

Developing a model to enhance professional competence in physical education for preschool instructors

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Published online: May 31, 2024

Accepted for publication : May 15, 2024

DOI:10.7752/jpes.2024.05124

Abstract:

Improving the professional competence of physical education instructors in preschool settings remains an urgent issue, often stemming from deficits in their professional practices and competence levels. **Objective:** In this study, we aimed to develop and evaluate an experimental model for enhancing the professional competence of physical education instructors, along with the pedagogical conditions necessary for its implementation in the preschool educational environment. **Materials and methods.** The research project was performed in preschool educational institutions in the Ural Federal District of Russia, involving 20 physical education instructors and 120 children aged 5-7 who were enrolled in these institutions. A model for improving the physical education instructors' professional competence has been developed and tested. It included 6 modules that provided innovative methods, conditions, forms and means of teaching and self-education, methodological support and the use by instructors of methods for building individual educational routes using IT technologies. With the help of a questionnaire, a high-stakes diagnosis of the professional competencies state among specialists in this category was carried out. The children's high-stakes level of mastering the educational program «Physical health» and the state of their physical fitness were analyzed. **Results.** The use of an experimental model for improving professional competence among physical education instructors in preschool institutions has had a positive impact on increasing the level of their knowledge, skills and abilities, which are provided for by the professional standard "Teacher". The most pronounced positive dynamics of the indicators values is in the improvement of subject, methodological and IT competencies. It has led to an increase in the level of mastering the educational program in the direction of «Physical health» by preschool children. At the end of the research project, all preschool children successfully mastered the program material. 53.03% of children who used an experimental model to improve the professional competence of instructors had a "high" level of physical qualities and basic types of movements formation. **Conclusions.** The obtained positive results of testing the proposed model for improving the physical education instructors' professional competence allow recommending it for use in the practice of activities in other preschool institutions.

Key Words: preschool children, physical education instructor, professional competence, learning model

Introduction

The main task of preschool institutions activities is the mental, physical and creative development of the child. Preschool institutions of various types represent the primary link where children receive initial training before entering school (Borisova, 2010). Preschool institutions are available in almost all countries of the world. Regardless of their status and forms of ownership, and the specifics of their activities, they must always fulfill the strategic objectives of teaching and raising children (Gorniak et al., 2024). These include the creation of conditions that meet modern requirements for the educational process, the use of IT technologies in the management of preschool education in education (Bruijns et al., 2022), and the introduction of innovative technologies to improve the professional qualities of teachers (Saunders et al., 2019). An important area is the

development of an information and communication environment in a preschool institution to increase the competence of parents in children's development and upbringing. The transition of a preschool institution to a new level of funding or a change in its status is possible.

Taking into account the strategic changes in preschool institutions presented above, an important task is to train professional specialists who can perform the tasks set (Madonna, & Belfiore, 2020). At the same time, preschool education specialists must quickly adapt and restructure their activities in all emerging changes in the field of children's education and upbringing (Fang et al., 2024). A key role in their pedagogical activity is assigned to their readiness for independent actions in order to increase the effectiveness of the educational process. According to N. G. Panteleeva (2019), "... success is determined by how much the teacher him\herself is ready for changes, which has a significant impact on the content of his\her pedagogical activity. Today it is becoming obvious that the achievement of educational goals largely depends on the personal potential, self-awareness and creative approach to the personnel's pedagogical activity, which allow for genuine dialogic developmental learning with children. The teaching profession is becoming more and more complex, characterized by a high level of mobility, which begins with the receipt of pedagogical education and continues throughout the teaching career".

An important area of activity for physical education specialists in preschool institutions is the implementation of activities aimed at preserving, strengthening and improving the health of children (Al-Walah et al., 2023; Clifford et al., 2023). The physical education tools and methods use is relevant due to the increase in the number of sick children (Lum et al., 2022) who are overweight or obese (White et al., 2020) and have disharmonious physical development. To do this, it is necessary to develop motor competence in children from an early age (Barnett et al., 2024; Moon et al., 2024), which allows forming a stable motivation for regular physical activity (Ryu et al., 2021; Chen et al., 2023).

