ISSN 2782-2575

Education & Pedagogy Journal

ISSUE 3 (11) 2024

MINISTRY OF EDUCATION OF THE RUSSIAN FEDERATION

Tomsk State Pedagogical University
(TSPU)

EDUCATION & PEDAGOGY JOURNAL

ISSUE 3 (11) 2024

TOMSK
2024

Founder:
Tomsk State Pedagogical University

The journal is published four times a year
The journal is listed in the subscription catalog “Russian Press”, index 85700.

Address:
ul. Kievskaya, 60, Tomsk, Russia, 634061. Tel./fax +7 (38-22) 31-14-64

Publisher and editorial address:
pr. Komsomolskiy, 75, office 205, Tomsk, Russia, 634041.
Tel. +7 (38-22) 31-13-25, tel./fax +7 (38-22) 31-14-64. E-mail: epj@tspu.edu.ru
https://edujournal.tspu.edu.ru/edujournal-contacts.html

Printed in the printing house of IP Kopyltsov P.I.
Marshal Nedelin str., 27, sq. 56, Voronezh, Russia, 394052.
Tel.: +7-950-765-69-59. E-mail: Kopyltsow_Pavel@mail.ru

Certificate of registration of mass media
The Federal Service for Supervision of Communications, Information Technology, and Mass Media (Roskomnadzor)
PI No. FS77-85427, issued on 13.06.2023.

Approved for printing: 25.09.2024. Publication date: 18.10.2024. Format: 70×100/16. Paper: offset.

Printed Sheet (Печ. л.) 5.38; Standard Printed Sheet (Усл. печ. л.) 7.0; Publishing Sheet (Уч.-изд. л.) 7.48.

Circulation: 1000 copies. Price: not settled. Order: 1287/H

Production editor: Yu.Yu. Afanasyeva. Text designer: O.A. Turchinovich.
Cover designer: V.Yu. Zyubanov. Translator: V.Yu. Zyubanov. Proofreading: E.V. Litvinova.

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About

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• The founder of the journal is Tomsk State Pedagogical University.

The journal publishes:

• Original articles in English dealing with the most pressing problems of theory, practice, philosophy, and history of education. In addition, authors are given the opportunity to publish Russian translations of these articles in other TSPU journals.

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The journal is published four times a year.

The call for papers for the upcoming issue is open.

PEDAGOGY

UDC 377.6
DOI: 10.23951/2782-2575-2024-3-5-22

ANALYSIS OF THE MODELING APPLICATIONS' TRENDS IN THE EDUCATIONAL PROCESS FOR 2020–2023

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Abstract. This study aims to investigate the trends of applying modeling processes in the educational process at the Arab and foreign levels for the period (2020–2023). The study followed the descriptive approach by presenting the modeling concept and the research areas covered in different languages and identifying the most important models used in the educational process based on the global database available on: (Google Scholar, elibrary.ru, Scopus). The study included (319), Arab and foreign studies that dealt with the restriction and numerical, qualitative, and methodological classification from 2020 to 2023. The study has identified the most important trends in which modeling was used as a research method. The study has also highlighted the models used in the educational process. We hope that the analysis of the trends will help to identify the areas and departments where modeling has been used to solve educational and scientific problems. The study has shown several results that could evaluate this study and help researchers in applying modeling as a research method.

Keywords: *Modeling, Modeling Methods, Modeling procedure, Educational Process*

For citation: Ghazi Hussein Taan Albayati. Analysis of the Modeling Applications' Trends in the Educational Process for 2020–2023. *Education & Pedagogy Journal*. 2024;3(11):5-22. doi: 10.23951/2782-2575-2024-3-5-22

Introduction

The modeling process plays a vital role in solving modern educational problems through predictions in strategic planning and management processes as well as in various scientific fields. The modeling process is considered one of the most precise methods of ensuring the plan. Although a variety of research methods have been developed, all with the same goal, modeling events can help develop plans and strategies to solve complicated problems. Computer programs have helped to improve the ability of predictive machine applications to perform tasks related to complex systems and to access problem-relevant big data. Modeling processes are widely used as cognitive and objective procedures in education, and the role of educational modeling increases directly with the technological development that accompanies the educational process and facilitates the transmission of information to students [1].

It is necessary to analyze the experiments on the use of modeling in the educational process to solve theoretical and practical problems that can be used as a means of cognitive awareness since the model and its different forms are considered theoretical transmitters of knowledge. Therefore, large amounts of data can be collected and processed through a framework that relies on this data to extract information [2].

Many studies have specifically addressed trending issues related to process modeling, especially in certain fields such as geography, sports, and other disciplines. We list some of the factors that have benefited from these studies to identify the results obtained, the tools used in data collection, and the methods used to conduct these studies: The study by Sansana (2021) is titled "Recent Trends in Hybrid Modeling for Industry 4.0." The aim of this study was to investigate hybrid modeling techniques, methods for identifying the systems relevant to digitalization, and criteria for evaluating models. The research method was descriptive and analytical. The research uncovers new methods and techniques that combine practical knowledge with big data and machine learning phenomena [3].

The study by Hegazy (2023) is titled "Recent Trends in Constructional Locative Modeling Research during the Period (2012–2022)". This study contains a reference overview of modern trends in the field of locative and constructional modeling from foreign and Arab sources. The study follows several methodological procedures, including the analysis of modeling concepts and the evolution of their study over time, as well as the leading foreign and Arab research areas. (181) Studies were included in the study [4].

The study by Trunfio (2020) is entitled "Recent Trends in Modeling and Simulation Using Machine Learning." The aim of this study was to identify modern trends and ideas for modeling and simulation systems based on advanced technologies. The study followed a descriptive-analytical method in processing the data. The study shows the diversity of trends in the field of machine learning [5].

The study by Tkacheva (2017) is entitled "Time Series Modeling Trend Analysis." The purpose of this study is to analyze modeling trends based on time series using a software system prepared for this purpose, and the study uses an algorithmic analytical approach. The research finds new ways to integrate practical knowledge and phenomena into big data and machine learning frameworks, leading to acceptable solutions and more powerful and clear artificial intelligence that can help researchers [6].

Based on previous research in conjunction with the review and review of the aforementioned research literature, within the limits of the theoretical and literary framework, the theoretical and methodological framework of the current study can be determined, which focuses on the application of the modeling method in educational studies and research at the Arab and foreign levels. Be it in education or in science. Therefore, we can point out that the current study is similar to the studies of (Takjiva, 2017), (Trunfio, 2020), (Hejazi, 2023) and (Sansana, 2021) in the methods and aspects used in the procedure – a descriptive study involving the modeling of trends and conducting a qualitative analysis. While the current study represents a comprehensive and overarching vision of research on modeling as a research method, it differs from this in terms of the sample and target population.

Scientific Novelty

The novelty of this study lies in the fact that for the first time, the trends of modeling in the educational process at the Arab and international levels are analyzed through a quantitative and numerical analysis of data between 2020 and 2023, given the increasing use of modeling in various fields of the educational process. Given the increasing use of modeling processes to solve educational problems, this study classifies the main types of modeling covered by research and studies, as well as the fields and specializations of this research, whether scientific, humanitarian, or socio-economic.

Study problem

In recent years, researchers have noted the increasing use of modeling methods in many fields, including education and the natural sciences. Therefore, the tasks of analysis, planning, and prediction are referred to as modeling processes, through which educational problems can be modeled and possible solutions can be found. There are two generally recognized methods. Qualitative and quantitative modeling can be used if the researcher cannot obtain quantitative data. Quantitative modeling methods should be used if the research topic has statistical data. The modeling process makes it possible to predict the future state of an object based on its past data. Many studies have shown the role of modeling in solving complex problems, e.g., [7–9].

Given the growing interest in research that uses modeling approaches in various human and scientific disciplines, I did not find similar studies on the application of modeling trends in the educational process at the Arab and foreign levels, which prompted the researcher to attempt to identify the application trends of modeling methods in the period 2020–2023, especially in the education sector. The main questions to be answered can be formulated as follows: **What are the trends in the application of modeling in the educational process?**

To answer the main question, we should answer the following sub-questions:

– In which areas is modeling applied in studies?

– What types of modeling are covered in these studies?

– What methodology is used in the modeling study?

Aims of the study

– to take stock of scientific and humanities research (doctoral theses, studies in journals, conferences, or peer-reviewed journals) in Arab and foreign fields.

– Analyze the trends of modeling applications in educational processes to show the usefulness of the models developed based on these trends.

– Inventory the types of models used in the Arab world and in foreign research.

Importance of the study

The importance of this study is to introduce researchers and interested parties to the trends in applicate modeling methods in educational research and to use them in future studies. The aim is to identify the most important types of trends that have emerged according to these models and to show the differences between published research in the Arab world and worldwide. Many studies have confirmed the importance of analyzing trends, for example, [10, 11].

Limits of the study

The boundaries of the material study are limited to research and studies published in peer-reviewed journals, conferences and periodicals, Arabic and foreign websites, and academic platforms. The spatial boundaries are limited to journals, conferences, and periodicals at two levels: the Arab and international worlds. The temporal boundaries are limited to the period 2020–2023.

Terms of the study

Modeling – Terminologically: Petukhov defines it as a method of studying physical phenomena, engineering designs, and systems and predicting their behavior [12].

Procedurally: It is an advanced research method based on the storage and processing of large amounts of data and the realistic reproduction of the environments, phenomena, and problems studied using computer programs.

Modeling trends – Terminologically*:* Ibn Manzur defines them idiomatically: they are "a system of emotions and reactions that reflect, positively or negatively, an individual's beliefs, interests, and Values" [13].

Procedurally: This is the process of conducting a quantitative and qualitative analysis of the data included in the current study, based on which the most commonly used aspects of modeling are identified. The process of applying the model in education focuses on analyzing the variable into mini-sections through which the characteristics of the situation can be studied for each of the aspects surrounding the variable [14].

Kalinovskaya pointed out that in modern education, many types of educational process models are widely used in teaching educational subjects. These classroom teaching models are based on various cognitive and practical educational activities involving varying degrees of subjectivity. The subjectivity of students in the process of learning the education major includes [15]:

1. **Experimental model:** The knowledge and necessary skills for experiments are formed based on the student's experience and organized in courses [16].
2. **Education model:** This model includes the interaction between teachers and students and between students in the education process. Problems are discovered on the spot during teaching practice and solved theoretically [17].
3. **Practical mode:** This mode involves active interaction between teachers and students, solving problems that arise in part-time work, and aims to alternate between educational, cognitive, and practical activities to connect theoretical knowledge with school reality [18].
4. **Semi-professional model**: This model consists of the modeling of professional and teaching activities within the framework of teaching practice and is related to the formation of a personal stance related to the acquired knowledge and professional activities, with an organizational, reflective

represent, communication, teaching and other important skills at the professional level [19].

5. **Guidance model:** It includes activities carried out by students in the educational process of pedagogy through discussion, which is a repeated position at the theoretical level to form a flexible scientific and educational way of thinking [20].

6. **Reflective mode:** Discover the contradiction between the nature of theoretical knowledge and the subjectivity of teaching activities and promote teachers' self-development [21].

7. **Practical Personality Models:** Here, basic information is presented to students verbally and visually in the form of models (diagrams, algorithms, matrices), where the student's task is determined by determining the meaning of the information within its own structure [22].

8. **Social (anthropological) model:** It focuses on the applied nature of educational knowledge and embodies the characteristics of the scientific method of educational thinking [23].

9. **Self-learning model:** It depends on the use of self-education opportunities, when the student himself builds a path for his educational development and methods for studying units in educational specializations [21].

10. **Educational model:** It is defined as the educational technology that embodies the teaching methods and organizational forms of education that constitute the educational basis of the educational model [24].

Each of these models can be used in different combinations in the educational process of future teachers in distance education and also for presentations to explain, explore, and clarify the educational topic under study. It is also used as a research method or as a helpful tool for analyzing and illustrating research topics. In order to determine the direction of application of the modeling process in the educational process, it is necessary to identify the elements of the educational environment (educational systems and management) that can be modeled to solve emerging problems. Whether personal, social, administrative, or geographical [25].

11. **Educational System Model:** Rodatko defines an educational system as a series of components. This model can be divided into four types: comprehensive, practical, logical, and open [26].

Dahin defined it as a group of elements that are logically consistent and interrelated in the educational system, such as the goals and content of education, the design of educational technology, the technology used in managing the educational process, the curricula, and the programs [17].

Depending on the educational goals and methods, the educational model is divided into three levels: 'Basic Levels,' 'Intermediate Levels' and 'Complex Levels'. The basic level can be used, for example, in lesson plans, the intermediate level can be used in modeling natural phenomena, and the complex level can be used with simulation software [27].

Advantages of applying modeling in education

There are many advantages to using modeling in education, such as [28]:

– It saves time, effort, and resources.

– Modeling allows you to predict various events and phenomena.

– It allows us to study complex systems for scientific and applied disciplines that cannot be studied in reality.

– Improving resource management through various methods.

– In scientific (applied) research, negatives can be evaluated to reduce errors, and appropriate actions can be taken for them.

– Modeling also supports environmental protection by assessing the impact of activities on the environment.

Methodology and procedures of the study

Study Methodology: A descriptive approach was used in the data analysis, and quantitative and qualitative analyses were conducted to explore research themes and methods, including qualitative analysis of studies that used modeling as a research method.

Society and sample of the study

The study represents research published in the Arab world and internationally from "2020–2023."

The procedure of the study

1. Conduct research in electronic libraries and international platforms that contain academic and educational articles.
2. Search for Arab and foreign websites, journals, and databases, as shown in Table 1.
3. Monitor and classify research methods related to the modeling process.
4. Classify studies at Arab and foreign levels.

Table 1

Shows Arab and foreign centers, journals, and platforms

Arabic websites & journals	Foreign websites & journals
Center of Rafad for Research	ResearchGate
Al-Sabt Center for Research & Publishing	E-library.ru
Arid Platforms	Scopus
ORCID	Scientific Electronic Library
Website of Iraqi academic scientific journals	CyberLeninka
	Willy
	E-Learning and Digital Media
	Educational Digital Platforms

From Table 2 we can see the researched (319) studies. It was divided into two parts, with the studies in the Arab countries reaching (129), with a percentage of (40.4%). This is a good indicator of the increasing use of modeling in Arab research and studies, compared to (190) studies abroad with a percentage of (61.2%). Among them were foreign countries (America, Eastern Europe). Thus, foreign studies have surpassed Arab studies in using the modeling method. Note: Figure 1.

Table 2

shows the distribution of studies according to place of publication

Level	Frequency	Percent
Arabic	129	4.40%
Foreign	190	6.59%
Total	319	100%

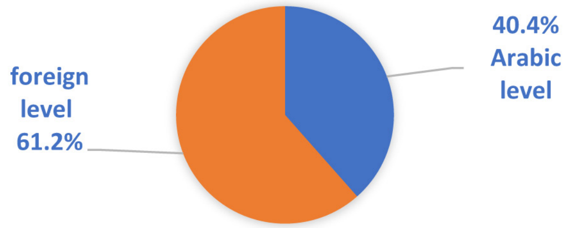

Fig. 1. Percentage of research by language of publication

The most important axes covered by the modeling method

The study covered four main axes, with each axis divided into several sub-fields or sections:

First axis: Field of Engineering Sciences

Table 3 shows that the analyzed data results demonstrate the researchers' interest in applying modeling in their research. The number of studies that dealt with modeling in the engineering field was (28), while the percentage for the current sample was (8.7%) of the total; it included five main fields: Civil, Electrical, Architectural, Computer, and Manufacturing. The results are similar to "Mahmoud" and "Zarubin" studies on using modeling in engineering [29, 30].

