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Pedagogical conditions for the development of cognitive independence in physical education lessons

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Abstract

Cognitive Independence (CI), which physical education has a high potential for fostering in students, is characterized by a developed set of cognitive skills, an ideal level of knowledge, a strong value attitude towards cognition, and competencies related to the ability and willingness to take the initiative and engage in professionally responsible activities. However, the biggest challenges for physical education teachers stem from a lack of program material that clearly defines the content of lessons for the development of students' CI as well as the stages of their entrance into the educational process. The purpose of the study is to theoretically justify and methodologically support the process of developing students' CI in physical education lessons. The methodology used in the study comprises a quasi-experimental pretest-posttest research design. The study participants included 210 students in grades 10 and 11 from two secondary schools in the city of Atyrau (the Republic of Kazakhstan) and teachers acting as experts. The study findings revealed substantial variations in the dynamics of students' CI in the control and experimental groups, confirming the efficiency of the application of the built-in model and technology. Despite the limitations, which lie in the fact that not all aspects of the development of students' CI in physical education lessons were considered, this study has provided the theoretical justification and methodological support for development of students CI in physical education lessons that might contribute to efficient specialists' training.

Keywords: CI, Cognitive independence, Model, Pedagogical conditions, Physical education lessons, Pretest-posttest research, Technology.

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Contents

Contribution of this paper to the literature

This study provides the theoretical justification and methodological support for developing CI in students in physical education lessons through the application of the built-in model and technology that might contribute to efficient specialists' training.

1. Introduction

Fostering students' cognitive independence (CI) was the subject of research in pedagogy, philosophy, and psychology in various historical periods, while the vector of research on this issue was multidirectional. The problem of CI in pedagogy has gone from the recognition of CI as an important means of forming an active and creative personality to the formation of conceptual provisions of personality-oriented and subjective pedagogy, which are based on the ideas of self-development, self-determination, and self-education of a person.

Lessons in physical education have a lot of promise for fostering CI. The primary challenges facing physical education teachers are brought on by a lack of program material that outlines courses' objectives for fostering students' CI as well as the steps involved in integrating them into the educational process.

Thus, it is essential to theoretically justify and methodologically support the process of developing students' CI in physical education lessons. The purpose of this research is to provide methodological and theoretical support for the development of student CI in physical education sessions. The study has practical value since senior school students' CI can be fostered in physical education classes using the designed model and technology of student CI development.

We hypothesize that if the following pedagogical factors are in place, the development of CI in physical education lessons will be more successful: (1) a clear understanding of the concept of CI; (2) the potential for the development of CI in physical education lessons; and (3) a system and technology for the development of CI in senior school students.

2. Literature Review

The tendency to form judgments and take decisions based on one's own experience and other information that seems genuine and factual is known as cognitive independence (CI). Trindel (2007) defines CI as a tendency away from normative influence and towards informational influence. CI is a personality trait that draws attention to and addresses several educational issues by stressing intellectual capacities and preparedness for independence in knowledge acquisition (Maygeldiyeva, Bekzhanova, Zhamansarieva, Stamkulova, & Usenova, 2020).

The present goal of modern education is to foster CI as a result of university globalization (Eliseev, 2016), which is the primary axiological reason for teaching students (Maygeldiyeva et al., 2020). Having a high level of knowledge, a clear value attitude towards cognition, a developed set of cognitive skills, competencies related to future specialists' ability and willingness to take initiative, and engaging in professionally responsible activities all contribute to students' CI, an integrative dynamic personal quality (Stamkulova & Kargapoltseva, 2019).

Another crucial factor is the capacity to understand the knowledge acquired. According to Margunayasa, Dantes, Marhaeni, and Suastra (2019), CI is the capacity to comprehend knowledge and is linked to better levels of student learning achievement. As a result, students with strong CI are able to solve problems in more effective ways than students with low CI (Juniati & Budayasa, 2022). This can lead to variances in how to approach easy and tough problems. Therefore, research on the impact of CI on mathematical problem-solving ability is crucial.