Children still have a low level of physical activity, which needs to be improved using innovative physical education and sports programs (Behan et al., 2019; Georgakis, & Hooper, 2021). It is known that the implementation of rhythmic-motor activity in children aged 5-6 in kindergarten in China allowed to obtain a significant positive result of psychoemotional activity than traditional PE programs (Wang et al., 2024). The use of new aerobic rhythmic exercises in the kindergarten curriculum has improved the motor functions of children (Hu et al., 2020). An improvement in the cognitive functions of preschool children was found when active games were used in their physical education (Núñez et al., 2024). According to the authors of Lum, et al. (2022) and Errisuriz et al. (2023), the organization of physical activity in preschool institutions is an ideal place for the possibility of developing large motor skills in young children. The effectiveness of physical education and recreation activities in preschool institutions is largely related to the level of development of physical education trainers' and teachers' of additional education in sports professional knowledge, skills and abilities (Mischenko et al., 2021; Xiong, 2022)

Despite the information available in the scientific literature on the use of various pedagogical technologies in the professional training of physical education instructors in preschool institutions (Prystupa et al., 2020; Sgambelluri et al., 2021), some issues of improving professional competencies of these specialists remain unresolved. This fact may explain the low physical activity of children (Behan et al., 2019; Al-Walah et al., 2023), which is associated with their lack of motivation for physical education. Difficulties of communication between the teacher and the parents of children are noted (Clifford et al., 2023), which does not ensure joint creativity in physical education. Low competence of physical education specialists in the field of IT technologies is still registered (Schulze-Vorberg et al., 2021).

This makes it difficult for them to study online (Saunders et al., 2019; Bruijns et al., 2022), which negatively affects their professional training. Therefore, the development and testing of pedagogical technologies aimed at improving the pedagogical competencies of physical education instructors in preschool institutions remains an urgent and timely task. We believe that increasing physical education instructors' professional knowledge, skills and abilities will improve not only their professional training, but also change children's attitude to physical activity. It will increase children's physical fitness and the level of theoretical training in human physical health.

Research aim is to develop and test an experimental model for physical education instructors' professional competence formation and pedagogical conditions for its implementation within the educational environment of a preschool institution.

Material & methods

The research project involved 20 physical education instructors and 120 older preschool children (aged 6.2 ± 1.1) who attended preschool educational institutions in the city of Zlatoust in the Ural Federal District (Russia). The diagnosis of the state of the preschool physical education instructors' professional competencies was carried out at the beginning and at the end of the research project. The developed questionnaire was used for the high-stakes diagnosis of the professional competencies development state. It highlights the subject, meta-subject, methodological, psychological, pedagogical and IT competencies.

They are related to labor functions, which are reflected in the professional standard «Teacher» (Professional standard "Teacher (pedagogical activity in preschool, primary general, basic general, secondary general education), (educator, teacher) " (as amended on June 16, 2019" (Order of the Ministry of Labor and Social Protection of Russia dated October 18, 2013 No. 544n, as amended by order of the Ministry of Labor and Social Protection of Russia dated December 25, 2014 No. 1115n and dated August 5, 2016 No. 422n). Each question was evaluated on a five-point scale. They gave a total assessment of the level of knowledge: where 0-5 points – low level; 6-15 points – average level; 16-20 points – high level. For each area of professional deficits, we have prepared test tasks of various levels of complexity: basic, advanced and high, Table 1.

Table 1. The structure of diagnostic materials (tests) to identify the level of professional competencies formation among physical education instructors in preschool institutions

The name of the professional competence	Number of tasks	Difficulty level*	Number of points
Subject	20	10 tasks – B (Б) 5 tasks – A (А) 5 tasks – H (В)	0-10 0-10 0-15
Meta-subject	10	4 tasks – B (Б) 3 tasks – A (А) 3 tasks – H (В)	0-4 0-6 0-9
Methodological	20	10 tasks – B (Б) 5 tasks – A (А) 5 tasks – H (В)	0-10 0-10 0-15
Psychological and pedagogical	10	4 tasks – B (Б) 3 tasks – A (А) 3 tasks – H (В)	0-4 0-6 0-9
IT competencies	20	10 tasks – B (Б) 5 tasks – A (А) 5 tasks – H (В)	0-10 0-10 0-15

Note: * - the level of difficulty of the tests: B – basic level; A – advanced level; H – high level; 1 point - for a basic level task; 2 points - for advanced level tasks; 3 points - for high-level tasks

Based on the analysis of scientific, methodological and specialized literature, as well as the results of testing specialists and accumulated own experience, we have developed an experimental model of physical education instructors' professional development. It was aimed at eliminating their existing professional deficits and high professional competence formation. The experimental model consists of 6 modules.