Table 3

Data from studies in the first axis for the field of engineering

N	Engineering departments	Types of modeling	Methodology	Publication year				Arabic Country		Foreign Country		Total
				2020	2021	2022	2023	F	%	F	%	
1	Civilian	1- Numerical	Analyze	2	1	–	3	2	7.1	4	14.3	6
		2- Computerization	Analyze	1	–	2	3	1	3.6	5	17.9	6
2	Electrical	3- Computerization	Descriptive	–	1	2	–		–	3	10.7	3
3	Architectural	4- Advanced	Descriptive	–	1	1	2	2	7.1	2	7.1	4
		5- Parametric	Analyze	1	–	–	2	1	3.6	2	7.1	3
4	Computers	6- Digital	Descriptive	1	–	1	2	2	7.1	2	7.1	4
5	Manufacture	7- Theory	Analyze	–	1	–	1	1	3.6	1	3.6	2
Total \ total percentage		28	8.7%	1.6%	1.3%	1.9%	1.4%	9	32.1%	19	67.9%	100%

The number of foreign studies was (19), with (67.9%) percent, while the studies in Arab countries were (9), with (32.1%) percent. The study of "Bibikhov" and "Fan" within the geometry axis also pointed to the role of modeling in conducting engineering research [31, 32].

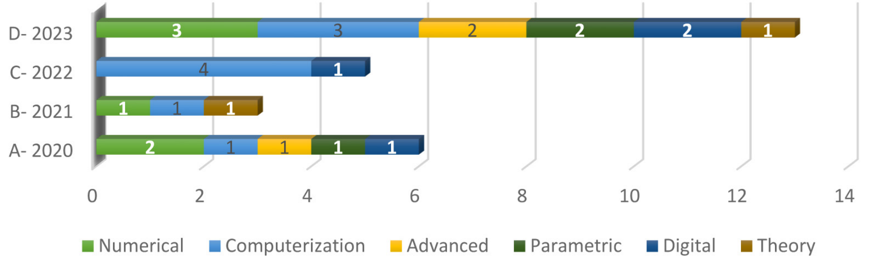

Fig. 2. Path of research in the field of engineering sciences in the period (2020–2023)

The research methods used in the field of engineering vary between analytical and descriptive. As for the place of study, we find that studies and research abroad in this field are superior to studies conducted in Arab countries.

Figure 2 shows that the number of studies that used modeling in engineering increased by (4.1%) in the year (2023), followed by the year (2022), which ranks second with (1.9%) in terms of the number of studies observed by the researcher. At the same time, the modeling used in the studies on this axis was divided into (6) categories: (numerical, computer, advanced, parametric, numerical, and theoretical). Numerical modeling included (6) studies, and computer modeling received (9) studies. This axis has the highest percentage of studies, which indicates a scientific interest at the Arab and foreign levels in the use of modeling in engineering and various sectors.

Second axis: the field of natural and applied sciences

The extrapolation in Table 4 shows the variety of areas in which modeling is applied in the educational process. The studies amount to (72) studies in which modeling has been applied in areas of natural and applied sciences, which represents (22.6%) of the total number of current research examples and includes (5) areas: (biology, mathematics, physics, mathematics, and chemistry).

As for the location of the studies, a total of (32) studies were conducted in Arab countries, which represents (44.4%) of the total number of studies (72) in this axis. In comparison, the number of foreign studies amounted to (40), representing (55.6%).

Figure 3 shows that the share of research with modeling in the natural and applied sciences reached (8.5%) in the year (2023). And in the year (2022) it was in second place with a growth rate of (8.2%). While the rate of the year (2021) is (5.9%) in terms of the total number of studies on this topic, the year (2020) is in last place with (5.6%). This shows us that modeling is increasingly used by researchers and interested parties in this field. There are (11) types of modeling for this axis: (mathematics, electronics, numerics, physical numerics, physics, and mathematics). "mathematical modeling" accounts for the largest share of applications in scientific research. (27) Studies have been observed that are split between the natural sciences and the applied sciences (biology, mathematics, and chemistry). This suggests that researchers are more interested in it than in other fields (i.e., natural and applied sciences).

Table 4

Data from the studies in the second axis for the field of natural and applied sciences

No	Dept. natural & applied sciences	Types of modeling	Methodology	Publication year				Arabic Country		Foreign Country		Total
				2020	2021	2022	2023	F	%	F	%	
6	Biological	1- Sports	Analyze	2	1	1	4	2	2.8	6	8.3	10
7	Sports	2- Electro-nic	Experimen-tation	–	–	1	1	1	1.4	1	1.4	2
8	Physics	3- Nume-rical	Experimentation	–	1	3	4	3	4.2	5	9.6	7
		4- Physical numerical	Experimentation	–	3	1	2	4	5.6	2	2.8	6
		5- Physical	Experimentation	2	1	–	1	2	2.8	2	2.8	5
9	Mathematics	6- Physical and sports	Experimentation	3	1	1	3	4	5.6	4	5.6	11
		7- Sports	descriptive	2	1	4	3	2	2.8	8	11.1	12
		8- Mathe-matic	descriptive	1	–	4	2	7	9.7	–	–	14
10	Chemistry	9- Mole-cular	Analyze	–	2	–	1	2	2.8	1	1.4	5
		10- Thermal	Analyze	2	3	3	–	3	4.2	4	5.6	10
		11- Sports	Analyze	3	2	4	–	2	2.8	7	9.7	2
Total \ total percentage		72	22,6%	5,6%	5,9%	2.8%	8,5%	32	44,4%	40	55,6%	100%

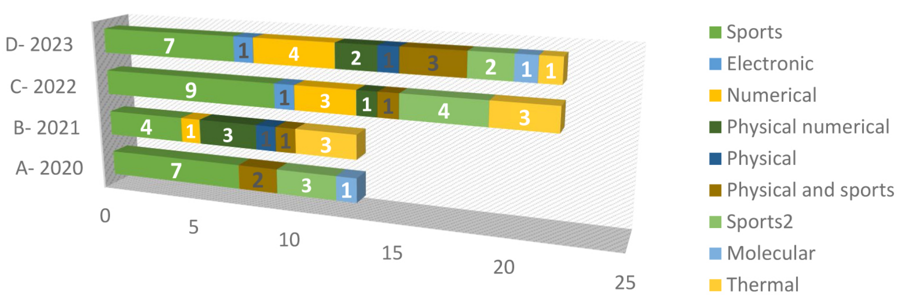

Fig. 3. Research path in the field of natural and applied sciences (2020–2023)

Third axis: field of humanities and social sciences

From Table 5, we can see that the humanities and social sciences field is characterized by a greater degree of modeling in the educational process. There are (96) studies, corresponding to (36.9%) of the total research sample. The axes include (8) major areas: (agriculture, economics, commerce, geography, sociology, psychology, sports and religion). A total of (37) studies were conducted in Arab countries, representing (44.4%) of the total number of studies in this axis, compared to foreign studies, which amounted to (96) studies in different fields. This corresponds to (59) studies, which is a ratio of (61.5%). Komissarov's findings highlight the effective role of modeling processes in the humanities compared to foreign studies [33].

Table 5

Data on third axis studies in the humanities and social sciences

No	Dept. humanities & social sciences	Types of modeling	Methodology	Publication year				Arabic Country		Foreign Country		Total
				2020	2021	2022	2023	F	%	F	%	
11	Agriculture	1- Spatial	Analyze	2	1	1	4	2	2.1	2	2.1	4
12	Economics	2- Electronic	Experimentation	–	–	1	1	1	1	1	1	2
13	Commerce	3- Numerical	Experimentation	–	1	3	4	3	3.1	5	5.2	8
		4- Physical numerical	Experimentation	–	3	1	2	1	1	2	2.1	3
14	Geography	5- Mechanism	descriptive	–	1	1	–	1	1	1	1	2
		6- Spatial	Analyze	1	1	1	–	3	3.1	7	7.3	10
		7- Sporting	Analyze	2	2	2	3	5	5.2	9	8.4	11
		8- Cartography	Analyze	2		1	3	3	3.1	4	4.2	7
		9- Cartography	Analyze	1		3	–	2	2.1	2	2.1	4
		10- Geospatial	Analyze	1	–	–	1	1	1	1	1	2
		11- Digital	descriptive	–	–	2	1	1	1	2	2.1	3
		12- Interactive	Semi-experimental		2	2	1	2	2.1	3	3,1	5
		13- Carto-graphic	Analyze	2	1	1	2	1	1	3	3.1	4
15	Sociology	14- Construc-tivism	Analyze	–	1	2	3	2	2.1	4	4.2	6
16	Psychology	15- Construc-tivism	Analyze	1	1	1	3	1	1	2	2.1	3
		16- Psycho-logy	Analyze	–	2	3	–	2	2.1	3	3.1	5
17	Sports	18- Sports	descriptive	2	3	3	4	5	5.2	6	6.3	11
18	Religion	19- Sectaria-nism	Semi-experimental	1	–	2	–	1	1	2	2.1	3
Total \ total percentage		96	36,9%	4,7%	6,1%	9,4%	10,4%	37	44,4%	59	55,6%	100%

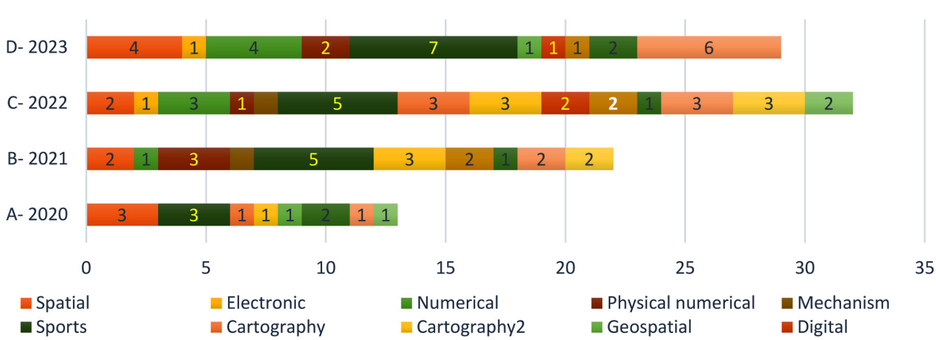

Fig. 4. Research path in the humanities and social sciences (2020–2023)

Figure 4 shows that the percentage of studies that used modeling in this axis has gradually increased, as the percentage of studies in the year (2020) reached (4.7%), followed by the year (2021) with a percentage of (6.1%), then the year (2022) with a percentage of (9.4%) and finally the year (2023) with (10.4%).

As for the types of modeling, they have also distinguished in this axis in (19) types, which are: (spatial, electronic, numerical, physical-numerical, mechanical, mathematical, cartographic, cartographic, geospatial, digital, interactive, cartographic, structural, psychological and doctrinal). "mathematical and structural" modeling received high rates in terms of its application in human and social sciences, as (21) studies on mathematical modeling and (12) studies on structural modeling were observed in the fields (geography and sports), and this shows the importance of mathematical and structural modeling in these two areas.

Fourth axis: field of education

In Table 6, we note that the field of education is more comprehensive and diverse than other topics dealing with the application of modeling in educational processes, as the total number of studies reaches (123) studies. The proportion of the total study sample (38.6%). This axis includes (10) different areas, namely (Secondary Education, Research and Studies Department, Kindergarten, Chemistry, Mathematics, Physical, Arabic language, English language, and Educational Technology). With the exception of the Department of Educational Research and Studies, which uses analytical methods, all studies on this topic follow experimental research methods.

Table 6

Data from studies of the fourth axis for the area of education

N	Dept. Education	Types of modeling	Methodology	Publication year				Arabic Country		Foreign Country		Total
				2020	2021	2022	2023	F	%	F	%	
19	Secondary Education,	1- Structural	Analyze	1	2	1	–	2	1.6	4	3.3	6
20	Research and Studies Department	2- Constructivism	Analyze	–	1	–	2	1	0.8	2	1.6	3
21	Kindergarten	3- Educational	Experimentation	–	2	1	–	1	0.8	2	1.6	3
22	Chemistry	4- Experimental	Experimentation	1	2	1	3	2	1.6	5	4.1	7
23	Mathematics	5- Three-dimensional numerical	Experimentation	2	2	2	3	3	2.4	4	3.3	7
		6- Cognitive	Experimentation	1	2	1	4	3	2.4	5	4.1	8
		7- Sports	Experimentation	2	1	1	5	4	3.3	5	4.1	9
24	Islamic teaching	8-Modeling strategy	Semi-experimental	–	2	1	1	1	0.8	3	2.4	4
		9- Cognitive	Experimentation	2	1	1	2	2	1.6	4	3.3	6

End of Table 6

N	Dept. Education	Types of modeling	Methodology	Publication year				Arabic Country		Foreign Country		Total
				2020	2021	2022	2023	F	%	F	%	
25	Sports methods	10- Modeling strategy	Experimentation	2	–	3	4	4	3.3	5	4.1	9
		11- Subjective	Experimentation	1	–	3	4	3	2.4	4	3.3	7
		12- Sensory	Semi-experimental	1	3	2	3	3	2.4	3	2.4	6
		13- Modeling strategy	Experimentation	1	1	3	4	4	3.3	5	4.1	9
26	Arabic language	14- Video	Semi-experimental	2	1	–	2	1	0.8	4	3.3	5
		15- Modeling strategy	Experimentation	–	1	1	2	2	1.6%	2	1.6	4
27	English language	16- Educational environment	Experimentation	1	2	2	2	2	1.6%	3	2.4	5
28	Educational technology	17- Vocational education	Experimentation	1	–	1	2	1	0.8%	3	2.4	4
		18- Games	Semi-experimental	2	1	2	–	2	1.6	3	2.4	5
		19- Modeling techniques	Semi-experimental	–	2	–	2	2	1.6	2	1.6	4
		20- Simulation models	Semi-experimental	2	2	2	2	3	2.4	5	4.1	8
		21- Information	Semi-experimental	–	2	1	1	1	0.8	3	2.4	4
Total \ total percentage		123	38.6%	6.6%	8.2%	9.4%	14.4%	47	38.2%	76	61.8%	100%

The studies conducted in the Arab countries amount to (47) studies, i.e. (38.2%) of the total number of studies counted in this axis, which amount to (123) studies in different fields, compared to foreign studies, which amount to (76) studies, i.e. (61.8%). This shows this field's superiority in applying modeling through pedagogical research and studies. Denisenko's study confirms this effective role of modeling [34].

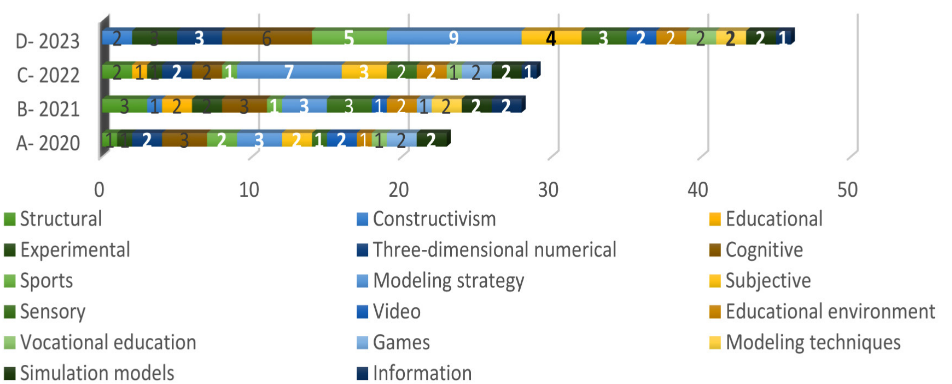

Fig. 5. Research Path in the field of Education Sciences (2020–2023)

Figure 5 shows the research path using modeling in education, which has grown exponentially as the percentage of research reached in 2020 (6.6%). This is followed by the year (2021) with a growth rate of (8.2%). Then the growth rate in the year (2022) is (9.4%). In the last year (2023), the growth rate is (14.4%). The modeling types in this axis are divided into (21) categories, namely: (structural, constructive, education, experimental, three-dimensional numerical, cognitive, mathematical, modeling strategy, subjective, sensory, video, educational environment, professional training, games, and modeling techniques, simulation modeling and information). The "Modeling strategies" accounted for the largest proportion of studies applied in education (22 studies), followed by "cognitive modeling" (15 studies).