CI indicates an individual's unique ability to receive, remember, and process information between cognition and personality (Rahman, Juniati, & Manuharawati, 2022a). It is a technique for processing knowledge about how to recall, think, and solve problems (Sudia & Lambertus, 2017). CI can result in disparities in how simple and difficult problems are solved, and as a result, it would have a good impact on students' learning accomplishments (Margunayasa et al., 2019).

In a study by Rahman, Juniati, and Manuharawati (2022b), it was found that while subjects with high CI might use the right strategy when articulating, modeling, and solving problems analytically, subjects with low CI use an insufficient method and draw the wrong conclusion. The results of the study imply that different degrees of CI may have an impact on how people use their mathematical skills. In addition, Juniati and Budayasa (2022) found that mathematics anxiety has a detrimental impact on problem-solving skills, while CI in pupils has a positive impact. The results indicate that students' ability to solve problems improves with increasing levels of CI and lower levels of mathematics fear.

Various aspects of CI have been addressed in previous studies (Bogoyavlensky & Menchinskaya, 2002; Danilov, 2008; Lyakh, 2009; Menchinskaya, 2012), and there are different approaches to determining its component composition. Based on the analysis of the theory and practice of the development of CI, the structure of CI is presented in Table 1.

Table 1 shows that CI is a complex integrative personality quality, including such components as motivation and value, cognitive and reflexive, creative and activity, that contribute to the formation of a personality able to perform certain functions on their own initiative, showing independence, realizing their own responsibility, activeness, and the ability to reflect.

The current study findings might contribute to the effective training of specialists, the designed model and technology of the development of students' CI can be used in fostering the CI of senior schoolchildren in physical education lessons.

Table 1. The structure of students' CI.

Components	Criteria	Features
Motivational and value component	Interest in the manifestation of CI	Students' interest in cognitive activity; the importance of such values as curiosity, initiative, courage, flexibility, originality, independence, and mobility of thought; high motivation to achieve a goal that is of predominant importance for independent cognitive activity; the need to reflect on their own cognitive activity.
Cognitive and reflexive component	Knowledge and awareness of the importance of cognitively independent activity	Knowledge of the types and methods of cognitive activity; knowledge of their capabilities for the realization of creative activity, as well as the presence of the Self-concept as the basis of creative activity; knowledge of their individual characteristics (initiative, curiosity, flexibility of thinking, originality, independence, etc.) for the development of cognitive potential; knowledge of strategies, stages, and ways of implementing independent cognitive activity; knowledge of various methods of developing thinking, imagination, perception, and attention.
Creative and activity component	Independent and active participation in cognitive activity, the presence of special skills	Readiness to implement cognitive activity; the ability to outline their own strategy for the development of creative activity (creative self-realization); possession of various ways of implementing independent cognitive activity; the ability to independently outline ways and a program for further development; the ability to extract information that will serve as material for independent cognitive activity; the ability to activate thinking: logical, figurative, and associative.

3. Methodology

Aiming at theoretically justifying and methodologically supporting the development of students' CI in physical education lessons, the quasi-experimental pretest-posttest research design, which allows for a straightforward evaluation of an intervention used on a group of study participants (Stratton, 2019), was used in the study. The methods used for research include mathematical and statistical techniques (mean, percentage, Student's t-test), as well as theoretical techniques (analysis, synthesis, comparison, generalization, classification, and systematization).

The secondary general education schools No. 10 named after S. Mukanov and No. 19 named after K. Satpayev in the city of Atyrau both participated in the experimental work. 210 students in grades 10 and 11 participated in the study: 104 in the experimental group and 106 in the control group. The experts included 30 subject-cycle instructors.

A scale of expert assessment of CI and Pashnev's (n.d.) questionnaire for the study of the level of cognitive activity of students (Pashnev's, n.d.) were both used to measure the development of students' CI in physical education sessions.

The expert assessment included evaluation of the students' project work preparation and performance by the teachers of various school subjects during the year. The experts were competent teachers who knew the students well. Expert assessments were carried out not in the form of a description of qualitative manifestations of students' properties but in the form of a quantitative assessment of these qualities and elements of behavior. The experts recorded more or less fractional, elements of students' behavior that are unambiguously understandable on the scale we developed in Table 2.

Table 2. Scale of expert assessment of CI of senior schoolchildren.