Module I (target). It includes such sections, as: social order (improvement of the preschool education system in the direction of modern development, the continuous nature of the teacher's professional improvement, increasing the level of professional competencies). The first module also includes a target component, which is aimed at developing an individual educational route (IER) and implementing a «model of methodological support» for physical education instructors.

Module II (theoretical and methodological). It includes a number of areas of a teacher's activity: socio-cultural, personality-oriented, competence-based, complex, activity-based, differentiated and principles: continuity of a teacher's pedagogical education, priority of interests and professional needs, taking into account the typology of a physical education instructor's personality.

Module III (informative). It contains the directions of educational programs for the teachers' professional improvement and self-development. It includes the organization of preschool children's physical activity; the implementation of physical culture and recreation work and interaction with the children's parents on issues of their physical education. As a result of the work, such competencies are formed: subject, meta-subject, methodological, psychological and pedagogical, IT competencies. Such pedagogical tools were used in the proposed model as: methodological materials, creativity, IT technologies and types of methodological support: assistance, interaction, support in the form of work in a group; collective; individual and independent study of the material. Physical education instructors in preschool institutions were trained in various forms of methodological work and interaction: round tables, consultations, development of a methodological portfolio, pedagogical advice, trainings, teaching hours, webinars, design seminars, participation in competitions, workshops, game workshops and open classes. Mutual learning and professional competence development took place through various forms of pedagogical experience presentations (open and final classes, master classes, presentations at pedagogical and methodological councils). Self-education included the study of scientific and methodological literature, self-testing of the level of knowledge, the innovative educational technologies development, the use of IER and work on self-education topics.

IV module (procedural and innovative). It includes forms of continuous pedagogical education (formal; informal; informational), the vector of education (scientific and methodological; educational and methodical; innovative; competitive; informational), methods and techniques for supporting physical education instructors'

professional improvement and self-improvement. This module also includes pedagogical conditions: building an individual educational route; assistance in solving problems of the teacher's professional movement; assistance in IT communication of the teacher with other participants of the educational process.

V module (diagnostic). It provides for the identification of teachers' professional deficits according to the developed criteria: self-assessment, expert assessment and test tasks. Identification of preferred forms and methods of eliminating professional deficits and developing interaction through a questionnaire was used.

Module VI (constructive) evaluates a physical education instructor's level of professional competence and professional development and its improvement.

The resulting digital material is subjected to statistical processing with the calculation of the arithmetic mean (M), its error (m) and sigma (σ). The reliability of the differences in the values of the indicators was calculated according to the t-Student criterion. The differences were considered significant at $p < 0.05$.

The participants of the project and the parents of the children gave written consent to participate in the research work. The content and conditions of the project do not contradict the requirements for scientific research with the participation of people, which are set out in the Helsinki Declaration of 2008.

Results

The values of the indicators of the high-stakes assessment of the labor functions implementation quality for physical education instructors in accordance with the professional standard «Teacher» are presented in Table 2.

Table 2. Values of indicators of the work functions performance quality by physical education instructors at the beginning and at the end of the research project, in points ($M \pm m$)

No	The labor function of the professional standard	Beginning of the project, n=20	End of the project, n=20
1.	Organization of children's, studying at a pre-school educational establishment motor activity within the framework of the preschool education programs implementation	9.7 ± 0.16	17.6 ± 0.32*
2.	Carrying out physical culture and recreation work within the framework of the preschool educational programs implementation	9.6 ± 0.14	17.2 ± 0.28*
3.	Interaction with parents (legal representatives) on preschoolers' physical education	9.8 ± 0.15	18.3 ± 0.46*
4.	Conducting PE classes taking into account the children's age, individual and psychophysical characteristics	8.6 ± 0.15	16.8 ± 0.21*
5.	The amount of points	9.4 ± 0.13	17.9 ± 0.35

Note. * the significance of differences in the values of the high-stakes testing indicators, $p < 0.05$

The analysis of the expert assessment results showed that at the beginning of the research project, the level of professional qualities realization among physical education instructors did not exceed 10 points and corresponded to the «average» level for all labor functions of the professional standard. At the end of the research project, the level of realization of professional qualities significantly increased and in all work functions corresponded to the «high» level, $p < 0.05$. The sum of points increased 1.9 times (from 9.4 ± 0.13 to 17.9 ± 0.35 points). The value of the increase in the performance of labor functions at the end of the research project is shown in Figure 1.