Research result

First: Topics and areas of modeling as a research method:

Table 7 shows the superiority of the education field over other fields in terms of research and the use of modeling in research, as the number of studies in this field reaches (123), which corresponds to (38.6%). This is a clear sign of the increasing use of modeling and a metric that should be considered when promoting the use of modeling in education in the future. The humanities and social sciences follow, with a slight difference. The number of studies is (96), and the corresponding proportion is (30.1%), followed by the natural and applied sciences. The number of studies in the natural and applied sciences is (72), while engineering is in last place with (28) study programs and a share of (8.8%). See Figure 6.

Table 7

The total number of topics and areas related to modeling in the studies

N	Axis	Fields	Topics of modeling	Arab level	Foreign level	Total of Studies	
						F	%
1	Engineering Sciences	5	7	9	19	28	8.8
2	Natural and Applied Sciences	5	11	32	40	72	22.6
3	Humanities and Social Sciences	8	19	37	59	96	30.1
4	Education	10	21	47	76	123	38.6

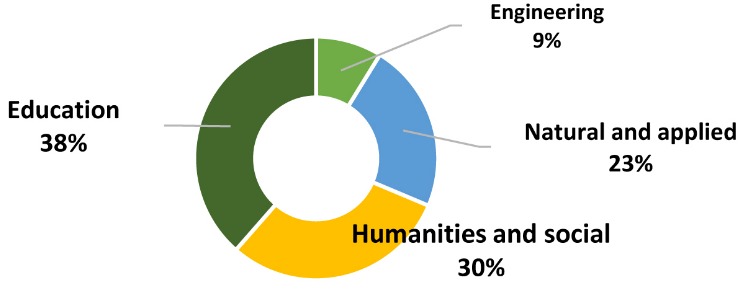

Fig. 6. The proportions of studies for fields of study

Second: Methods used in research that apply modeling methods:

From the extrapolation of Table 8, we can see the diversity of the methodology of the studies that have addressed the topic of modeling in (4) types of research, namely: (experimental, quasi-experimental, analytical, and descriptive), and since most of the studies that have used modeling as a research method are studies in the field of education, compared to studies in other scientific fields, despite their diversity. Experimental research and studies had the highest percentage (39.2%) compared to other studies, followed by studies with an analytical approach with a percentage of (32%), while studies with a descriptive and quasi-experimental approach were close to each other (14.1–14.7), as indicators of an increasing interest of researchers in the field of education in the use of modeling.

Table 8

Distribution of studies by research methodology

Years	Methodology								Total
	Experimental		Quasi-experimental		Analytical		Descriptive		
	F	%	F	%	F	%	F	%	
2020	20	6.3	8	2.5	21	6.6	6	1.9	55
2021	23	7.2	15	4.7	18	5.6	7	2.2	63
2022	32	10	12	3.8	25	7.8	18	5.6	87
2023	50	15.7	12	3.8	38	11.9	14	4.4	114
Total	125	39.2%	47	14.7%	102	32%	45	14.1%	319

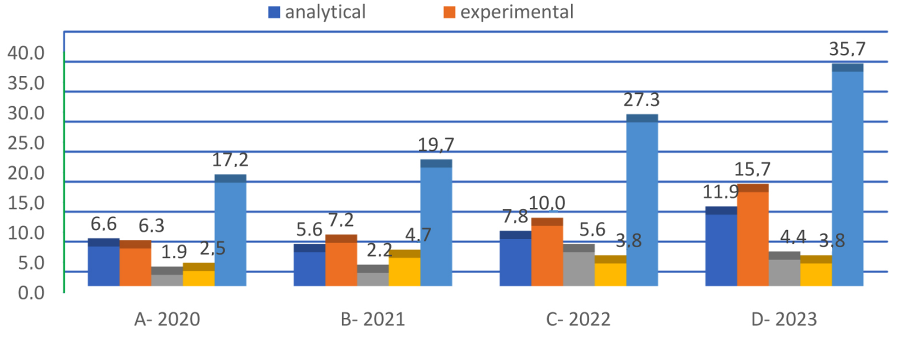

Fig. 7. Percentage distribution of studies by research methodology

As seen in Figure 7, the studies are distributed chronologically by the methods used to create the studies and by the studies that used modeling in their procedures. We also noted a change in the density of research on modeling topics over the last four years as the number of published research papers gradually increased so that in 2020, there were (55) studies that accounted for (17.2%) of the total number of studies in the sample. Subsequently, there was a slight increase in the number (63) or proportion (19.7%) of studies in 2019. In 2022, the number of studies increased significantly compared to the previous year, with a number of (87) or a share of (27.3%). Finally, in 2023, the number of studies increased significantly (114), which corresponds to a share of (35.7%) of the total number of studies. This shows that researchers are increasingly interested in using modeling as a research method in these areas. This significant increase sheds light on the research methods and the possibilities of using modeling in practice, especially in education. The current study results show that Arab and foreign researchers are increasingly interested in using modeling to solve specific problems in education and other disciplines. In particular, the role of modeling and its importance in science and human studies. The current study highlights the weaknesses of using methods other than experimental, descriptive, and analytical methods. The current study's results help identify pathways for modeling's application in the broader scientific and educational fields. The results provide an overview of the main methods used in research and the studies that use modeling in their procedures. The results of this study can be generalized to the extent that this sample represents studies and research.

Recommendations for further research

– Conduct further research and studies to observe modern trends in the use of modeling in educational processes.

– Apply the modeling process to a broader scope and time period to identify differences in the use of models in the past and present.

– Researchers and individuals interested in the topic of modeling can benefit from the results of the current study and apply modeling to other areas.

– The study is not limited to the researcher's experience and addresses the latest research findings and trends in the field of modeling applications for future study and research.

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АНАЛИЗ ТЕНДЕНЦИЙ ПРИМЕНЕНИЯ МОДЕЛИРОВАНИЯ В ОБРАЗОВАТЕЛЬНОМ ПРОЦЕССЕ НА ПЕРИОД 2020–2023 гг.

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Аннотация. Идеи данного исследования обобщены в процедуре справочного обзора тенденций применения процессов моделирования в арабском и зарубежном образовании за этот период (2020–2023 гг.). Исследование придерживалось описательного подхода и представило концепции моделирования и области исследований, рассматриваемые на разных языках, а также определило наиболее важные модели, используемые в образовательном процессе, на основе следующих глобальных баз данных: (Google Scholar), elibrary.ru, Scopus... и т.д.). Исследование включает в себя (319) арабских и зарубежных исследований, включающих ограничения и числовые, качественные и методологические классификации за период с 2020 по 2023 год. Исследование раскрывает важнейшие тенденции использования моделирования как метода исследования. В исследовании также представлен набор моделей, используемых в образовательном процессе. Есть надежда, что анализ тенденций поможет определить области и сектора, которые используют моделирование для решения образовательных и научных проблем. Исследование показывает ряд результатов, оценивающих это исследование, которые могут помочь исследователям в этой области принять процесс моделирования в качестве метода исследования.

Ключевые слова: *Моделирование, Методы моделирования, Процедура моделирования, образовательный процесс*

Для цитирования: Ghazi Hussein Taan Albayati. Analysis of the Modeling Applications' Trends in the Educational Process for 2020–2023 // Education & Pedagogy Journal. 2024. Issue 3 (11). P. 5–22. doi: 10.23951/2782-2575-2024-3-5-22

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Submitted December 27, 2023

UDC 374(091)
DOI: 10.23951/2782-2575-2024-3-23-38

HISTORICAL AND PEDAGOGICAL BACKGROUND OF EDUCATIONAL ACTIVITIES IN MIXED-AGE GROUPS

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Abstract. The author examines the historical presence of educational activities in mixed-age groups. This topic is relevant because many pedagogical practices from the pre-revolutionary and Soviet periods are being reintroduced in modern Russia. For example, collectivism, traditionally valued in the Soviet Union, was officially recognized as a national value in Russia in 2022, which underlines the need for a renewed scientific study of the various forms and types of collective activities, including in the field of education. The educational aspect of mixed-age group activities has significant development potential. The effectiveness of collective education can be improved by organizing interactions between participants of different ages, creating a more realistic model of a diverse society.

A problem-oriented analysis of the scientific literature has shown that mixed-age groups are considered an educational tool for moral and social development, especially by specialists in psychology and pedagogy. This view underlines the importance of examining the empirically developed elements of education within these groups through which educational work has been carried out in practice. The focus, therefore, shifts to understanding how these elements of learning, originally intended to promote character and social values, also contributed to wider educational outcomes. In this context, it becomes clear that in modern pedagogy, where participants re-evaluate the historical experiences of their predecessors, mixed-age groups emerge with a clear focus on education rather than character development.

Nevertheless, the development of such mixed-age groups also requires recourse to the accumulated historical and pedagogical foundations for the implementation of certain pedagogical elements. This foundation enables the formalization of preconditions – such as voluntariness, the existence of an internal hierarchy (e.g., 'ranks'), productive activities, simultaneous development in multiple environments, and diversity of forms, means, and methods – that align collectivity, pedagogical goals, and mixed-age composition in a way that is still relevant today. By drawing on this historical foundation, educators can better integrate these elements to develop pedagogical practices that are both effective and appropriate for today's context.

Keywords: *educational activity, history of extra-training pedagogy, extra-training education, supplementary education, children's movement, theory of collectivity, mixed-age group*

For citation: Lobanov V.V. Historical and Pedagogical Background of Educational Activities in Mixed-Age Groups. *Education & Pedagogy Journal*. 2024;3(11):23-38. doi: 10.23951/2782-2575-2024-3-23-38

Identifying potential educational activities in mixed-age groups is crucial for understanding collective practices in modern Russia. According to M. Boguslavsky, Russian education today actively draws on historical and pedagogical knowledge [1, p. 372], including collectivism, which the Russian government recognizes as a traditional value. We distinguish between pedagogical activities within mixed-age groups and pedagogical activities of mixed-age groups. The former refers to individual, group, or collective participation in the educational process, while the latter describes the group's efforts to engage its members in socially oriented educational activities appropriate to their developmental stages. A mixed-age group is seen as an actor engaging in activities beyond traditional teaching and character education. Therefore, the analysis focuses on educational activities not in school classes but in Socio-pedagogical, Scout, Pioneer, Komsomol, and Communarstvo, as well as extra-training and Society for the Promotion of Physical Development.

Voluntary educational activities in mixed-age groups became popular at the turn of the 19th and 20th centuries. During this period, several works on extra-training education were published by renowned specialists such as V. Vakhterov (1896), V. Ladyzhensky (1902), V. Charnolusky (1913), E. Medynsky (1913, 1915, 1916) and V. Nevsky (1917).

These recommendations were extensively tested by societies that promoted both extra-training education and physical development (P. Lesgaft, V. Pirussky). The analysis of the relevant books and documents shows that voluntary pedagogical groups of adults of different ages were formed in extra-training education. However, the student groups were mixed-age groups rather than collectives. Committed educators had to take into account the age-specific characteristics of children and adolescents [2, p. 61].

During the Soviet period, researchers focused primarily on the pedagogical activities of mixed-age groups intentionally created by educators to fulfill normative tasks within the formal education system (S. Shatsky, A. Makarenko, L. Novikova, T. Konnikova, L. Bozhovich, V. Sukhomlinsky). However, most of these communities, from Makarenko's squads to Konnikova's school communities, had only a limited potential for subjectivity. Researchers also focused on legally formal and seemingly totalitarian practices, but, in reality, informal and non-totalitarian (A. Mudrik). These practices were often associated with the Pioneer, the Komsomol, and Communarstvo (I. Ivanov, L. Umansky, A. Lutoshkin, and others). Key factors in the social success of these groups included voluntary membership, self-government with the General Assembly as the supreme authority, a diverse and multidisciplinary approach to activities, and compensation for shortcomings in the official education system, which was widely accepted in society.

Modern research (by L. Bayborodova, M. Rozhkov, L. Krapivina, B. Kupriyanov, B. Deych, and others) shows that today's practice in mixed-age groups is largely based on methods proposed by Soviet scientists and supporters of children's movements.

Current pedagogical science has a solid understanding of methods for developing mixed-age groups as communities that solve educational tasks together but are not involved in strategic goal setting. Examples of this are school communities. However, there is no clear description in the literature of the conditions that enable a mixed-age group to become a true community through pedagogical activities in which members are actively involved in setting their own goals for functioning and development. The aim of this study is to identify these conditions based on an analysis of historical and pedagogical experiences.

The main results of this study are presented on the basis of the development of educational activities in mixed-age groups and communities. In collaboration with V. Revyakina, we found that CAS activity clubs that promote physical development bring enthusiasts together to support the holistic development of children and adults [3]. This was achieved through educational guidance in sports facilities and health education camps. Participants who excelled often became organizers and took on an important role in other educational activities. Different settings served as temporary backdrops for these mixed-age groups, which dealt with different topics. In Tomsk, for example, the same children could visit different venues, participate in seasonal camps, and learn at the ‘Razvitie’ school (center for personal development). The value of a varied, extra-training education was widely recognized in the pre-revolutionary period, as school time was seen as short and too focused on completing the compulsory curriculum.

The pre-revolutionary initiatives of S. Shatsky are remarkable examples of social and pedagogical practices. He proposed a classical interpretation of a children’s club: “The main idea of a children’s club is to create a center where children’s lives are organized based on the needs arising from their nature. Typically, children’s institutions are organized according to the requirements imposed on them by society and the state, without taking into account the child’s needs” [4, p. 258]. S. Shatsky has drawn up a list of children’s ‘instincts,’ which can be summarized as follows: Sociability and the desire to communicate, the urge to know, the thirst for creativity, self-actualization and self-fulfillment, and the tendency to follow role models [5, p. 123]. Sociability corresponds to the communicative aspect of the activity; the pursuit of knowledge can be seen as a prerequisite for subsequent creative work, and the desire to emulate patterns of behavior in pedagogical practice is only realized when there is respect for the leader or active members. Of particular value is Shatsky’s idea that children’s work should be both instructive and productive.

S. Shatsky argued that the ‘old pedagogy’ shaped children’s lives according to adult standards, emphasizing the accumulation of knowledge and “strove to bring children into stable, strictly regulated molds” [6, pp. 40–41]. Shatsky, therefore, criticized the approach of exposing children to rigid educational content that cannot even be changed by teachers, resulting in a lack of development of children’s agency. In contrast, Shatsky suggested creating an environment that focuses on the most important elements of life: physical work, play, art, and intellectual activities [4, p. 259].

S. Shatsky’s commitment to the idea of mixed-age collectivism in education is also evident: “...one should think not only of a community of children but of children and adults" [4, p. 266]. This view was shared not only by Shatsky but also by his colleagues such as A. Zelenko, M. Poletaeva, and N. Massalitinova [7]. Shatsky understood the connection between school education and social development and considered collective or collaborative learning as the foundation for future joint work. He defined mixed-age teaching in the sense that age groups do not necessarily correspond to grade levels [6, p. 55].

In the Soviet Union, club activities served as the foundation for mixed-age educational practices. In the Dzerzhinsky community, schooling was compulsory, and A. Makarenko organized primary school groups based on production activities. However, an educational agency was allowed within the framework of club activities organized by V. Tersky, which is similar to S. Shatsky's. Tersky noted that the clubs "united children, teachers, and staff in a common cause, although each child participated in the activities according to their interests and inclinations. Society for the Promotion of Physical Development were organized into one club" [8, p. 74]. The educational activities reflected in the programs and plans were shaped by pedagogical requirements and the specific interests and hobbies of the children and the clubs, resulting in constant change. This allowed the clubs to change their own goals and content.

In the 1930s, A. Makarenko emphasized the role of club activities in improving the industry. The diverse orientations of clubs made them valuable resources for promoting inventive, project-related, work-related, creative, and organizational activities among children and youth. In terms of the suitability of educational activities, it was significant that younger children (ages 8–14) in Makarenko's community had their own group in which they could work in age-appropriate ways. These younger children could participate not only in general production but also in a free workshop that allowed for individual creative work and various clubs. In Makarenko's institutions, both younger and older children could thus become active through educational activities in clubs.