No	Assessment criteria	Grade				
		5	4	3	2	1
1	Internal motivation to perform activities					
2	Readiness and striving on their own for new knowledge					
3	The desire and ability to act according to their own views and beliefs					
4	Activeness on their own initiative					
5	Readiness to search for various solutions without outside participation					
6	Expressed awareness of their actions					
7	Manifestation of cognitive activity					
8	Ability to navigate in a new situation					
9	Independence of volitional efforts					
10	Creative approach					
11	The ability to organize their cognitive activity					
12	The ability to engage in purposeful activities					

To increase the reliability of the expert evaluation, the following requirements were met:

- The assessed qualities were defined in terms of the observed behavior.
- The expert had the opportunity to observe the behavior of the evaluated student for a fairly long period of time.
- At least five experts were required to assess one student.
- Ranking was carried out by experts only on one trait at a time, instead of evaluating one subject at a time according to the entire list of criteria.
- The expert evaluation data were correlated with the results of test surveys.

When processing the results of the expert scale, the mean value for each criterion was found, taking into account the 5-point scale. The expert assessment made it possible to quickly collect diagnostic information and record the dynamics of the development of components of CI in schoolchildren.

The experimental work consisted of the following stages:

1) The pretest, which measured students' levels of CI in the motivational and value, cognitive and reflexive, and creative and activity components at the start of the experiment, was carried out from 2018 to 2019;

2) The treatment stage, which aimed to raise the level of development of CI among senior school students in physical education classes in accordance with the purpose, objectives, and design principles, was carried out from 2019 to 2020;

3) From 2020 to 2021, the posttest was administered to students in order to gauge their level of cognitive development and assess the success of instructional environments that had been conceptually justified.

Using motivational, value, cognitive, and reflexive components, as well as creative and activity components, the pretest assessed the growth of students' CI in physical education sessions. The experiment complied with educational research standards for reproducibility of results for various student groups and representativeness of the sample (n = 210). 30 teachers served as experts for the study.

The treatment included developing a model and technology for the students in senior high school to develop their CI, putting the pedagogical conditions for this development into practice in physical education lessons, and analyzing the outcomes. The main pedagogical conditions of this process were the use of individual and differentiated approaches in the physical education lesson based on a systematic study of students' difficulties in the process of cognitive activity; the allocation in the content of the subject "Physical culture" of tasks and ways of implementing CI that correspond to the age characteristics of students and their needs; actualization of the value attitude of students to the process of developing CI; creating a supportive emotional tone for the educational process and a learning environment; special purposeful activity of the teacher to develop CI in physical education lessons; special training of teachers who possess innovative technologies for the development of students' CI.

The posttest determined the level of formation of students' CI both in the control group and in the experimental group to compare and identify differences after the treatment stage. The composition of control and experimental groups did not change throughout the experiment, indicating the homogeneity of the compared groups and the objectivity of the results obtained during the experiment. The posttest documented changes in the dynamics of students' academic motivations, including levels of development of motivation for physical education, components of CI, and levels of formation of cognitive activity and independence. These dynamics included cognitive, communicative, emotional, student position, achievements, and external motivation.

The Student's t-test was used in the statistical data processing to ensure that the mean values in the two samples were equal. Methods of mathematical statistics were used to objectively substantiate the validity and reliability of quantitative indicators, to determine statistically significant differences in sample means as an indicator of the influence of methods used on the development of the students' CI, and to identify patterns and dynamics in the obtained qualities.

The arithmetic mean (X) was calculated by adding the test results for a particular test and dividing this sum by the sample size (number of students):

$$\overline{X} = \frac{\sum X}{n}, \tag{1}$$

Where X is the value of the quantities for which it is necessary to calculate the average value; N is the total number of values of X (the number of units in the studied population).

The Student's t-test is applicable for comparing large and medium (with a volume of more than 30 values) unequal samples, as well as small (with a volume of less than 30 values) equal samples. The advantage of using the Student's t-test is that it can be used both when comparing independent samples and when comparing dependent samples.