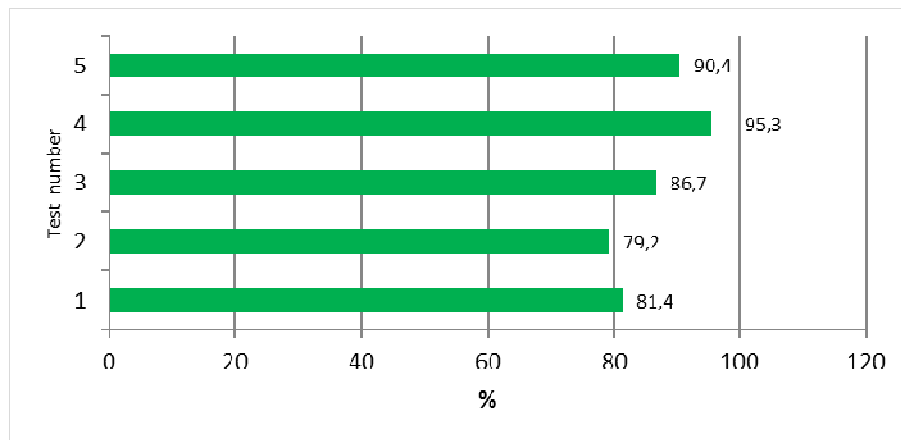


Fig. 1. The percentage of the high-stakes increase in the values of indicators of the labor functions performance quality by physical education instructors at the end of the research project

At the end of the research project, a significant increase in the physical education instructors' professional competence in all work functions of the professional standard was established. The highest value of the increase (95.3%) was established in labor function No. 4 "Conducting PE classes taking into account the children's age, individual and psychophysical characteristics". The lowest value of the increase (79.2%) was registered in the labor function No. 2 "Carrying out physical culture and recreation work within the framework of the preschool educational programs implementation".

At the end of the research project, positive changes were found in the number of points scored by physical education instructors for completed professional competence assessment tests according to the levels of complexity of the questions asked, Table 3.

Table 3. The high-stakes distribution of points scored by teachers for performing tests of assessment of professional competencies by levels of complexity of questions, in points (M±m)

Professional competences	Number of tasks	Difficulty level	Difficulty level* (the average score for the group)			
			Basic	Advanced	High	The amount of points
Subject	20	10 tasks – B (B) 5 tasks – A (II) 5 tasks – H (B)	Beginning of the project			
			8.2±0.12	7.4±0.10	6.8±0.10	22.4±0.45
			End of the project			
			10.0±0.23	8.9±0.19	12.8±0.27	28.7±0.56 [#]
Meta-subject	10	4 tasks – B (B) 3 tasks – A (II) 3 tasks – H (B)	Beginning of the project			
			2.8±0.03	3.5±0.02	5.4±0.11	11.7±0.19
			End of the project			
			4.0±0.17	4.8±0.19	7.8±0.46	16.6±0.78 [#]
Methodological	20	10 tasks – B (B) 5 tasks – A (II) 5 tasks – H (B)	Beginning of the project			
			7.6±0.23	6.6±0.33	6.8±0.36	20.6±0.89
			End of the project			
			10.0±0.34	8.4±0.28	11.4±0.32	29.8±0.67 [#]
Psychological and pedagogical	10	4 tasks – B (B) 3 tasks – A (II) 3 tasks – H (B)	Beginning of the project			
			3.1±0.04	3.9±0.03	6.2±0.24	13.2±0.48
			End of the project			
			4.0±0.12	5.2±0.23	8.2±0.78	17.4±0.88 [#]
IT competencies	20	10 tasks – B (B) 5 tasks – A (II) 5 tasks – H (B)	Beginning of the project			
			6.4±0.30	5.1±0.20	5.2±0.22	16.7±0.82
			End of the project			
			10.0±0.37	7.4±0.25	9.6±0.44	27.0±0.90 [#]

Note: * - the level of difficulty of the tests: B – basic level; A – advanced level; H – high level;
1 point - for a basic level task; 2 points - for advanced level tasks; 3 points - for high-level tasks.
[#] - the significance of differences in the values of the high-stakes testing indicators, $p < 0.05$

At the final stage of the research project, all physical education instructors coped with the tasks of the basic level of the selected clusters of professional competencies assessment and partially advanced and high difficulty levels. At the end of the project, the sum of points in all competencies was significantly higher compared to this indicator at the research beginning, $p < 0.05$.

At the end of the research project, an increase in the number of instructors who have a "high" level of professional competencies formation (subject, meta-subject, methodological, psychological and pedagogical, IT competencies) was established. The number of instructors with «low» and «average» competence levels decreased in all clusters, Table 4.