In the 1930s, A. Makarenko increasingly focused club activities on improving the industry. The different directions of club activities can be seen as resources for inventive, project-related, work-related, creative, rationalizing, and organizational-managerial activities of children and youth. Regarding the feasibility of educational activities, it was particularly valuable that the younger children (8–14 years) in Makarenko's community had their own group working at a level appropriate to their age. These younger children could work not only in the general production environment but also in a free workshop that allowed for individual creative work and participation in various clubs and interest groups.

The humanistic and creative work-oriented pedagogical approach in Makarenko's club activities may have been influenced by his lesser-known adoption of scouting practices [9, p. 194], which were not widely recognized during the Soviet period. The Scout movement provided children with stimulating activities such as long-term play, experiential learning, careers, and the development of practical life skills. However, in pre-revolutionary Russia, these practices were not fully realized when the movement began, nor could they successfully merge with the traditional ‘poteshnye’ groups. Instead, scouting practices merely supplemented formal schooling, as evidenced by the ‘Iron Law,’ which provided for the exclusion of low-performing students from the scouts.

In this context, the educational activities of the Scouts were seen as a means to achieve the goals of an organization created by adults for children. However, the interactions within this system were structured in a playful way, which encouraged the interest of the older children in teaching the younger ones. The mixed-age nature of educational activities is evident in the ranks of the Boy Scouts, where, as R. Baden-Powell envisioned, an instructor could be a youth or an adult responsible for training a patrol of 6 to 8 Scouts or even a squad consisting of several patrols [11, p. 1]. Some of these 6–8 boys would eventually lead their own patrols. Training (scouting skills) could be acquired by any scout to any extent, and there was a rank ladder that included levels such as Cub Scouts, Boy Scouts, and Rovers. In other words, developing a Scout’s personality involves the growth of knowledge, skills, authority, and responsibility.

Scouting education aims to develop skills for learning and living without being associated with formal schooling. According to N. Krupskaya, “Every Scout must master a specialty... Examinations are held for such qualifications as a basket weaver, beekeeper, blacksmith, boatman, trumpeter, carpenter, cook, electrician, translator, laundress, gardener, and others” [13, p. 26]. In addition, the Scouts often organized various vocational training courses in their clubs, further enhancing the educational value of their activities.

The Scouts’ successes in promoting mixed-age group activities were so significant that they could not be ignored, even though the Soviet leadership after 1918 viewed Scouting as a tool to enforce “obedience to the king, parents, and employers” [13, pp. 17–18]. Nadezhda Krupskaya supported the Scouts’ approach and emphasized that “only the ideals of an adult, which a youth can embrace with all the enthusiasm of youth, can truly captivate them” [13, p. 21]. She repeatedly emphasized the tremendous power of the ideals and rules of Scouting in the process of personal development. “The instructor guides the boys through a series of stages, with each Scout understanding how their individual goals relate to the overall goal” [13, p. 26]. This suggests that the goal cannot be separated into pedagogical and child-centered components in a true mixed-age group.

Several aspects of Scouting were adopted by the Pioneer organization founded by the Komsomol to introduce unique forms and methods for working with youth in a non-scouting movement. Even before a youth organization was founded in the country, Nadezhda Krupskaya developed and presented a draft charter for the Union of Working Youth of Russia in 1917. The draft envisaged the Union as a mixed-age organization comprising boys and girls, young men and young women (§ 1). Its activities included universal, free compulsory education up to the age of 16, establishing libraries, reading rooms, and scientific cinemas, and self-organized youth CAS activities, clubs, and excursions [14, p. 30]. This list indicates an attempt to reproduce the familiar tradition of extra-training education, enriched with a socio-political aspect. However, unlike older youth, teenagers were probably unable to participate fully in adult-oriented formats.

As early as 1922, Nadezhda Krupskaya identified shortcomings in the organization of work with children and young people. She pointed out that the Komsomol imitated the structure and activities of the Bolshevik Party, which were often too demanding and uninteresting for young people. The Komsomol also did not offer the playful elements that young people wanted, which could prepare them for collective action through small tasks. A year later, however, Krupskaya had to clarify her position: "I did not want to say that our task is only to play and learn, not to reshape life; you are only children, so stay away from where you are not wanted" [13, pp. 4–5]. The lack of appeal of the Komsomol formats for many members of the Russian Communist Union of Youth (RCUY) led to the emergence of a unified Pioneer organization in Soviet Russia, even though the first children's groups were founded without instructions from the party or the Komsomol. Immediately after the October Revolution, "children's organizations, clubs, and conferences began to emerge under the banner of non-partisanship" [15, p. 88].

As young people's interest in socio-political life drew them to the Scout movement, the Communist Party and the Komsomol began to look for attractive alternatives after the Scouts were banned in 1923. Following an analysis of the emerging communist children's movement (clubs, squads, groups), the Fifth Congress of the RCUY in October 1922 endorsed "the organization of children in Young Pioneer squads as the most suitable form" [15, p. 60]. The Komsomol organized the first meeting of pioneer squads on February 13, 1922, in Moscow, and on May 19, the all-Russian Komsomol conference decided to establish squads in all the towns and villages of the country.

In 1923, Nadezhda Krupskaya, who had become a prominent theoretician of the children's movement, described the Young Pioneers as a communist organization for boys and girls aged 11 and up whose aim was to promote a sense of collectivism [16, p. 93], albeit using different methods and forms than in the adult organizations [16, p. 94]. Krupskaya emphasized collective and self-directed projects, games, and working for the good of society as key activities. She emphasized the need for "less drum roll and more concentrated work" [17, p. 105]. This view was reiterated a year later by People's Commissar (Minister) Anatoly Lunacharsky, who saw the Pioneers as a solution to the problems of school discipline – as a pedagogical tool – and emphasized that "every teacher must understand that the Pioneer movement can comprehensively address all their pedagogical problems and that only it can solve these challenges" [18, p. 206].

By 1924, the communist youth groups had grown to around 200,000 members, leading to a "further consolidation of organizational leadership by the Komsomol and closer ideological ties to the party and social organizations" [15, p. 66]. The age limit for membership in the children's organization was raised to 16, and the Komsomol leadership decided to establish training courses and clubs for overseers (Pioneer leaders – a clear allusion to the Boy Scouts) and to involve younger Komsomol members in Pioneer activities.

By 1927, Nadezhda Krupskaya's originally less didactic approach to the Pioneers had also changed. In addition to entertainment, games, and work, she emphasized the importance of collective learning by involving all children, not just the most active ones, in activities such as group reading, excursions, and the publication of brochures [19, p. 206]. According to Krupskaya, this marked a division of the Pioneers' educational activities into in-school and out-of-school activities, including extra-training programs.

The literature indicates that after 1932, as Pioneer Squads became more popular in schools, teachers began to use the organization to artificially link academic success to the goals of the Pioneer movement to improve student achievement. In his text, V. Krapivin writes, "At the Pioneer Squad meeting ... every student who is failing is asked to make their Pioneer pledge to improve their grades. And they agree, only to be dismissed early" [20]. This approach is also supported by instructional guidelines from the 1950s, in which principals are encouraged to strengthen the role of Pioneer Squads "in the struggle for high academic achievement and discipline" [21, p. 15]. Consequently, extra-training educational activities, especially those initiated by students, lost value. Pioneer leaders were expected to rely on external models to organize club and work activities, such as the "Steps of a Young Pioneer" introduced in 1958 [21, pp. 6, 67]. This limited the ability of Pioneers to take an active role in their own extra-training education. From the 1960s through the 1980s, student interest in school-based Pioneer activities declined due to the growing gap between student and educator goals. This led students, especially boys, to reject leadership positions in Pioneer squads and contributed to the emergence of various extra-training groups for children, adolescents, and young adults. Some of these groups were truly collective in nature and engaged in various forms of educational activities. A notable example is the experience of the Pioneer headquarters of the city of Tomsk, which O. Pirozhkov founded after studying the practices of the Pioneer headquarters of the Kuibyshev district in Moscow. This headquarters developed pedagogical practices that encouraged the development of Pioneers as active participants and focused on the Pioneer community, such as seasonal schools and camps for Pioneer leaders.

As Z. Ravkin and T. Ignatieva noted, the work of Pioneer squads was seen in school pedagogy as a tool for promoting students' social activity, where the emphasis was not on individual agency. In the 1950s, however, specialized squads were formed on the Pioneers' initiative. These squads were sometimes concerned with local history or nature study, but more often, they were militarized. Overly independent groups, such as the Young Friends of the Border Guards, Young Friends of the Soviet Army, and Young Dzerzhinsky Followers, were gradually phased out of actual activities and, in some regions, existed only in reports. Nonetheless, they served as examples of the emergence of voluntary and, to a certain extent, self-directed collectives within the Pioneer organization, which differed from the more formal groups in the schools.

According to R. Nemov, the goals of these formal groups were "imposed from the outside, based on the tasks of the organization to which the group belonged" [23, p. 531].

Based on the research of E. Shteinberg [24, pp. 19–22], it can be said that the ability of the Pioneers and their squads to act was largely restricted by directives from higher Komsomol bodies, which in turn followed the decisions of the Communist Party. This meant that the members of the primary Pioneer collectives were essentially excluded from determining the basis and direction of their activities. Virtually all students joined the Pioneer organization, effectively undermining the principle of voluntary membership. In this context, Z. Ravkin and T. Ignatieva have rightly pointed out that the pursuit of mass participation is a key factor contributing to significant shortcomings in the work of children's organizations [22, p. 234]. Only the extra-training groups, as E. Shteinberg, correctly noted, "preserved the principle of individual initiative as a conscious activity of children and youth who voluntarily joined the organization and actively participated in it" [24, pp. 22–23]. A characteristic feature of these groups was the presence of 'rank ladders,' which reflected the status of participants within the group and, in some ways, mirrored the experiences of the Scout and early Pioneer movements. Examples include the Victoria Musketeer Club (Novosibirsk), with its ranks of militiamen, musketeers, and captains, and the Karavella Squad (Sverdlovsk), with titles ranging from novice to commander and others.

Thus, the members of V. Krapivin's Karavella Squad emphasized the difference between the status of a student and a Pioneer: "In class, you are used to doing what the teacher says... But in the squad, you have to make your own decisions. ... The squad is part of the Pioneer organization and is for kids, which means it's your own organization!" [25, pp. 15–16]. Life in Karavella contrasted with the customs at school, where leaders were often chosen by teachers based on academic performance: "It is very good if someone is an excellent student and has great discipline, but that is not the only reason why someone is chosen as a leader" [25, p. 16].

Soviet researchers recognized that the greatest success in educating youth was achieved in Pioneer groups, where members felt they were true masters of their organization and were involved in significant activities to improve their environment [26, p. 345]. However, the rigid regulation of Pioneer activities within the formal, mass school environment meant that the pioneers' desire for independence was not fulfilled. As N. Krupskaya put it, the Pioneer organization failed to strike a balance between an organization of children and an organization for children. As a result, Pioneer's educational work retained elements of collectivity at best but lacked voluntarism. Furthermore, the loss of connection between the needs of children and the proclaimed communist ideals likely contributed to the eventual demise of the Pioneer organization.

The viability of the Pioneer organization could have been greatly enhanced by the inclusion of the community movement initiated in 1958 by the Young Frunzenets Commune (YFC) under the leadership of I. Ivanov at the Pioneer House in the Frunze district of Leningrad. This movement aimed to combine pioneering work with the legacy of S. Shatsky and A. Makarenko and the Pioneer clubs of the 1920s. Participation in the commune was voluntary, and the collective, creative initiatives distinguished it from the Pioneer squads of the schools. I. Ivanov regarded the YFC as a unified collective of adults and children and valued intergenerational cooperation [27, pp. 356, 386].

Z. Ravkin and T. Ignatieva emphasized a unique feature of communal self-government: the educators (adults) were inside and outside the group and formed a special team – the advisory council of the commune [22, p. 230]. The highest authority remained the general assembly. This concept of educators as a primary collective within a secondary collective embodies A. Makarenko's idea of unity between child and adult collectives. The greater autonomy of the commune was also evident in I. Ivanov's unsuccessful attempt to create satellite groups in the city's schools initially contrasted with the natural emergence of such groups later on, which resulted from the commune's development.

The researchers argue that the commune represented the highest stage of collective development, in which each member was expected to adhere to "goals, values, customs, traditions, style, and way of life" within the YFC [28, p. 77]. Educational activities in the YFC should be seen as participants' engagement in project work based on collective creative methods. This approach to creativity, which aims to improve society, involves understanding and changing reality.

The experience of the Frunzets Commune inspired many enthusiasts throughout the country to form communal groups as active units. However, the government failed to unify these groups under the control of the Komsomol, similar to the incorporation of the Timur Brigades into the Young Pioneers. In fact, those who attempted to organize communal groups were often expelled from the institutions and removed from their positions and the Komsomol. After the 1960s, the pedagogization of Communarstvo in the 1970s led to the development of pedagogical squads. These squads, in turn, responded to the excessive regulation from above by scaling back their activities, except for a few that had already been established before the corresponding decree of the Central Committee of the Leninist Communist Youth Union of the Russian Federation [28, p. 87]. These developments illustrate the connection between the growth of subjectivity and the pedagogical aims of the movements. Pedagogical components existed among the scouts, pioneers, communal groups and pedagogical squads, role-players, Tolkien fans, fantasy enthusiasts, and authors of Soviet-era songs. However, the collective nature of these groups was not always clear.

The practices and historical experiences of the children's and youth movements are still relevant in today's Russia. For example, the All-Union Pioneer Organization – Federation of Children's Organizations, founded in 1990 as the successor to the Pioneer Organization, continues to play an important role. Its work focuses on current trends in children's culture and considers the different perspectives of children as active participants in educational events. At the same time, unlike modern movements initiated by the authorities, this structure makes decisions based on its own historical and pedagogical experience.

The analysis of educational activities in mixed-age groups requires reflection on the development of extra-training clubs and activities. The mixed-age character was a distinct feature of pioneer houses, although these institutions had strict age limits, and their programs did not consider individuals' varying interests over time. While joining the clubs was voluntary, there were no normative ways to continue activities after completing a program; working with graduates required teachers and administration. Nevertheless, the extra-training environment encouraged collective activities, including pedagogical, educational, and research-related endeavors. For example, the development of extra-training educational and career-oriented activities in pedagogical classes underscores this trend. Overall, the emphasis on pedagogical principles in the pioneer houses and palaces along the lines of "learn it yourself – teach your teammates" was an important feature.

The analysis of Soviet literature shows that, despite the widespread practices, there were truly collective and mixed-age pedagogical activities in general schools, according to I. Kon, even in the late 1980s, the mass education system did not support either individual or collective agency: "In the bureaucratically organized education system... teachers are forced to suppress students' independence" [29, p. 124]. To conclude the analysis, it is important to emphasize that later developments in Soviet extra-training education show the emergence of structures with a pronounced capacity for agency. For example, in 1989, the Pioneer Headquarters of Tomsk developed into a mixed-age research collective and later became the public organization Tomsk Hobby Center and a municipal institution with a similar name. Its predecessor, the headquarters of E. Shteinberg, is now a mixed-age group called Nadezhda.

Conclusion

First of all, it was established that the indisputable foundations for pedagogical work in mixed-age groups are deeply rooted in the works of N. Krupskaya, A. Lunacharsky, S. Shatsky, A. Makarenko, I. Ivanov, V. Sukhomlinsky and others. Therefore, the deep and enduring value of the national theoretical heritage and traditions of socio-pedagogical clubs, CAS activities, and the various children's and youth movements must serve as a basis for shaping today's views on pedagogical activities in mixed-age collectives. However, it must be clarified that in the Soviet educational tradition, mixed-age interactions were typically seen in the context of joint activities of students of different ages under pedagogical guidance, which limited the degree of self-management and the development of the group as a collective educational unit. In this context, it becomes clear that only collective mixed-age activities that take into account the needs and abilities of both the individual and the group at different stages of their development can ensure the agency of educational practice. It should also be noted that mixed-age activities are not necessarily collective or purely pedagogical in nature.