The Student's t-test is computed using the following formula to compare average values:

$$t = \frac{M_1 - M_2}{\sqrt{m_1^2 + m_2^2}} \tag{2}$$

Where M1 is the arithmetic mean of the first compared population (group), M2 is the arithmetic mean of the second compared population (group), m1 is the average error of the first arithmetic mean, and m2 is the average error of the second arithmetic mean.

If an indicator's likelihood according to the table of values was at least 95%, it was said to have proven reliability.

The presented data provide sufficient grounds for concluding that the general methodology and applied scientific methods, content, and organization of the experiment, as well as statistical processing of the results of the conducted experimental study, are reliably consistent with the intended purpose of the study and guarantee full compliance with the studied problem, the conducted pedagogical experiment, and the proposed model of the development of senior schoolchildren's CI in physical education lessons.

4. Results and Discussion

In the experiment's treatment phase, we created and applied a model for senior school students' CI growth during physical education sessions. The model's goal is to foster the growth of senior school students' CI in physical education classes. The following tasks are involved in the teachers' efforts to help children become more independent thinkers:

- Timely assessment of the degree of CI growth.
- Organization of the educational process, taking into account the psychological and pedagogical capabilities of senior school age for the development of CI.
- Implementation of modern pedagogical technologies that allow developing CI.
- The opportunity to realize the cognitive potential of children to solve the cognitive tasks of the lesson.
- Implementation of an individual approach to students.

- Organizing group interaction among students and their mutual influence to create conditions for the development of CI.

The goal of students is to realize the cognitive abilities of their personalities and their desire to develop CI. The tasks of the students are:

- To be active in cognitive activity, strive for independence and for qualitative changes in the product of this activity;
- To be open to the development of new types of cognitive activity;
- To interact with peers, exchange ideas, and share subjective experiences.

The levels of development of CI in students (high, medium, and low) assume a set of certain knowledge, skills, and abilities and ways of carrying out activities:

High level. The student is characterized by a constant manifestation of cognitive interests and initiative, is actively, independently, and productively involved in cognitive activity, and generates a large number of ideas. Special skills related to cognitive activity are well developed.

The medium level. The student does not attach much importance to the development of the cognitive potential. Cognitive activity is carried out consciously and purposefully, but irregularly. The student is able to put forward creative ideas but cannot implement them independently. Special skills related to cognitive activity are not sufficiently developed.

Low level. The student is characterized by a weak understanding of the importance of developing cognitive potential. There is a lack of motivation to perform creative tasks and a lack of initiative. The students work slowly, with the help of a teacher, and with low productivity. Special skills are poorly developed.

The model for the development of CI in senior schoolchildren in physical education lessons is presented in Figure 1.