Table 4. The number of physical education instructors with different levels of professional competence formation during the project implementation, %

Competencies	Professional competencies level, n=20					
	Beginning of the project			End of the project		
	Low	Average	High	Low	Average	High
Subject	40.0	40.0	20.0	20.0	30.0	60.0
Meta-subject	45.0	45.0	10.0	15.0	35.0	50.0
Methodological	45.0	30.0	25.0	15.0	40.0	45.0
Psychological and pedagogical	35.0	40.0	25.0	15.0	30.0	55.0
IT competencies	60.0	30.0	10.0	20.0	30.0	50.0

The analysis of the instructors' individual educational routes (IER) conducted at the end of the research showed that they all coped with the set goals and objectives. It was revealed that 12 instructors, or 60.0% of the

IER corresponded to the "high level, 8 specialists (40.0%) had the "average" level. No instructors were identified who did not submit the IER or it did not meet the requirements.

The dynamics of the results of the physical education instructors' participation in the methodological work of preschool teachers in the 2021-2022 and 2022-2023 academic years was analyzed. It was found that in the 2022-2023 academic year, when instructors performed IER, there was a significant increase in interest in planning and their participation in various forms of methodological work, Table 5.

Table 5. Participation of physical education instructors in methodical activities of preschool institutions, %

Name of the activity	2021-2022 academic year, n=20	2022-2023 academic year, n=20
Seminars (theoretical; problematic; psychological and pedagogical)	30,0	60.0
Workshops	40.0	80.0
Master classes	35.0	70.0
Methodical festival	20.0	70.0
Festival of pedagogical ideas	15.0	60.0
Consultations	40.0	90.0
Open classes	35.0	75.0
Contests held in the pre-school educational establishments	30.0	80.0
Game workshops (business game; methodical bridge; solving situational problems)	25.0	80.0
Development of a methodological portfolio	30	90.0
Round table	40.0	90.0
Teaching hours	30.0	80.0
Pedagogical advice	40.0	90.0
Webinars	20.0	85.0

90% of physical education instructors took part in such events as a round table, consultations, the development of a methodological portfolio and pedagogical advice. Participation in other events was also high, ranging from 60.0 to 80.0%. The conducted research project made it possible to increase the level of mastering by children of the educational program "Physical health", Table 6.

Table 6. Distribution of the number of children according to the level of the educational program "Physical health" development, %

The level of the educational program development by children	2021-2022 academic year, n=120	2022-2023 academic year, n=120
Low	20.8	10.0
Average	57.5	36.07
High	21.7	53.03

Note: the high level of the target is 1 point, the average level of the target is 2 points, the low level of the target is 3 points

It was found that the targets of the educational program "Physical health" with a level of "high" in the 2021-2022 academic year were achieved by 26 children (21.7%). After conducting a research project in the 2022-2023 academic year, 64 children (53.03%) were identified with this level.

It was found that at the end of the 2022-2023 academic year, the number of senior preschool children who reached the targets for mastering the educational program at the "low" level and by 59.6% with the "average" level decreased by 51.9%. The number of children with the «high» level increased by 144.3%.

Children with the "high" level of mastering the educational program "Physical health" have a high level of physical qualities and basic types of movements (walking, various types of running and jumping, static and dynamic balance, ball exercises, formation and change of formation) development.

The conducted research project shows that the improvement of the physical education instructors' professional competencies has significantly increased the level of mastering the educational program "Physical health" for children aged 5-7 by the preschoolers.

Dicussion

The effectiveness of physical education and wellness work among preschool children largely depends on the level of physical education instructors' professional qualities development (Al-Walah et al., 2023; Clifford et al., 202). A key area of their professional activity is the development of stable motivation for physical activity in children (Ryu et al., 2021; Chen et al., 2023), which forms their motor competence (Barnett et al., 2024; Moon et al., 2024). The use of means and methods of physical culture allows increasing the level of their physical and somatic health.