Secondly, it was noted that a broad interpretation of the pedagogical profile holds promise for establishing a group as a collective subject of action. In contrast, the traditional view of the collective as a pedagogical phenomenon does not focus on the process of initiative and transformative action of the group within society but rather on the formation and education of the individual within the collective. In other words, the educational collective is only subjectively meaningful in relation to its members; otherwise, it functions merely as a pedagogical instrument. The incompleteness of education, which is reduced to mere learning and upbringing, defines the limits of mixed-age groups, whose activities no longer meet their maturing members' needs.

Based on the above, the historical and pedagogical material shows how important it is to include in the educational activities of the collective not only learning and education but also teaching, creative work, and research. This means that education within the collective should be aimed at developing both the individual and the group, improving the methods and content of the unchanging program for newcomers by the older collective members, and creating educational products through collective mixed-age activities. At the same time, functioning within a single environment is usually insufficient to ensure natural mixed-age diversity within the collective, as there are external requirements for the composition of participants.

Thirdly, the analysis carried out shows that the educational character of mixed-age group activities in the national experiences is mainly characterized by several preconditions:

1. Voluntary entry and exit of individuals from the collective, limited by the will of the collective as a subject, which determines the relative stability of the composition and longevity of the activity;
2. The uniformity and productivity of the collective's goals, which are not differentiated into children's and educational activities within a heterogeneous age group;
3. The presence of activities of various forms, methods, and directions within the structure, including educational, pedagogical, exploratory, playful, work-related, and communicative activities of a creative nature that are relevant to members at all stages of their personal development;
4. The determination of the participant's status within a formalized internal hierarchy with specific ranks and professional development opportunities that allow influence on the leadership of the collective;
5. The distinction between the pedagogical work of the collective and the activities of a school class, which is inherently limited in its subjectivity;
6. The development of the collective's activities in several environments simultaneously.

These circumstances and conditions must be considered when examining the positions of contemporary scholars who describe the educational potential of mixed-age groups and identify the essential characteristics of the mixed-age collective as an educational subject.

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ИСТОРИКО-ПЕДАГОГИЧЕСКИЕ ПРЕДПОСЫЛКИ ОБРАЗОВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ В РАЗНОВОЗРАСТНОМ КОЛЛЕКТИВЕ

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Аннотация. Фокус исследовательского интереса автора сосредоточен на актуальном вопросе обнаружения проявлений элементов образовательной деятельности в историко-педагогическом наследии разновозрастных коллективов. Ценность и своевременность данной научной проблемы обусловлена тем, что в настоящее время в практике российского образования вновь реализуются многочисленные феномены и процессы, ранее существовавшие в дореволюционный и советский периоды. Так, традиционный для Советского Союза коллективизм был признан в 2022 г. отечественной ценностью, что определило востребованность научного переосмысления различных форм и видов коллективной деятельности, включая образовательную. В этой связи именно образовательный аспект коллективной деятельности, протекающей в условиях разновозрастности, обладает наиболее выраженным воспитательным потенциалом. В образовательной деятельности в разновозрастном коллективе, в отличие от целенаправленной воспитательной работы, эффективно реализуется косвенное воздействие на личность. При этом важно, что результативность воспитания в коллективе и через коллектив может быть усилена организацией взаимодействия участников разного возраста, что делает коллектив более реалистичной моделью разновозрастного социума.

В результате проблемно-ориентированного анализа научной литературы установлено, что разновозрастный коллектив воспринимался специалистами в области психологии и педагогики в основном как воспитательный. Это привело к значимости рассмотрения эмпирически возникающих в практике элементов образования, в ходе освоения которых осуществлялась воспитательная работа. В данном ракурсе становится очевидным, что в современной образовательной действительности, акторы которой переосмысливают исторический опыт своих предшественников, начинают конституироваться разновозрастные коллективы с отчетливой образовательной, а не воспитательной направленностью. Тем не менее, развитие подобных коллективов тоже востребует опору на накопленный историко-педагогический базис реализации отдельных элементов образования, дающий возможность формализовать предпосылки (добровольность, наличие внутренней иерархии в виде «рангов», продуктивность деятельности, развитие одновременно в нескольких средах, разнообразие форм, средств, методов и др.) согласования коллективности, образовательности и разновозрастности, которые будут целесообразными и в настоящее время.

Ключевые слова: *образовательная деятельность, история внешкольной педагогики, внешкольное образование, дополнительное*

образование, детское движение, теория коллектива, разновозрастный коллектив

Для цитирования: Lobanov V.V. Historical and Pedagogical Background of Educational Activities in Mixed-Age Groups // Education & Pedagogy Journal. 2024. Issue 3 (11). P. 23–38. doi: 10.23951/2782-2575-2024-3-23-38

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Submitted June 11, 2024

UDC 378
DOI: 10.23951/2782-2575-2024-3-39-50

APPROACHES TO MEANING-MAKING AND PRACTICAL IMPLEMENTATION OF PEDAGOGICAL INITIATIVES BY PROSPECTIVE TEACHERS

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Abstract. *Background.* The value of a teacher's initiative is determined by the fact that it enables future and current teachers to actively contribute to the innovative updating of educational content to promote the self-realization of themselves and their students. The development of initiative in future teachers plays an essential role in developing their professionalism and their capacity for self-development. First of all, the teacher must be active and proactive when it comes to finding new teaching methods, introducing innovations into the educational process, and finding solutions to various educational problems. A proactive teacher can better adapt to society's changing demands and teach students more effectively.

This study aims to examine different approaches to training proactivity in future teachers and consider effective methods for the practical implementation of pedagogical initiatives in the educational process. The article aims to determine the importance of pedagogical initiative in the process of professional training of teachers and to identify their ability and readiness for creative activity and self-development.

Materials and methods. A systematic analysis of existing publications on the research topic was conducted to determine the importance of the concepts of pedagogical initiative in the context of the development process of a future teacher. Methods were applied to collect and analyze data from news feeds on university websites to determine the types of initiatives maintained by the university. The data obtained was analyzed, systematized, and interpreted.

Results. In the theoretical part of the study, three approaches are examined to construct the meaning of a future teacher's pedagogical initiative.

In the first case, an approach is highlighted in which the meaning of the concept of initiative emerges as a psychological characteristic of an individual in the conditions of self-motivation, reaction to external stimuli, and self-actualization.

In the second case, the concept reveals the characteristics of students' independent, proactive engagement indicated for different levels of education.

In the third case, an approach in which initiative is considered intrinsic and integral competence of a certified teacher is emphasized.

In the practical part of the study, a comparative analysis of the work of teaching and non-teaching universities on the issue of forming initiativeness in future teachers was carried out.

Keywords: *initiative, universities, future teachers, classification, education*

Source of funding: The research was supported by the Russian Science Foundation under grant number 23-28-00577, https://rscf.ru/project/23-28-00577

For citation: Chervonny M.A., Yakovlev I.N. Approaches to Meaning-Making and Practical Implementation of Pedagogical Initiatives by Prospective Teachers. *Education & Pedagogy Journal.* 2024;3(11):39-50. doi: 10.23951/2782-2575-2024-3-39-50

Introduction

Society expects the Russian higher education system to be able to respond quickly to resource shortages under the conditions of external containment and to train personnel as quickly and efficiently as possible to meet the needs of the economy.

The domestic education system needs to ensure personnel and technological sovereignty. The period from 2022 to 2031 has been declared the Decade of Science and Technology. In this context, it is a priority task to ensure a new quality of personnel training, including attracting talented young people to science [1]. To ensure technological sovereignty and establish the conditions for cultivating qualified personnel, a reimagined approach to the development and preparation of teachers is essential.

Justifications that a teacher should move from patterned behavior to proactive behavior can be found in a number of papers [2, p. 25; 3, pp. 14–16; 4, p. 66]. Such a process entails adhering to the established requirements and standards of the educational process and fostering the expression of individual initiative within the scope of professional pedagogical activity. The significance of cultivating a teacher's initiative is evident in its capacity to empower prospective and practicing teachers to actively engage in the innovative renewal of the educational field, enhance the quality of educational processes, and facilitate their personal and professional self-realization. The active manifestation of teacher initiative alone creates a condition in the educational process under which students of schools, vocational schools, and universities show a strong interest in future professions.

You can find a definition of the term initiative that contains various semantic charges. Thus, L. Dashevskaya considers social initiatives as a form of realization of the professional needs of future specialists [5, p. 8]. I. Golovinova understands initiative as a personality trait in which the future teacher shows activity and independence in setting goals and objectives and in their direct implementation [6, p. 7]. Initiative as a way of realizing professional needs is considered in his work by I. Tsvelyukh [7, p. 8]. Researcher I. Popova defines the concept of initiative as the self-directed activity of a novice teacher, which is not driven by external stimulation and enables them to implement and realize new ideas independently [8, p. 7]. According to Dean Abdelaziz, educational initiatives are a series of practical actions and activities that prospective teachers implement based on their mentors' guidance [9, p. 3].

Thus, in the above concepts, different semantic accents are found in the description of the psychological process of the emergence of initiative and its action implementation in the manifestation of diverse connections with other psychological concepts, such as activity [10, p. 131], independence [11], subjectivity and agency [12]. Considering the importance of the aforementioned concepts, the manifestation of a pedagogical initiative by prospective teachers is, on the one hand, an inner creative impulse of the student and, on the other hand, an external act of experimental professional activity that extends beyond the scope of their formal educational tasks. In this context, the challenge of practically implementing these initiatives within the framework of a pedagogical university emerges.

Aim of this study:

1. Describe the main approaches to the meaning-making of the concept of professional initiatives, i.e., initiatives directly related to the teacher's educational profile.

2. Examine the approaches and models for attracting students in the practice of formation and implementation of initiatives that exist in the activities of universities.

Materials and methods

The material for this study is scientific and pedagogical literature on the topic of research, as well as news feeds on the websites of 34 pedagogical and 10 non-pedagogical universities in Russia, which are directly involved in training future teachers. The following methods were used in this research: Analysis of scientific and pedagogical literature, analysis of news feeds of the websites of pedagogical and non-pedagogical universities.

Results and discussions

In the first step of analyzing the meaning of pedagogical initiative, it should be noted that the essence of the definition can be found mainly in works of pedagogical psychology. V. Anisimova, revealing the essence of student initiative, defines the concept of initiative from two different points of view: On the one hand, the initiative is nothing more than an externally generated internal motivation of a student for new forms of educational activity and at the same time the ability to independent, proactive activity [2, p. 25]. In the work of S. Rubinstein, initiative is seen as an expression of a higher degree of independence. The author understands initiative as a specific ability to take on any task thanks to one's initiative, without waiting for impulses from outside [13, p. 204]. K. Albukhanova-Slavskaya defines initiative as the free activity of a subject, expressed in his own initiatives, motives, and undertakings [14, p. 58]. M. Govorov considers initiative as a personality trait that serves not only as an internal condition for the organization of the subject's activity but also as a regulator of the main moral values of a person [15].

At the next stage of analyzing the formation of the meaning of pedagogical initiative, one should take into account a not insignificant part of the research, in which the initiative is revealed at different (from the initial to the completed professional) stages of development of the future teacher, taking into account the ontogenesis of his personality. Thus, I. Novikova and G. Shurukhina studied the individual typical features of the initiative of high school and university students [16, pp. 259–261]. O. Bronzova, in her work, proposes to consider the development process of initiative in vocational school students from two points of view: organizational-pedagogical and psychological. Based on the proposed aspects, criteria for the development of student initiative and the stages of the initiative in vocational school students are given [17, p. 32]. A. Polichka examines the creative initiative among undergraduate students. The author understands it as the independent manifestation of creative activity, expressed in the execution of work that deviates from a given template [18, p. 438].

At the final stage of analyzing the aspects of meaning formation of the concept of pedagogical initiative, we will highlight another approach, which can also be found in a number of works by teachers and researchers in the field of practical education. In this approach, pedagogical initiative is considered an integral property of a person, as a graduate specialist's complex professional quality (competence) after completing the corresponding stage of pedagogical training. In particular, V. Pakhalyan considers initiative as one of the components of professionally important qualities or professional competencies [4, p. 66]. A. Makhinin, in his work, combines motivational and cognitive aspects and describes initiative as a human quality that manifests itself outside a specific situation [19, p. 25]. Special attention is paid to initiative as a creative phenomenon. In her research, K. Shapovalova proposes to consider initiative as a personality trait that goes beyond external stimuli when performing an innovative activity [20, p. 2].

An approach based on the development of competencies in the field of higher vocational education aims to shape the personality of the future teacher by combining his theoretical knowledge, practical training, skills, and high motivation for the successful performance of different types of professional and social activities. Competence is understood here as a personal quality that includes various aspects: motivational, cognitive, behavioral, value-semantic, and emotional-volitional regulation in the context of professional work [21, p. 50]. Training the general professional competencies of a future teacher requires an integrated approach. These competencies are developed through the active participation of students in the educational process, which should combine interactive teaching methods and extracurricular work to develop professional skills. A teacher must be more than just a provider of knowledge – their personality and values play an important role in developing student's competencies. They should help each student find their own learning path and get them interested in the subject and specific areas of academic and professional activity. Social activities among students are also important as they stimulate activity and socially valuable communication. To be successful in the professional field, future teachers must prepare themselves for lifelong learning, possess the ability to quickly analyze information, make creative decisions, and demonstrate strong communication skills. These qualities, together with the knowledge and skills resulting from higher education outcomes, constitute both professional and general cultural competencies.

In his work, A. Polichka considers initiative a holistic readiness for work [18, p. 439]. Such readiness of the future teacher appears in the context of his professional training precisely in the role of competence. According to E. Berezneva, the ability to act independently is a crucial personal quality that is reflected in the capacity to set specific goals, persistently strive to achieve them through one's own efforts, take responsibility for one's actions, and demonstrate initiative and awareness not only in familiar situations but also in new contexts that require unconventional decisions [22, p. 12]. A. Solovyova considers what competencies a teacher should have to be able to take the initiative. As a result, the following set of competencies is identified:

– Research and information competencies;
– reflective competence;
– organizational, diagnostic, and prognostic competence [23, p. 827].

The training of future teachers primarily occurs at universities, encompassing both pedagogical and non-pedagogical disciplines. In practice, various approaches and experiences exist to foster the development of a future teacher's initiative. The existing approaches and models based on the initiative of future teachers found at universities are particularly intriguing. Identifying universities that actively develop and implement models for fostering the initiative of future teachers is essential. Examining these models will enable us to compare effective strategies for the proactive development of teachers.

Initially, the activities of pedagogical universities were examined. In 2023, an analysis was conducted of the news feeds and structural organization of the websites of 34 pedagogical universities in Russia, resulting in the compilation of their ratings in numerous instances [24, p. 64]. The professional initiatives of future teachers were examined in the context of their pedagogical activities, additional education, leisure pursuits, pedagogical start-ups, and extracurricular involvement (Table 1).

Table 1

Types of initiatives and their representation

Types of initiatives	Number of initiatives presented
Extracurricular	100
Leisure	37
Start-ups	11
Additional education	10
Lessons	7

As the table above shows, universities most frequently develop extracurricular initiatives that allow students to realize their projects outside of formal academic commitments. In second place are initiatives related to leisure activities, which often have a social focus. Educational start-ups and initiatives in additional education for children are represented in roughly equal numbers. The fewest initiatives were found in connection with teaching activities conducted during lessons.

In addition, the identified presence of various initiatives among students (related to teaching activities, additional education, and pedagogical start-ups) turned out to be insufficient, which indicates that these initiatives are not used in pedagogical universities to prepare students for professional activities. The modern characteristics of this activity, such as initiative and innovation, require the development of appropriate models and educational technologies in the field of higher education [18, p. 67].