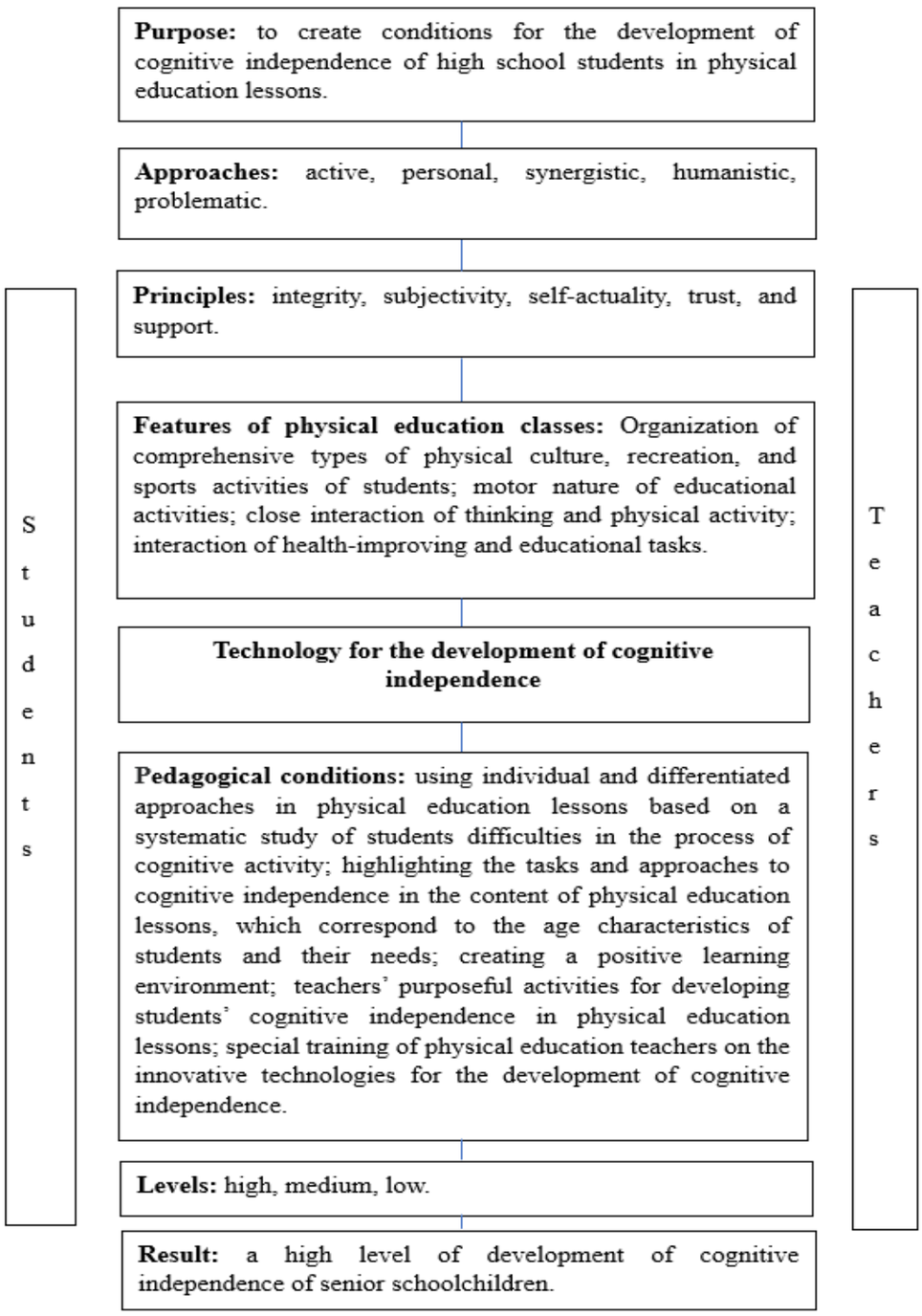

Figure 1. The model for the development of students' CI in physical education lessons.

The technology of students' CI development is a purposeful and controlled interaction between a teacher and a student, aimed at creating and implementing conditions in the educational process that allow students to track their independent cognitive achievements in mastering various types of activities both in a lesson and in the school as a whole. The technology supports the activities of both a physical education teacher and high school students in implementing independent cognitive activity. The principles of complexity, objectivity of information provision, the subjective nature of the interaction of participants, comprehensiveness, trust of subjects towards each other, and independence serve as the basis for the CI development technology. When designing the technology for the development of students' CI, the following was considered:

- A student is an active participant in implementing the technology for the development of their CI;
- A student actively performs self-analysis and self-assessment of their cognitive potential development.
- A student actively participates in their development and self-improvement.

A schematic representation of the technology for the development of CI in senior schoolchildren in physical education lessons is presented in Table 3.

Table 3. The technology for the development of students' CI in physical education lessons.

Components of the technology	Teacher's activities	Students' activities
Setting a learning goal based on the individual needs of a student	Creating conditions for students to analyze a given cognitive situation that requires an independent decision and awareness of their capabilities. Evaluating the cognitive potential of students and the level of their independence, and outlining possible ways to solve a problem.	Evaluating the cognitive potential based on an objective analysis of a given situation, independently determining the circle of their interests, and ways to solve a cognitive situation.
Technological support of the process of CI development	Applying various pedagogical technologies based on the principle of independence and using the cognitive potential of students in line with the requirements for the educational process in a secondary school and for physical education lessons.	Determining their role in the implementation of a particular technology based on the assessment data and self-assessment, selecting the most significant moments and aspects for themselves, and using the proposed possibilities of pedagogical technologies.
Development of an individual trajectory for the development of CI	Implementing an individual trajectory for the development of CI together with the students, specifying tasks for an individual student, and carrying out general coordination of independent cognitive activity.	Designing their own independent cognitive activity with concrete results, designating the most significant conditions of activity, while actively interacting not only with the teacher, but also with other students.
The content of training within the framework of independent cognitive activity	Assistance in the selection of forms, methods, and means of training in accordance with personality traits. Choosing forms, methods, and means of training based on methodological recommendations. Selection of content in accordance with the needs and abilities of the student. Differentiation and individualization of the content of the development of CI.	Consciously choosing forms, methods, and means of realization of the cognitive process.
Evaluation of the activity effectiveness and timely correction	Assessment of the students' CI based on the specified criteria.	Students' self-assessment of their cognitive activity results is performed based on their claims and existing criteria. Establishing the reasons that determined the result.

