	12
Previous experience in innovation activities	EG-1	5	10	2
	CG-1	3	15	2
	EG-2	3	7	10
	CG-2	2	13	5
Perception of innovation-related courses	EG-1	9	1	7
	CG-1	8	3	9
	EG-2	8	0	9
	CG-2	10	0	10
Integrating innovations into teaching practice	EG-1	9	1	7
	CG-1	6	1	13
	EG-2	7	1	9
	CG-2	10	1	9
My negative attitude to innovations in ecological education can be changed	EG-1	7	0	10
	CG-1	8	1	11
	EG-2	10	0	10
	CG-2	7	1	12

(author's development)

After listening to the new training courses, 71% of the experimental group had a positive attitude (ready and partially ready) to innovations in the future practice of forming ecological knowledge in children, while 58% of the control group had a positive attitude. In general, the number of teachers ready to use innovations in school education increased by an average of 10% in the experimental groups and 3% in the control groups, while the number of those who were fully

ready increased by 6%. Most of the 74 students in the final pedagogical experiment were ready to introduce new subjects.

5. Discussion

Over the past decades, innovative measures that can make environmental education innovative have been proposed and supported by many research programs carried out with the help of some global organizations (UNESCO, UN), The EU Smart Cities Information System (The Smart Cities Information System), projects (The European Innovation Partnership on Smart Cities and Communities), and programs (EU-Eastern Partnership, European Fund for Strategic Investment (EFSI)) (Unesco.org., 2016). The innovative educational space for the promotion of environmental knowledge is presented as a set of tasks and conditions for their effective implementation, starting with the training of young professionals in the field of preschool and primary education.

In recent years, many studies have analyzed students' attitudes towards the principles of environmental education and its necessity and further practical activities. In a study on measuring the environmental literacy of Slovak technical students (Sueldo & Streimikiene, 2016), it was noted that the formation of environmental awareness and its complexity depends on rational arguments, facts, and a qualitatively new system of values. This system is called "eco-ethics," and it takes care of the ability to communicate one's beliefs, self-reflect, and become a moral example for others. This homogeneity in the formation of children's ecological awareness, in our opinion, is positive and should be based on the professional approach of the teacher to environmental education. Innovative methods of teaching and upbringing make it possible to find effective solutions to environmental problems.

A study of students' perceptions of success, career, and prosperity (Trask-Kerr et al., 2019) showed that some young people emphasize the need for environmental safety and the ecological component of human life expectancy as a condition for a quality and successful future. According to the study, 35.59% of students focused only on individual goals. Meanwhile, 44.07% expressed concern about the environmental situation and linked the environment and their own successful life in the future in abstract terms. In all experimental groups, there were discussions about the relationship between individual happiness and social and environmental well-being. According to the results of our study, 65% of the students who participated in the experiment had a favorable or relatively favorable attitude toward environmental education and the need to form the foundations of environmental awareness in children.

The pedagogical experiment presented here is also a logical continuation of similar works that consider innovation as part of the teaching profession (Ivanova et al., 2020), the peculiarities of introducing innovations and the latest pedagogical knowledge into practice (Kiki-Papadakis & Chaimala, 2016). Special attention should be paid to the introduction of non-discriminatory research programs, socio-cultural programs to adapt educators to new knowledge, eco-ethics guidelines, and the removal of psychological and cultural barriers to innovation by all participants in the educational process (Boghian, 2018; Balanyuk, 2014). Our experience has shown that familiarization with environmental knowledge and ethics requires the use of the latest technologies. Barriers and concerns about the formation of ethical foundations need to be

discussed and can be overcome by educators at the university level. Future teachers and educators can implement innovations in different ways, and invite specialists to the classroom.

The issues of forming environmental education in non-standard, crisis, and extreme conditions that children and teachers in Ukraine are currently facing remain unresolved. It is important to find ways to overcome psychological and cultural barriers to the perception of ecological knowledge.

6. Conclusions

The research model of this study continues similar projects that have been carried out in Ukraine and other European countries. Such research contributes to the study of those prediction characteristics that can determine attitudes toward innovative pedagogical knowledge and environmental education guidelines of future school and preschool teachers. Thus, it is possible to identify a set of factors that provide for the integration of new knowledge and innovations into teaching practice.

The effectiveness of the introduction of an additional variable (academic disciplines) in the experimental groups increased the positive attitude toward the need for environmental education and innovative pedagogical knowledge for an average of 71% of respondents. This indicates the need to introduce environmental education guidelines into the professional activities of practicing teachers, constantly working to update the content of courses related to environmental education and eco-ethics.

The problem of conscious innovation incompetence and psychological barriers that prevent students from opening up to innovations in environmental education remains an open one. It is essential to develop educational technologies that can help future specialists effectively overcome psychological barriers.

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