Subsequently, an analysis of the websites of ten non-pedagogical universities in Russia was conducted. (Search for effective and reflective models).

Two out of ten universities in Russia are federal, while eight out of ten are flagship universities. All of these universities have faculties or institutes dedicated to teacher training. A flagship university in Russia is a higher education institution established in a region by merging existing universities. Its main purpose is to support the development of the region by supplying the local labor market with highly qualified professionals, addressing the current challenges of the regional economy, and carrying out educational and innovation projects in cooperation with regional authorities and businesses [11].

As in the case of the pedagogical universities, the newsfeed and the structural departments were examined. An analysis of the newsfeed revealed that four out of ten universities offer events to develop student initiatives. These events take place annually and extend over the entire academic year. Not only students but also teachers can propose initiatives. Many of these initiatives are social in nature and aim to develop the university and the region as a whole. Initiative banks are formed on the basis of the accepted applications. Each initiative is then selected, and a decision is made on its implementation and funding. In this case, such a model can be described as competitive. Students from the pedagogical disciplines are also involved in this model.

At one of the ten non-pedagogical universities that participated in the study, a structural unit is set up to formulate initiatives. At the university, a community hub (Tocka Kipeniya) will be organized - a free space for collective work in different regions of Russia, which gathers and forms active communities, teams of technology start-ups, and scientific projects that bring together business, government, and youth. Such centers are supported and promoted by the Agency for Strategic Initiatives. Under this project, all students can advance their education and science projects to meet the labor market's demands. This model can be described as a design model. Under this model, future teachers can propose and implement their initiatives equally with all others.

In the remaining five non-pedagogical universities, the future teachers' initiatives are presented through conferences, forums, and various non-systematic events. An analysis of the newsfeed revealed no events specifically for students of pedagogical disciplines. However, student teachers are included in a specially structured educational system at the university that applies to all fields of study and departments and is geared towards promoting and developing student initiatives. Therefore, the initiatives of future teachers can also be presented within such a system.

To determine the extent to which our study aligns with other research, it is essential to conduct a detailed analysis and comparison of the results and conclusions. Several authors highlight the importance of prospective teachers' own initiative and its significance for their future professional activities, a perspective with which we fully concur. However, initiative is often portrayed in various ways in their works, such as the expression of creativity or the development of social and business projects. In our study, the focus is specifically on the formation of professional (pedagogical) initiative, which is directly tied to the qualifications outlined in the graduate's diploma.

Conclusion

The manifestation of the initiative is examined in the works of educators and psychologists from three perspectives of its meaning formation: the psychological aspect, aligned with the stages of pedagogical education, and from the viewpoint of the graduate's complex quality (integrated competence). These perspectives serve as crucial criteria for developing initiative in future teachers. Together, they form the approaches that have emerged in university educational practice to foster initiative, emphasizing the importance of future teachers demonstrating pedagogical initiative that extends beyond their formal educational tasks and is geared towards broadening their professional activities.

Analyzing the approaches to the meaning-making of an initiative helps identify key aspects that must be considered when developing, supporting, and implementing student initiatives within the pedagogical environment.

The identified level of representation of various student initiatives – such as participation in and the generation of activities in leisure, additional education, and educational start-ups – remains relatively limited. This suggests a scarcity of educational technologies specifically designed to foster these initiatives in pedagogical universities, reflecting an implicit rather than explicit support and encouragement of student activity in forming their professional, subject-oriented qualities. Modern requirements for preparing students should include ensuring active and creative participation in professional projects, fostering independent decision-making, and emphasizing innovative activities. These elements promote student initiative and necessitate the development of suitable educational technologies for higher education.

About half of the non-pedagogical higher education institutions have developed or are currently employing models and technologies for fostering initiative among students across all disciplines. Additionally, the conceptual foundations of these university activities are examined, with initiatives in these models typically having a social orientation. Student teachers actively engage in developing these initiatives. Reviewing the newsfeeds of pedagogical university websites can provide valuable insights into innovative approaches to student initiatives that can support the development of future teachers. Analyzing non-pedagogical university websites' newsfeeds and academic sections has also revealed effective models for cultivating future teachers' initiatives.

All these aspects underscore the importance of developing initiative in future teachers as a critical direction in education. Consequently, studying models for fostering initiative and their successful adaptation in teacher education is vital for preparing qualified professionals in the field of education.

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ПОДХОДЫ К СМЫСЛООБРАЗОВАНИЮ И ПРАКТИЧЕСКОЙ РЕАЛИЗАЦИИ ПЕДАГОГИЧЕСКОЙ ИНИЦИАТИВЫ У БУДУЩИХ УЧИТЕЛЕЙ

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Аннотация. *Обоснование.* Ценность инициативы педагога определяется тем, что она позволяет будущим и действующим учителям активно содействовать инновационному обновлению содержания образования, содействовать самореализации себя и обучающихся. Формирование инициативы у будущих учителей играет важную роль в развитии их профессионализма и способности к саморазвитию. Первоначально, учитель должен быть активным и инициативным в поиске новых методов преподавания, внедрении инноваций в образовательный процесс, а также в поиске решений для различных образовательных задач. Учитель-инициатор способен лучше адаптироваться к изменяющимся требованиям общества и обучать учеников более эффективно.

Цель данного исследования заключается в исследовании различных подходов к формированию инициативы у будущих учителей, а также в рассмотрении эффективных методов практической реализации педагогических инициатив в образовательном процессе. Статья направлена на выявление значимости смыслообразования педагогической инициативности в контексте профессиональной подготовки учителей и установления их способности и готовности к творческой деятельности и саморазвитию.

Материалы и методы. Проводился систематический анализ существующих публикаций на тему исследования для выявления смыслообразования понятий педагогическая инициатива применительно к процессу развития будущего учителя. Применялись методы сбора и анализа данных новостных лент сайтов университета для определения видов инициатив, культивируемых в университетских практиках. Полученные данные подвергались анализу, систематизации и интерпретации.

Результаты. В теоретической части исследования рассмотрены три подхода к построению смысла педагогической инициативы будущего учителя.

В первом случае, выделяется подход, в котором смысл термина инициатива рождается как психологическая характеристика личности, в условиях ее самомотивации, ответа на внешние стимулы и самореализации.

Во втором случае, в термине проявляются характеристики самостоятельной активной деятельности студентов, приводимые для разных уровней обучения.

В третьем случае, выделен подход, в котором инициатива рассматривается как имманентная и интегральная компетентностная характеристика дипломированного учителя.

В практической части исследования проведен сравнительный анализ работы педагогических и непедагогических вузов в вопросе формирования инициатив будущих педагогов.

Ключевые слова: *инициатива, вузы, будущие педагоги, классификация, образование*

Источник финансирования: исследование выполнено за счет гранта Российского научного фонда № 23-28-00577, https://rscf.ru/project/23-28-00577

Для цитирования: Azbel A.A., Zhang Jinfang, Ilyushin L.S. Which is More Important, Being Active or Being Good? Comparative Study of Children's School Awards in Russian and Chinese Schools // Education & Pedagogy Journal. 2024. Issue 3 (11). P. 39–50. doi: 10.23951/2782-2575-2024-3-39-50

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Submitted June 14, 2024

UDC 372.851
DOI: 10.23951/2782-2575-2024-3-65-86

CONCEPTUAL GUIDELINES FOR TEACHING MATHEMATICS IN THE SECOND GRADE OF GENERAL EDUCATION SCHOOLS

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Abstract. The proposed article is a continuation of a series of articles dealing with the guidelines for teaching mathematics in the 1st through 11th grade of general education schools based on the Federal State Educational Standard, taking into account the division into knowledge elements. The implementation of the conceptual guidelines makes it possible to determine the content elements in 2nd grade, including the natural numbers from 1 to 100 and zero, counting numbers, actions of addition, subtraction, multiplication, and division; the multiplication tables; the relationships between arithmetic operations; the properties of arithmetic operations; measuring and comparing quantities (length, time, mass, cost); the examples of polylines and polygons; the examples of sets; logical thinking and reasoning; working with tables and bar charts; the examples of algorithms for arithmetic operations, quantities, and geometric constructions; the text problems in one or two actions using models, tables, short notes and diagrams. On this basis, the content of the 2nd-grade textbook is designed, and the ideas underlying the 1st-grade textbook are developed. The theoretical part allows students to answer control questions and helps them solve tests, problems, and exercises with one or more variants. The conceptual guidelines of mathematics teaching in grade 2 form the basis for a vertical structure of mathematics teaching from grade 1 to 11 in general education schools.

Keywords: *primary education, teaching, mathematics, knowledge element*

For citation: Nikitin A.A., Nikitina O.A. Conceptual Guidelines for Teaching Mathematics in the Second Grade of General Education Schools. *Education & Pedagogy Journal*. 2024;3(11):65-86. doi: 10.23951/2782-2575-2024-3-65-86

The authors further develop the guidelines for teaching mathematics in primary school based on the Federal State Educational Standard. The implementation of these guidelines makes it possible to determine the elements of textbook content in the 2nd grade [1–4]. These include learning to count natural numbers from 1 to 100 and zero; performing addition, subtraction, multiplication, and division; introducing multiplication tables; recognizing relationships between arithmetic operations; determining properties of arithmetic operations; measuring and comparing quantities (length, time, mass, cost); Looking at examples of polylines and polygons; providing examples of sets; applying logical thinking and reasoning; working with tables and bar charts; and looking at examples of algorithms for arithmetic operations, measurements, and geometric constructions; representing one- and two-step text problems using models, tables, short notes, and diagrams.

In this context, six main guidelines are defined.

The first guideline deals with counting natural numbers from 1 to 100 in ascending and descending order, direct and reverse counting of numbers, and using direct and reverse counting in the definition of addition and subtraction operations. It covers adding and subtracting numbers from 0 to 100, including performing column-wise operations. The multiplication and division operations are introduced, and the elements used in multiplication (product and multipliers) and division (quotient, dividend, and divisor) are considered. Multiplication tables for single-digit numbers are introduced, which must be memorized, as well as tables for multiplying single-digit numbers by numbers from 11 to 100 when the product is less than or equal to 100. Division is introduced through multiplication, and the relationship between division and subtraction is shown. The order of operations in expressions with and without parentheses is defined. The concepts of alphanumeric and alphabetic expressions are introduced. The commutative and associative properties of multiplication and the distributive properties of multiplication for sums and differences are studied. Finding unknown components of addition and subtraction, including the use of the trial and error method, is carried out. Modeling, creating tables, short records, and diagrams are used to solve one- and two-step text problems involving addition, subtraction, multiplication, and division.

The second guideline includes using tables to extract data and creating bar charts to solve theoretical and practical problems.

The third guideline suggests familiarizing with geometric shapes (polylines and polygons), determining a polyline's length and the polygon's perimeter, constructing right angles on squared paper, and creating squares and rectangles with specific side lengths.

The fourth guideline refers to the study of quantities such as length, time, mass, and cost, the conversion of units of these quantities, the determination of sums and differences, the comparison of quantities, and the estimation and evaluation of measurement results of lengths and time values.

The fifth guideline relates to sets and elements of sets, including incorporating one set in another, intersecting two sets, looking for common characteristics, grouping, recognizing patterns for numbers, quantities, and geometric shapes, looking at true (correct) and false (incorrect) statements, including those with ‘all’ and ‘each,’ determining steps of logical reasoning and concluding.

The sixth guideline covers performing algorithms for oral and written calculations, measurements, and constructing geometric shapes.

These guidelines are closely linked and support each other in their development.

The mathematics textbook developed for second-grade students [1, 2] follows the proven structure of the textbook for first-grade students [5, 6] and consists of chapters, sections, and units. The textbook also contains a subject index, answers, instructions for problems and exercises, and a detailed table of contents.

The concept of an episteme, which was introduced in 2006 [7, p. 4] and later defined as an “element of knowledge” [8, p. 6], forms the basis for the content of the textbooks. This means that “each unit of representation in the textbook contains a new idea for study or a set of interrelated concepts that define a new idea for study” [9, p. 3]. This ensures the consistency and equivalence of the content elements, considering the timing of presentation and learning [8].

The main goal of second-grade class instruction is to follow the conceptual guidelines suggested by the authors of multilevel mathematics textbooks for grades 5–11 in general education schools [10–24].

The guidelines for teaching mathematics in the 2nd grade result from the theoretical material, open and control questions, tests with one and several variants, problems, and exercises.

The Roman numeral system for natural numbers is introduced in the second grade. The symbols’ I’, ‘V,’ and ‘X’ are used for the Roman natural numbers from one to twenty. The traditional representation of the natural numbers from twenty-one to twenty-nine is then introduced. The notation and order of the natural numbers from 21 to 29 are considered. Tables represent the natural numbers from 21 to 29 as the sum of 20 and a one-digit natural number, using the direct counting of numbers.

The pronunciation and notation of the numbers are given for the two-digit numbers from 10 to 19, the two-digit natural number 20, and the two-digit natural numbers from 21 to 29. The adjacent natural numbers are determined for the numbers from 21 to 29. The direct counting of the numbers from 21 to 29 and counting backward of the numbers from 29 to 21 are introduced. The natural ordinal numbers from the twenty-first to the twenty-ninth are determined.

The general rule for comparing natural numbers from 20 to 29 is applied, where each natural number is less than the following natural number. The rule for comparing three natural numbers is determined: If the first number is less than the second and the second is less than the third, then the first number is less than the third. The relationship between the comparison rules 'less than' and 'greater than' is considered. A comparison table with the numbers from 20 to 29 is created.

An introduction to the natural numbers from thirty to thirty-nine is given. The notation and order of the numbers from 30 to 39 are considered, with the notation of these numbers placing the number 3 on the far left and the numbers from 0 to 9 on the far right. A table represents the natural numbers from 30 to 39 as the sum of 30 and a one-digit natural number and uses direct counting of the numbers.

An introduction to the natural numbers from forty to one hundred is given. The notation and order of the numbers 40, 50, 60, 70, 80, 90 and 100 are considered. It is established that forty equals four tens, fifty equals five tens, sixty equals six tens, and so on; ninety equals nine tens, and one hundred equals ten tens. Counting in steps of ten from 10 to 100 is taken into account.

The natural numbers between the tens are listed in ascending order. The sequence of the natural numbers from 0 to 100 is recorded in a table.

The ordinal numbers from the thirtieth to the hundredth are defined. The rule states that in the sequential enumeration of natural numbers, starting with 1, each number is in the position indicated by its number. For example, 30 is in the thirtieth position in the sequence of natural numbers. Note that the ordinal numbers from the tenth to the twentieth and the thirtieth, fortieth, fiftieth, sixtieth, seventieth, eightieth, ninetieth, and hundredth are pronounced and written as single words. For two-digit ordinal numbers denoted by two words, the rule is that the first word remains unchanged while the second word changes the same way as the one-digit ordinal number.

Two natural numbers are considered adjacent if one is the successor of the other. For example, 29 and 31 are adjacent to 30 because 30 is the successor of 29, and 31 is the successor of 30. If we enumerate the natural numbers from 1 to 100 in ascending order, going from one number to the next, we get the sequence 1, 2, 3, and so on down to 100. This is the direct counting of the natural numbers from 1 to 100. On the other hand, if you enumerate the natural numbers from 100 to 1 in descending order, going from one number to the adjacent one each time, you get the sequence 100, 99, 98, and so on down to 1. This is the reverse counting of the natural numbers from 100 to 1. The enumeration of natural numbers such as 11, 32, 100, and 79 is neither a direct nor a reverse counting in the range from 1 to 100 and neither a counting in ascending nor descending order.

A definition of the number line is given, which starts at zero, with the natural numbers marked one after the other, as in direct counting. An analogy is drawn between the numerical ray and a school ruler, noting that a school ruler with marked intervals is a number line segment.

A general rule for comparing two natural numbers is formulated: One natural number is less than another if it appears earlier in the ascending enumeration. This rule also applies to ordinal numbers. The following rule applies when comparing two-digit natural numbers: the number with fewer tens is smaller for two two-digit numbers. For two two-digit numbers with the same number of tens digits, the number with fewer digits is the smaller one. All one-digit and two-digit numbers are less than 100.