The levels of CI development in senior school students were tracked throughout the experiment in accordance with the indicators and criteria we established.

Students' independent activity, which includes the need, desire, and willingness to take any steps necessary to achieve the goal, the capacity to plan and organize their activities, engaging in mental labor, being creative, finding pertinent information, making voluntary efforts to achieve the goal, diligence, etc., is closely related to the development of CI.

Table 4 presents the pretest and posttest results according to Pashnev's (n.d) questionnaire for the study of the level of cognitive activity of students, based on which Figures 2 and 3 are compiled.

Table 4. The pretest and posttest results of students' cognitive activity development in the control and experimental groups.

Level	Groups	Pretest		Posttest	
		N	%	N	%
High	Control	25	23.6	26	24.5
	Experimental	26	25	47	45.2
Medium	Control	46	43.4	47	44.3
	Experimental	45	43.3	42	40.4
Low	Control	35	33.0	33	31.1
	Experimental	33	31.7	15	14.4

Figure 2 illustrates that there were no appreciable differences in the levels of cognitive activity between the students in the control and experimental groups at the time of the pretest. The majority of senior school students (43.4% in the control group and 43.3% in the experimental group) showed a medium degree of cognitive activity development.

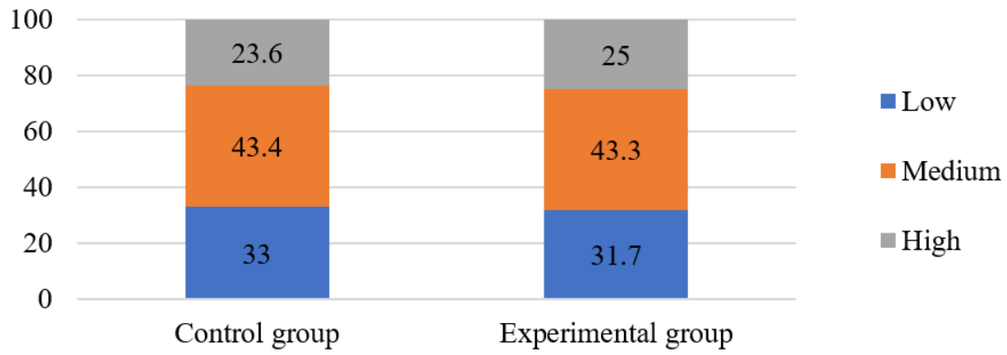

Figure 2. The pretest levels of students' cognitive activity development in the control and experimental groups.

Figure 3 shows the significant variations in cognitive activity levels between the control and experimental groups following treatment.

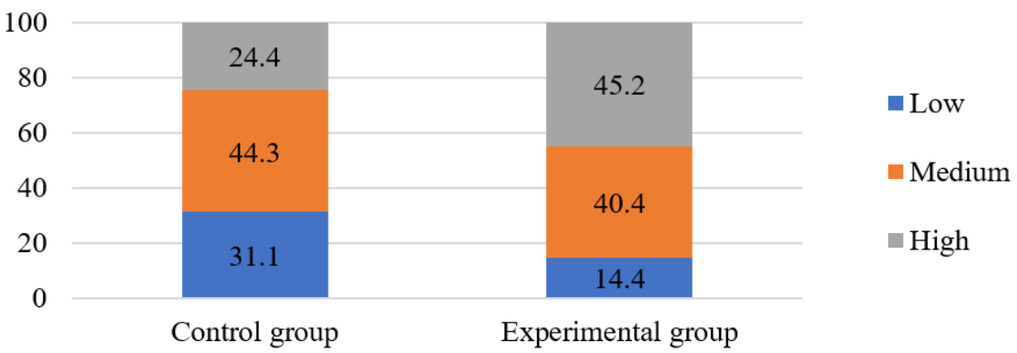

Figure 3. The posttest levels of students' cognitive activity development in the control and experimental groups.