Physical education instructors' professional competence is determined by the parameters of labor functions, which are reflected in the professional standard "Teacher" (Professional standard "Teacher (pedagogical activity in preschool, primary general, basic general, secondary general education), (educator, teacher)» (as amended on June 16, 2019) " (Order of the Ministry of Labor and Social Protection of Russia dated October 18, 2013 No. 544n, as amended by order of the Ministry of Labor and Social Protection of Russia dated December 25, 2014 No. 1115n and dated August 5, 2016 No. 422n). Despite the existence of a standard of requirements in the activities of physical education instructors in preschool institutions, there is a need to improve the professional qualities of such specialists. It is due to the existing gaps in the professional training of physical education instructors. This fact is indicated by studies by some authors (Schulze-Vorberg et al., 2021; Clifford et al., 2023). Educators should have the ability to adapt to the changing conditions of their activities (Fang et al., 2024; Moon et al., 2024). Many scientists pay attention to the need for continuous improvement of teacher education (Saunders et al., 2019; Madonna, & Belfiore, 2020; Górnjak et al., 2024). Therefore, the topic of scientific work chosen by us seems relevant and necessary for improving pedagogical activities in preschool institutions.

We have proposed and tested a model for physical education instructors' professional competence formation and the pedagogical conditions for its implementation within the educational environment of a preschool educational institution. The model includes 6 modules, which include improved methods, forms of training and self-education, methodological support and the use by instructors of methods for building individual educational routes using IT technologies.

A survey of physical education instructors conducted at the beginning of the research project revealed their insufficient level of professional competencies development. Their knowledge did not exceed 10 points and corresponded to the "average" level in all labor functions of the professional standard for this profession. These data are consistent with the opinion of other researchers who observed teachers of additional physical education (Xiong, 2022). Earlier, we confirmed that the level of professional competence did not meet the requirements for the profession of "Teacher of additional education" (Mischenko et al., 2021).

The approbation of the proposed model for improving physical education instructors' professional qualities showed a significant increase in the level of knowledge, skills and abilities by the end of the research project. At the same time, in all work functions, he corresponded to the «high» level. At this stage of the project, all physical education instructors coped with the tasks of the basic difficulty level of the tests and partially advanced and high difficulty levels. At the end of the project, the sum of points in all professional competencies was significantly higher compared to this indicator at the research beginning, $p < 0.05$. At the end of the research project, an increase in the number of instructors who have a «high» level of professional competencies formation (subject, meta-subject, methodological, psychological and pedagogical, IT competencies) was established. The number of instructors with "low" and "average" competence levels has decreased in all clusters. Improving the preschool teachers' professional competence has allowed increasing the children's physical activity. It was found that the targets of the educational program "Physical health" with a level of "high" in the 2021-2022 academic year were achieved in 21.7% of children. After conducting a research project in the 2022-2023 academic year, 2.4 times more children (53.03%) were identified with this level. At the same time, the number of children with a "low" level of knowledge decreased by 2.1 times and by 1.6 times with an "average" level. The successful development of the children's educational program "Physical Health" allowed the instructors to achieve a high level of physical qualities and basic types of movements development in more than 50.0% of children. Similar achievements in the development and improvement of physical qualities in preschool children, through increased professional development of teachers, were obtained by M. Lum et al. (2022).

The results of the conducted research project showed a significant positive result, which was obtained from the approbation of the proposed model for the physical education instructors' professional competence formation. This fact made it possible to significantly increase the level of children's development of the educational program "Physical health" and led to an increase in the physical qualities of the observed children.

Conclusions

A model for the physical education instructor's professional competence and pedagogical conditions for its implementation formation within the framework of a preschool educational institution is proposed here. The model includes 6 modules of a teacher's professional development, which is based on increasing the level of relevant competencies development, which are provided for in the professional standard. The pedagogical

conditions for the implementation of the experimental model are presented by innovative means, methods, conditions and forms of training and self-education, methodological support and the use by instructors of the methodology for building individual educational routes using IT technologies.

The implementation of an experimental model for improving physical education instructors' professional competence has significantly increased the level of their knowledge, skills and abilities. At the end of the project, the sum of points in all professional competencies was significantly higher compared to this indicator at the beginning of the research, $p < 0.05$. In all work functions, professional competencies corresponded to the «high» level. The highest indicators in the development of professional competencies were identified in the subject, methodological and IT competencies, which are provided for by the professional standard «Teacher».

Improving motor competence in preschool children has made it possible to increase the effectiveness of their assimilation of the educational program in the direction of «Physical health». At the end of the research project, 90% of preschool children mastered the program material with the «average» and «high» levels. 53.03% of children who used an experimental model to improve the instructors' professional competence had a «high» level of physical qualities and basic types of movements formation (walking, various types of running and jumping, static and dynamic balance, ball exercises, formation and change of formation).

The approbation of the proposed model for improving physical education instructors' professional competence has shown its effectiveness. It can be recommended for use in the practice of activities in other preschool educational institutions.

Conflicts of interest. The authors declare no conflict of interest.

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