Parentheses are sometimes used to indicate the order of arithmetic operations. If an expression contains a left parenthesis, there is a corresponding right parenthesis of the same type. If an expression contains a right parenthesis, there is a corresponding left parenthesis before it. The rule of operations states that operations inside parentheses are executed first. In an expression without parenthesis that contains addition and subtraction, the operations are performed one after the other. The difference is undefined for natural numbers if the minuend is less than the subtrahend. If an expression contains nested parentheses, the operations within the innermost parentheses are performed first. Such expressions are referred to as double parentheses. The order of operations can be numbered by writing the operation number above the operation character.

If you replace a number with a letter in a numeric expression, you will obtain an alphanumeric expression. Expressions that only contain letters are called literal expressions. The properties of addition and subtraction are taken into account, and these properties are recorded as literal expressions. The commutative property of addition can be written as $A + B = B + A$, where A and B are numbers and the summands A and B are interchanged. This is where the name of the property comes from: the commutative property of addition. The associative property of addition is introduced, which states that the result of adding the sum of the first and second numbers to the third number is the same as the sum of the first number to the sum of the second and third numbers. The addition's associative property can be written as $(A + B) + C = A + (B + C)$, where A, B, and C are numbers. The rule says: If an expression contains only addition operations, the operations can be performed in any order. This rule allows the following for the sum of several summands: 1) changing the order of the addition operations; 2) changing the placement of parentheses; 3) inserting parentheses; 4) removing parentheses. For four numbers A, B, C, and D, a corollary of the associative property of addition is $(A + B) + (C + D) = (A + C) + (B + D)$. In addition, the associative property of addition and subtraction of numbers is introduced, which states that the result of subtracting the third number from the sum of the first and second numbers is the same as the sum of the first number added to the difference of the second and third numbers. In literal notation, the associative property of addition and subtraction can be written as $(A + B) – C = A + (B – C)$, where A, B, and C are numbers and the differences (A + B) – C and (B – C) are defined. For four numbers A, B, C, and D with defined differences (A + B) – (C D), A – C, B – D, a corollary of the association property of addition and subtraction is: (A + B) – (C + D) = = (A – C) + (B – D). These properties apply to all numbers.

The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 represent the number of tens. The number 10 is equal to 1 ten, the number 20 is equal to 2 tens, i.e., 20 can be represented as 20 = 10 + 10, and 30 is equal to 3 tens, i.e., 30 can be represented as 30 = 10 + 10 + 10, and so on. If you add a ten to a certain number of tens, the number of tens in the data set increases by 1 ten. A table of adding one ten to the tens from 1 to 9 is considered. Tens can be added in the same way as numbers from 1 to 10. Tens addition tables are created.

A table is created with one-digit numbers from 0 to 9, which is used when adding one-digit and two-digit numbers. Examples of adding a one-digit number to a two-digit number and finding the sum of two two-digit numbers when the sum is less than or equal to 100 are considered.

The arithmetic operation of addition can be written 'in a line' or 'column-wise.' When the addition is 'column-wise,' tens are written under tens and units under units. The '+' sign of the addition is placed on the left between the first and second summands, and a line is used instead of the equals sign. With 'column-wise' addition, we proceed from right to left by adding units with units and then tens with tens. 'Column-wise' addition is straightforward but requires additional notation above the corresponding numbers. We will look at examples of the 'column-wise' addition of a two-digit number and a one-digit number whose sum is less than 100, the addition of two two-digit numbers whose sum is less than 100, and the addition of two natural numbers whose sum equals 100.

If you subtract a ten from a certain number of tens, the number of tens in the notation of the number is reduced by 1. A table is created for the subtraction of a ten from tens. Tens can be subtracted in the same way as numbers from 0 to 10 are subtracted. Tables are created for the subtraction of tens. It is specified that the difference is reduced by the number of subtracted tens when a certain number of tens is subtracted from a two-digit number.

If a two-digit number has more than 1 ten, it can be represented as the sum of two addends, the first being a certain number of tens and the second being a two-digit number from 10 to 19. There is a table for the subtraction of one-digit numbers from 10 to 19, which is used for subtraction. Examples are used to describe how to write and perform the subtraction of a one-digit number from a two-digit number, how to find the difference between two two-digit numbers when the number of tens in the minuend is equal to the number of tens in the subtrahend, how to find the difference between two two-digit numbers when the number of tens in the minuend is greater than the number of tens in the subtrahend, and how to perform the subtraction of 100. The association property of addition and subtraction is applied to subtraction.

The arithmetic operation of the subtraction can be written 'in a line' or 'column-wise.' If the subtraction is performed 'column-wise,' tens are written under tens and units under units. The subtraction's minus sign '–' is written on the left between the minuend and the subtrahend, and a line is used instead of the equals sign. When we perform a column-wise subtraction, we move from right to left and start the subtraction with the unit placed in the number. Examples of subtractions are considered when the number of units in the minuend is greater than or equal to the number of units in the subtrahend; subtraction of a one-digit number from a two-digit number when the minuend has fewer units than the subtrahend; subtraction of a two-digit number from another two-digit number when the minuend has fewer units than the subtrahend; subtraction of a one-digit number and a two-digit number from 100.

Students know from the 1st-grade curriculum that to find an unknown addend in the sum of two addends, you must subtract the known addend from the sum. Sometimes, it makes sense to designate the difference, the minuend, or the subtrahend of two numbers with a letter. Pupils know that the minuend equals the sum of the difference and the subtrahend. If the difference and the minuend are known, the difference must be subtracted from the minuend to determine the subtrahend. This value is inserted back into the original expression to check the correctness of the calculated unknown value in a sum or difference.

It is sometimes useful to use the trial method to find an unknown addend in a sum or an unknown minuend or subtrahend in a difference. This method usually consists of two parts: The first is about finding a suitable value for the unknown by substituting zeros or natural numbers, and the second is about justifying that there are no other suitable values for the unknown. When you find an unknown in addition or subtraction in an equation, the experiment starts with zero and then moves on to the natural numbers 1, 2, 3, and so on in order. This means that the 0 is inserted into the expression first. If the 0 does not fit, the numbers 1, 2, 3 etc., are inserted one after the other and checked. If, after several steps, a suitable value is found that satisfies the equation, this value is called 'found by trial and error.' Once you have found a suitable value, you must prove there are no other solutions. When checking, the value found is inserted back into the expression to check for equality.

If it is necessary to add the same summands repeatedly, the arithmetic operation of multiplication is used. Multiplication is indicated by the multiplication sign '·' or '×.' When multiplying, the number of repetitions of a number is normally written first. The numbers that are multiplied are called factors. The commutative property of multiplication is formulated: The product does not change when the factors are interchanged. The following rule applies to the number 1: If one of the factors is equal to 1, the product is equal to the other factor.

The multiplication tables of natural numbers from 2 to 9 with one-digit natural numbers are considered. The students should memorize these multiplication tables. They should also learn to correctly write examples from the multiplication tables to articulate the actions performed and determine the results of the calculations.

A multiplication table of the number 10 with one-digit natural numbers is considered. The following applies to the multiplication of 10 by one-digit natural numbers: The product of any number multiplied by 10 is obtained by adding a zero to the right of this number. The multiplication of natural numbers from 1 to 10 with natural numbers from 1 to 10 is shown in a general table. The multiplication operation is defined by addition. To multiply the first number by the second number, the second number must be added as often as the value of the first number. The rule for 0 in multiplication states that if one of the factors is 0, the product equals zero.

The definition of multiplication by addition results in the products of one-digit natural numbers from 1 to 9 with numbers from 11 to 100. These products are considered in the range of 11 to 100. Lessons in grade 2 also include numbers from 0 to 100; only the product of 1 with these numbers is considered for the numbers from 51 to 100.

The properties of multiplication are considered, including the commutative, associative, and distributive properties of multiplication for the sum of numbers and the distributive property for the difference of numbers. The commutative property of multiplication, where A and B are numbers, can be written as $A \cdot B = B - A$ using the literal notation. The factors A and B are interchanged in the product. The associative property of multiplication is considered using a numerical example and formulated as follows: The result of multiplying the first and second numbers by the third number is the same as the product of the first number and the product of the second and third numbers. The associative property of multiplication, where A, B, and C are numbers, can be written literally as $(A \cdot B) \cdot C = A \cdot (B \cdot C)$. The rule says that if an expression contains only multiplication operations, these can be performed in any order. This rule allows for several factors in the product: 1) changing the order of multiplication; 2) changing the placement of parentheses; 3) inserting parentheses; 4) removing parentheses. When determining the order of operations for multiplication, addition, and subtraction in an expression without parentheses, the rule states: If the expression contains multiplication, addition, and subtraction and there are no parentheses, multiplication is performed first, followed by addition or subtraction in that order. The distributive property of multiplication for the sum of numbers is considered using a numerical example and formulated as follows: The product of the first number and the sum of the second and third numbers is equal to the sum of the product of the first number and the second number and the product of the first number and the third number. Using the literal notation, the distributive property of multiplication for the sum of numbers where A, B, and C are numbers can be written as follows: $A \cdot (B + C) = A \cdot B + A \cdot C$. The distributive property of multiplication for the difference of numbers is also considered using a numerical example and formulated as follows: If the difference between the second and third numbers is defined, the product of the first number and the difference of the second and third numbers is equal to the difference of the product of the first number and the second number and the product of the first number and the third number. Using the literal notation, the distributive property of multiplication for the difference of numbers where A, B, and C are numbers can be written as $A \cdot (B - C) = A \cdot B - A \cdot C$.

The multiplication of one-digit natural numbers by tens is considered, and it is established that to multiply a one-digit number by a certain number of tens, you must first multiply that one-digit number by the number of tens and then multiply the result by 10, using the associative property of multiplication. Here, you will find a multiplication table for one-digit natural numbers with tens, where the product is a number between 10 and 100. It explains how to multiply one-digit natural numbers by two-digit numbers. Using the representation of a two-digit number as the sum of the number of tens and the number of units, the one-digit number is first multiplied by the tens of the two-digit number, then this one-digit number is multiplied by the units of the two-digit number, and the sum of the products obtained is determined.

The division is used to perform operations with numbers. The division is indicated by the division sign ':' or '/.' The components of the division operation are defined – the dividend, the divisor, and the quotient. The number that is divided is called the dividend. The number by which the dividend is divided is called the divisor. Using the example of the numbers 6 and 3, these numbers' quotient is defined as the expression 6 : 3 or as the number 2, which is the result of the division. The following applies to natural numbers: If you divide the product of two factors by one of the factors, the result is the other factor. Division can, therefore, be defined by multiplication. Just as multiplication can be defined by addition, division can also be defined by addition. Division can also be defined by subtraction. The following rule applies: If the first number is repeatedly subtracted from the second number and the result is zero, then the first number is divisible by the second number. In this case, the first number is said to be evenly divisible by the second number. Conversely, if the first number is repeatedly subtracted from the second number and results in a number that is less than the second number and not equal to zero, then the first number is not evenly divisible by the second number. This relationship between division and subtraction can be used to check the correctness of division.

Multiplication and division are linked. The rule says: The dividend equals the product of the quotient and the divisor. You can use multiplication tables to determine the quotient. Multiplication tables for one-digit natural numbers and multiplication tables for one-digit natural numbers with numbers from 11 to 50 allow you to calculate the quotient. The rule for the number 1 when dividing, the rule for dividing a natural number by itself, and the rules for the number 0 when dividing are taken into account. For the number 1, the rule states: If the divisor equals 1, the quotient equals the dividend. Another rule says that if the dividend and the divisor are the same natural number, their quotient is 1. The rule says: The quotient of the division of zero by any natural number is zero. Furthermore, the rule in mathematics states that division by zero is undefined. Students must memorize and know these rules.

Therefore, all four arithmetic operations (addition, subtraction, multiplication, and division) are connected.

Questions such as ‘How much more?’, ‘How much less?’, ‘How many times more?’ and ‘How many times less?’ are considered. The difference between the numbers must be determined to find a number that is greater or less than a certain number by a certain amount. To determine how much one number is greater than another, subtract the smaller number from the larger one. The difference indicates how much greater the larger number is than the smaller one. To determine how much one number is less than another, subtract the smaller number from the larger one. The difference shows how much smaller the smaller number is compared to the larger number. To find out how many times one natural number is larger than another, you can use the multiplication tables and divide the larger number by the smaller number. To find a number that is greater or less than a given number a certain number of times, you need to find the division quotient. If the larger number is evenly divisible by the smaller number, the quotient indicates how many times the larger number is greater than the smaller number. To find out how many times one natural number is less than another, you can also use the multiplication tables and divide the larger number by the smaller number. If the larger number is evenly divisible by the smaller number, the quotient shows how many times the smaller number is less than the larger number.

The length is regarded as a numerical characteristic of the extent. The standard unit for length is one meter. This standard is used to define other metric measures of length. The meter is abbreviated to ‘m’ – for example, 1 m, 2 m, and so on. The relationships between meters, decimeters, and centimeters are explained. It is known that 1 dm = 10 cm and 100 : 10 = 10, so we get the equality 1 m = 10 dm. Meters, decimeters, and centimeters are metric measures of length. From the 1st grade curriculum, students know that you can express the lengths of two sections in the same units and add them together. Alternatively, you can add centimeters to centimeters, decimetres to decimetres, and meters to meters, converting the units if necessary. Pupils also know that the difference between the lengths of two segments can be determined by expressing the lengths in the same units and subtracting them. The minuend must be equal to or greater than the subtrahend. Alternatively, you can subtract centimeters from centimeters, decimeters from decimeters, and meters from meters, converting the units as necessary.

A comparison of the lengths of two segments is considered. The segment with more meters is longer. If two segments have the same number of meters, the number of decimeters is compared. The segment with the most decimeters is longer. If two segments have the same number of meters and decimeters, the number of centimeters is compared. The segment with more centimeters is longer. If two segments have the same number of meters, decimeters, and centimeters, they are the same length. The estimation and evaluation of the result of the length measurement are taken into account. The accuracy of the length measurement depends on the selected measurement standard. For example, the length can be measured in meters, decimeters, and centimeters using a ruler or tape measure. An estimate can be made using steps, whereby the length of a step is measured in centimeters. The difference between the measurement result with a measuring device and the result of the estimate provides an evaluation of the measurement. If the measurement with a measuring device and the forecast do not agree, subtracting the smaller value from the larger value gives the difference, which is the evaluation of the measurements.

Issues related to time measurement are discussed, and basic concepts are defined. One rotation of the Earth around its axis is one day. A day is divided into 24 equal time intervals, each comprising one hour. A day, therefore, has 24 hours. An hour is abbreviated as “h”. For example: 1 h, 2 h and so on. The equation 1 day = 24 hours therefore applies. A day consists of four time intervals: Night, morning, day, and evening. The day begins at midnight. The night lasts from midnight to 6:00 a.m. The morning starts at 6:00 a.m. and lasts until midday. The day lasts from midday until 6:00 p.m. The evening follows the day and lasts from 6:00 p.m. to midnight.

A clock is a device for measuring time. The dial is divided into 12 equal intervals, usually identified by a number from 1 to 12. The hour hand moves from one marked number to the next, completing a full circle in 12 hours. Some watches have dials divided into 24 equal intervals marked by numbers from 1 to 24. The hour hand of such a watch completes a full circle in one day. If the dial is divided into 60 equal intervals, the minute hand moves from one marker to the next in one minute. Minutes are abbreviated as min. For example: 1 min, 2 min, and so on. The equation 1 hour = 60 minutes applies. To achieve precise time measurements, a combination of different time units is used.