As a result, just 24.5% of schoolchildren in the control group displayed a high degree of cognitive activity, compared to 45.2% of senior school students in the experimental group. Differences between the students' cognitive activity in the control and experimental groups are shown in Table 5.

Table 5. Student's t-test results for pretest and posttest of the development of students' cognitive activity in the control and experimental groups.

Experiment Stage	High Level	Low Level
Posttest	$t_{emp}=2.4^*$	$t_{emp}=2.31^*$

Note: $t^* \leq 1.98$ ($p<0.05$), $f=108$.

As seen from the table, the difference in students' high level of cognitive activity was statistically supported ($t_{emp}=2.4$, $t_{theor}=1.98$; $p=0.05$). These students demonstrate interest in study, work hard to understand the phenomena and their relation to each other, strive to become experts at using knowledge in new contexts, and discover novel approaches to accomplishing their goals. They may exhibit strong-willed traits, tenacity and persistence in pursuing their goals, and wide-ranging and enduring cognitive interests.

At the medium level of students' cognitive activity, there was no statistically significant difference between the control and experimental groups. The students in the control group (44.3%) and the experimental group (40.4%) strive to understand the significance of the study material, seek to understand the relations between phenomena and processes, and master the techniques for applying knowledge to a greater extent only under the same circumstances. The relative consistency of volitional efforts is a defining characteristic of these students, which manifests in the students' desire to solve the problem and, if it is difficult, seeking assistance or exploring for solutions, not refusing to finish the assignment.

Only 14.4% of students in the experimental group and 31.1% of students in the control group were found to have poor levels of cognitive activity ($t_{emp}=2.31$, $t_{theor}=1.98$; $p=0.05$). These students exhibit passivity, respond poorly to the teacher's expectations, and do not demonstrate a desire for independent study. The instability of volitional attempts, the lack of desire to expand the student's knowledge, and the absence of "Why?" questions are characteristics of this level.

The results of students' CI assessment according to the expert scale are demonstrated in Table 6.

Expert evaluations during the pretest demonstrated a relatively low level of students' CI development both in the control and experimental groups. The innovative approach, cognitive activity, readiness, and thirst for new knowledge were not sufficiently displayed by the students. The posttest evaluation showed that there were very small changes in these indicators in the control group.

The differences between the students' cognitive activity in the control and experimental groups that resulted from the expert evaluation are shown in Table 7.

Table 6. The expert evaluation of the students' CI.

No	Assessment criteria	Control group		Experimental group	
		Pretest	Posttest	Pretest	Posttest
1	Internal motivation to perform activities	2.9	2.7	3.1	3.8
2	Readiness and striving on their own for new knowledge	1.5	1.6	1.7	2.6
3	The desire and ability to act according to their own views and beliefs	4.2	4.2	4.3	4.4
4	Activeness on their own initiative	2.3	2.3	2.4	3.6
5	Readiness to search for various solutions without outside participation	2.9	2.7	2.9	4.6
6	Expressed awareness of their actions	2.2	2.4	2.4	3.5
7	Manifestation of cognitive activity	1.7	1.6	1.8	3.9
8	Ability to navigate in a new situation	3.9	3.7	3.9	4.5
9	Independence of volitional efforts	2.7	2.5	2.8	3.6
10	Creative approach	1.2	1.3	1.4	2.4
11	The ability to organize their cognitive activity	3.3	3.4	3.5	3.9
12	The ability to engage in purposeful activities	3.2	3.2	3.2	3.4

Table 7. Student's t-test results for pretest and posttest expert evaluation of the of students' cognitive activity in the experimental group.

Assessment Criteria	Posttest
Readiness and striving on their own for new knowledge	$t_{emp}=2.22$*
Activeness on their own initiative	$t_{emp}=2.98$**
Readiness to search for various solutions without outside participation	$t_{emp}=2.77$**
Manifestation of cognitive activity	$t_{emp}=2.25$*
Independence of volitional efforts	$t_{emp}=2.2$*
Creative approach	$t_{emp}=2.4$*

Note: $t^{*}\leq 1.98$ ($p<0.05$) and $t^{**}\leq 2.62$ ($p<0.01$), $f=108$.

Posttest results from the experimental and control groups were compared, and a number of important changes were found. The Student's t-test revealed statistically significant differences in the experimental group's pretest and posttest results. Students started to display cognitive activity (3.9) ($t_{emp}=2.25$, with $t_{theor}=1.98$; $p=0.05$), a creative approach (2.4) ($t_{emp}=2.4$, with $t_{theor}=1.98$; $p=0.05$), and activeness on their own initiative (3.6) ($t_{emp}=2.98$, with $t_{theor}=2.62$; $p=0.01$). Students became more willing to look for different solutions (4.6) ($t_{emp}=2.77$, with $t_{theor}=2.62$; $p=0.01$), and there was an increase in students' independence of volitional efforts (Scale 9) (3.6) ($t_{emp}=2.2$, with $t_{theor}=2.62$; $p=0.01$) and willingness and desire for new knowledge (2.6) ($t_{emp}=2.22$, with $t_{theor}=1.98$; $p=0.05$).

All of the differences that were discovered enable us to state that the experiment was successful in fostering students' CI during physical education lessons.

5. Conclusion

The relevance of the development of students' CI is due to the processes of modernization of education, optimization of methods and technologies of the organization of the educational process, and the transition of modern society to world quality standards, where the main component of a modern personality is its cognitive activity.

1. Based on the literature review, CI is defined as a complex integrative quality of personality characterized by the presence of various components and elements (motivational and value, cognitive and reflexive, creative and activity) that contribute to the formation of personality as a subject of cognitive activity, allowing individuals to perform certain functions on their own initiative, realizing their own responsibility, and having the ability to reflect.

2. The features of physical education lessons include the correct setting of lesson goals, the maximum individualization of learning, the optimal workload of all students in the lesson, the independent nature of educational activities, the organization of diverse types of physical culture, recreational, and mass sports activities for students, and the motor nature of educational activities.

3. A model for the growth of students' CI in physical education courses was developed in accordance with the aim, objectives, and research object of the study. The model incorporates the goal, strategies, guiding principles, subjects of interaction, technology for fostering CI, stages at which it manifests itself, educational conditions, and the outcome.

4. The pedagogical tools created to help students improve their CI include goal-setting, technological support, the creation of a personal trajectory for that development, the content of cognitive activity, and the assessment of its efficacy.

5. The experimental validation of the model of student CI growth in physical education sessions supported the validity of the proposed hypothesis. The results of the experiment demonstrated that improving the CI in physical education lessons will be more successful if: (1) the definition of CI is clarified; (2) the potential for improving CI in physical education lessons is revealed; and (3) a system and technology for improving CI of senior school students in physical education lessons have been developed.

6. The criteria for assessing the students' CI have been developed, allowing us to establish the levels of development of CI by demonstrating the active, conscious, and initiative activities of students in physical education lessons.

7. The experiment entailed building the conceptual underpinnings of senior school students' CI during physical education sessions. A phased deployment of this procedure was planned for this goal.

By seeing substantial changes in the dynamics of students' growth in CI in the control and experimental groups, the success of the model and technology's application is established.

6. Limitations and Future Implications

The limitations of the study lie in the fact that not all aspects of the development of students' CI in physical education lessons were considered. Prospects for future research are seen in identifying effective methods and means of developing students' CI in other subjects, the didactic and methodological development of the content and organizational support of this process, and the intricacies of training teachers for the development of students' CI.

Despite the *limitations*, this *study* has provided the theoretical justification and methodological support for developing CI among students in physical education lessons that might contribute to efficient specialists' training. The designed model and technology for the development of students' CI can be used to foster the CI of senior schoolchildren in physical education lessons.

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