The comparison of two-time values is considered under the assumption that each time value is written with the equality 1 h = 60 min. The time value with more hours is greater. If two-time values have the same number of hours, the number of minutes is compared. The time value with the greater number of minutes is larger. If both the hours and minutes are the same, the time values are considered equal. Time values can be added or subtracted. To determine the sum of two-time values, you can first add the minutes to the minutes and the hours to the hours, converting the units if necessary. To determine the difference between two time values, one can subtract the minutes from the minutes and the hours from the hours, converting the units if necessary. The minuend must be equal to or greater than the subtrahend. If two-time values are given, subtracting the smaller value from the larger value results in a differential comparison of these values. This shows how much greater the larger time value is compared to the smaller one, and vice versa, how much smaller the lesser time value is compared to the larger one. The accuracy of the time measurement depends on the chosen unit of measurement. Time is measured in hours and minutes. An estimate of the time can be made using a timetable, for example. Comparing the measurement result obtained with a measuring device with the result obtained by estimation makes it possible to evaluate the measurement results. If the measurement with a measuring device and the result obtained by estimation do not match, subtracting the smaller value from the larger value enables a differentiated comparison of the time measurements and, thus, an evaluation of the measurements.

The concept of mass is introduced. On Earth, every object or body has mass. Mass can be determined using a special balance or scale. There are different types of scales. One of the most common mass units is the kilogram, abbreviated as 'kg' (e.g., 1 kg, 2 kg). In some cases, the hundredweight is used as a unit of mass (formerly known as the centum weight or quintal). One hundredweight is equal to 100 kilograms. The equation 1 hundredweight = 100 kg applies. An object with a greater number of hundredweights has a greater mass and is therefore heavier. If two objects have the same number of hundredweights, their mass is compared by the number of kilograms. The object with more kilograms is heavier. If both the number of hundredweights and kilograms are the same, the objects are considered to have the same mass. Mass values can be added or subtracted. To determine the sum of two masses, you can first add the kilograms to the kilograms and the hundredweight to the hundredweight, converting the units if necessary. To determine the difference between two masses, you can subtract the kilogram from the kilogram and the hundredweight from the hundredweight, converting the units if necessary. The minuend must be equal to or greater than the subtrahend. When the masses of two objects are given, subtracting the smaller mass from the larger mass provides a comparison of these values. This shows how much greater the larger mass is compared to the smaller mass and, conversely, how much smaller the smaller mass is compared to the larger mass.

The cost of goods and services is measured in money. In Russia, the currency standard is rubles and kopecks, where 1 ruble = 100 kopecks. Comparing costs in rubles and kopecks is similar to comparing lengths in meters and centimeters. An item with more rubles is more expensive. If two items have the same number of rubles, the number of kopecks is compared. The item with more kopecks is more expensive. If both the number of rubles and the number of kopecks are the same, the items are considered to have the same cost. Cost values can be added or subtracted. To determine the total cost of two items, one can first add the kopecks to the kopecks and the rubles to the rubles and convert the units if necessary. To determine the difference between the costs of two items, one can subtract the kopecks from the kopecks and the rubles from the rubles and convert the units if necessary. The minuend must be equal to or greater than the subtrahend. If two cost values are given, subtracting the smaller value from the larger value results in a differential comparison of these values. This shows how much greater the higher cost is compared to the lower ones and, conversely, how much lower the smaller costs are compared to the higher ones.

Using a ruler and a pencil, you can draw different geometric shapes on paper by connecting dots with line segments. Examples of shapes consisting of segments called polylines are presented. It defines what is meant by the vertices of a polyline, namely its startpoints and endpoints. If it does not matter where the start and end points are, both ends of the polyline are called endpoints. What is meant by the segments of a polyline is defined. The rule states that a polyline is described by listing its corner points in the order in which segments connect them.

It should be noted that polylines are considered so that when moving along the polyline from its starting point to its end point, each corner point and each segment is traversed only once. With such polylines, the inner point of each segment does not belong to another segment of the polyline. The vertices of a polyline are called adjacent if a segment of the polyline connects them, and the segments of a polyline are called adjacent if they have a common vertex. The rule states that two adjacent segments of a polyline are not collinear. The length of a polyline is equal to the sum of the lengths of its segments.

The concept of a polygon is introduced by the concept of a polyline using the example of a quadrilateral. A polyline is a polygon if its vertices and segments simultaneously fulfill the following three properties: 1) each vertex of the polyline is a common point for only two segments; 2) each segment of the polyline contains only two points belonging to other segments; 3) from each vertex of the polyline, moving along the segments, one can reach any other vertex. A polyline's vertices that form a polygon are called vertices of the polygon. A polyline's segments that form a polygon are called sides of the polygon. The designation of a polygon can start from any vertex and run successively through all sides. The perimeter of a polygon is the sum of the lengths of all its sides. It is explained how to draw a right angle on squared paper, knowing that all angles within a cell on squared paper are right angles. The construction of a rectangle on squared paper with vertices at the intersections of the grid lines, including the specified side lengths, is considered. Similar to a rectangle, a square can be drawn on squared paper, including the specified side lengths.

The concepts of a set and an element of a set are introduced. In the first grade, we discussed what it means to combine elements in a set. Each set is defined by its elements. If the first set of elements is completely contained in the second set, the first set is also said to be contained in the second set. In this case, the first set is a subset of the second set. The intersection of two sets is defined. A set that contains no elements is called an empty set. The empty set is contained in every set. If two sets have no common elements, it is said that their intersection is empty or that their intersection forms an empty set. If sets have a common element, these sets are said to have a non-empty intersection.

It should be noted that a set can be denoted by a letter or a symbol. One way to represent a set is to list all the elements of the set. This is done with curly brackets: "{" for the left bracket and "}" for the right bracket. All elements of the set are listed within the curly brackets. Note that in the representation of a set, all elements are unique and can be listed in any order.

The elements of a set can be described or defined using a characteristic. A characteristic of a set element is a distinguishing feature that determines its inclusion in the set. If a characteristic is present, all set elements can be divided into two sets: One set contains all elements with this characteristic, and the other set contains all elements without this characteristic. The characteristics of numbers include, for example, one or two digits, even or odd, and so on. In everyday life, we often compare and determine quantities. Quantities include length, mass, cost, and time. A characteristic can be, for example, that a quantity is greater than a certain amount. When examining geometric shapes, one characteristic could be whether the shapes consist of segments, whether their lengths are greater or lesser than a given measure, and much more. An example of categorization is dividing students into sets, such as classes sorted by grades.

An ordered set of elements is defined as a set in which the elements follow a sequence rule. This means that there is a rule for two different elements of the set according to which one element follows the other. The result is a sequence of elements. The elements in the sequence are ordered. A rule, a condition, or a property can define the sequential enumeration of elements of a set. Such an enumeration is a pattern. Various patterns are considered using examples of everyday objects, numbers, and geometric shapes. For sets of numbers, patterns can include the arrangement of numbers in ascending or descending order, direct and reverse counting, features of recording numbers, finding the next number by addition, subtraction, multiplication, or division, and more. Different patterns can also be found and explained when looking at different geometric shapes, such as examining the number of vertices, sides, and angles formed by segments, measuring and comparing segment lengths, and the specifics of the arrangement of shapes.

A statement that establishes or proves something is called an assertion. When considering statements, it is always assumed that they refer to elements of a certain initial set. True (correct) and false (incorrect) statements can be formulated for the elements of a set. If a statement applies to all set elements, it is described as true or correct. If the word 'all' is used in a statement, this means that all elements of the set are considered without exceptions, i.e. all elements of the set are included. When the word 'every' is used in a statement, it means that every element of the set is considered, i.e., every element of the set is included. If a statement does not apply to all elements of the set, it is said to be false or incorrect for that set. Students learn to recognize and construct true (correct) and false (incorrect) statements by using the words 'all' and 'every' when solving tests, problems, and exercises. Corrections are made when necessary. The dependencies between the condition and the answer to a task are considered. The condition of the task can be true or false, establishing three rules of dependency between the condition and the answer. The first rule states that if the task condition is true and the measures taken to solve the task are correct, then the answer is also true. The second rule states that if the task condition is true, but the measures taken to solve the task are false, then the answer can be either true or false. The third rule states that if the task condition is false and the measures taken to solve the task are true, the answer can be either true or false. Solving a problem can consist of one or more steps. Performing the actions to solve a problem is a logical thought process. If only one action is performed when solving a problem, a logical thought process is being carried out. If two actions are performed when solving a problem, two logical conclusions are drawn, and so on. The complete answer to the problem is the conclusion drawn from the solution to the problem. Usually, a short answer is written down, but it is always implied that the short answer is a short form of the complete answer.

The addition table for natural numbers from 1 to 10 and the multiplication table for natural numbers from 1 to 10 are considered. It is shown how data can be extracted from the tables. An example of a table is one that represents observations in nature. Observations about the development and growth of plants and the behavior of animals and birds can be recorded in tables. A weather forecast can also be presented in a table format. Additionally, various tables are created for sports competitions to display tournament standings.

Charts are sometimes used for the visual representation of measurement results and the comparison of quantities. Vertical or horizontal segments or rectangles can represent the values in a chart. Such charts are called bar charts. The data for a chart can be taken from a table.

Representing one- and two-digit numbers in the form $A \cdot 10 + B$ is considered. The multiplication table of 10 with one-digit natural numbers is used for this purpose. Multiplying a one-digit number by 10 results in the tens: 10, 20, 30, and so on. In the notation of a two-digit number, the one-digit number in the first place from the left indicates the number of tens in the number, while the one-digit number in the second place from the left indicates the number of units in the number. If A is zero, then the expression $A \cdot 10 + B$ stands for the one-digit number B, which can be written as $0 \cdot 10 + B$. If A is not zero, then the expression $A \cdot 10 + B$ stands for a two-digit number, which is the sum of a certain number of tens digits A and the one-digit number B. Examples of algorithms for adding two one-digit numbers, algorithms for adding a two-digit number and a one-digit number when the sum is less than 100, algorithms for adding two two-digit numbers when the sum is less than

100, and algorithms for adding two numbers when the sum is equal to 100 are considered.

Examples of algorithms for multiplying two one-digit numbers, algorithms for multiplying a one-digit number by a two-digit number when the product is less than 100, and algorithms for multiplying two numbers when the product is equal to 100 are considered.

The following condition must be met for a subtraction algorithm for natural numbers and zero: The minuend is greater than or equal to the subtrahend. In other words, for two numbers $A \cdot 10 + B$ and $C \cdot 10 + D$, where A, B, C and D are one-digit numbers, either $A \cdot 10 + B > C \cdot 10 + D$ or $A \cdot 10 + B = C \cdot 10 + D$. Examples of algorithms for subtracting one-digit numbers from the numbers 0 to 19, algorithms for subtracting one-digit numbers from two-digit numbers 20 to 99, algorithms for subtracting two-digit numbers from two-digit numbers and algorithms for subtracting from a 100 are considered.

The following conditions must be met for natural numbers and zero when performing a division algorithm: The divisor is not zero; The dividend is greater than or equal to the divisor, or the dividend is equal to zero. In other words, if you divide two numbers $A \cdot 10 + B$ and $C \cdot 10 + D$, where A, B, C, and D are one-digit numbers, the divisor $C \cdot 10 + D$ is not zero; and either $A \cdot 10 + B > C \cdot 10 + D$, $A \cdot 10 + B = C \cdot 10 + D$ or $A \cdot 10 + B = 0$. This is also true if the divisor is not zero and the dividend is 100, meaning that the divisor is either less than or equal to 100. Division algorithms can be performed by moving from multiplication to division using multiplication tables. If a product in the multiplication table matches the dividend, the dividend can be divided by one of the factors of the product. The quotient of dividing a product by one of its factors is equal to the other factor. In this case, the division can be performed without a remainder. If the multiplication table does not contain a product that is equal to the dividend, the division algorithm cannot be performed evenly. Examples of using multiplication tables of one-digit natural numbers for division algorithms, division algorithms using multiplication tables of one-digit natural numbers by numbers from 10 to 100, and the algorithm for dividing 100 by natural numbers are explained.

Examples illustrate algorithms for measuring lengths, time intervals, mass, and costs.

The steps of the algorithm for constructing a right angle on a sheet of paper with detailed illustrations of each step are considered. A triangle with a right angle is called a right triangle. The steps of the algorithm for constructing a right triangle, including those with specific side lengths forming the right angle, are considered. To visually represent word problems, a model, table, or short diagram is sometimes created. A model of a problem is a representation using symbols and signs for arithmetic operations. Objects are denoted, for example, by the first letters of words or Roman numerals. All known quantities and the quantities to be found are recorded. For the sake of simplicity, a table is sometimes used to represent a text problem. Here, as in the model, labels are used together with additional symbols such as greater than '>,' less than '<,' and a question mark '?' for the unknown quantity. The known quantities, their amounts, dependencies, and what needs to be found are recorded in the table. A short description of the problem is a short form of the problem using labels and additional characters. As in the model or in the table, the objects or actions are usually labeled with initial letters or Roman numerals. Known quantities, their dependencies, and what needs to be found are recorded with curly brackets '}' and arrows such as '↰' and '□.'The problem schema is created using a segment that displays the known quantities, dependencies, and information to be found. Labels and symbols are also used for clarity. Examples of text problems include finding quantities through addition, comparing sums as defined in the problem statement, and comparing differences as specified in the question or problem statement.

Examples of one-step text problems involving multiplication and division are thoroughly analyzed, including the creation of models, tables, short records, and diagrams. Examples of text problems involving finding quantities by multiplication, multiplication by comparison as defined in the problem statement, and division by comparison as defined in the question or problem statement are considered.

In two-step text problems, specific examples demonstrate the construction of models, the organization of tables, and the creation of short records and diagrams. A text problem may be such that the performance of one step does not depend on the performance of another step, or it may be such that the performance of the second step depends on the performance of the first step. In the second case, the value required for the second step is determined from the problem condition in the first step, and the required quantity is determined in the second step based on the condition and the value obtained in the first step. Each step of a text-based problem can be represented as a separate model, table, short record, or diagram. This approach helps plan the solution and represent it as a sequence of actions to be performed.

The last chapter of the textbook revisits the concepts and properties studied throughout the course. It emphasizes that definitions, rules, and properties presented within 'frames' in the textbook should be memorized and recalled to avoid difficulties when applying them to practical tasks during review.

"It is assumed that students should know the solutions to all tests, problems, and exercises in the chapters because the specific ideas can be found in tests, problems, and exercises and furthermore can be developed both in theory and in other tests, problems, and exercises" [25, p. 8]. Sometimes, the textbook contains tests, problems, and exercises with a higher level of difficulty and complexity, which require additional mental effort, but it also broadens students' mathematical horizons and knowledge. The solutions to the tests, problems, and exercises can be discussed with peers, teachers, and parents.

"The authors believe that prior individual reading of upcoming topics or reading with adults is an important element of general learning. Incorporating reading into homework can improve students' understanding of lessons, help them overcome anxiety about new material, and increase their psychological confidence in learning math" [25, p. 9].

A teacher's guide [4] was developed for the 2nd-grade math textbook [1, 2] to provide teachers with the authors' idea of how the material should be presented and provide teachers with the means to present the material in accordance with the textbook; Enable students to master the material with the help of the textbook and the teacher's support" [25, p. 8].

The teacher's book contains methodological approaches, explanations of all questions in the chapter, and analyses of solutions and answers to tests, problems, and exercises [3, 25]. It also contains the math curriculum, sample lesson plans, and sample tests and problem solutions [4, 26].

The 2nd-grade textbook and the teacher's book thus continue to build a unified vertical structure of mathematics education from grade 1 to 11, ensuring a coherent and logically structured perception of the general school mathematics curriculum by students.

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КОНЦЕПТУАЛЬНЫЕ НАПРАВЛЕНИЯ ОБУЧЕНИЯ МАТЕМАТИКЕ ВО 2 КЛАССЕ ОБЩЕОБРАЗОВАТЕЛЬНОЙ ШКОЛЫ

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Аннотация. Предлагаемая работа является продолжением серии статей, в которых рассматриваются направления обучения математике в 1-11 классах общеобразовательной школы на основании Федерального государственного образовательного стандарта с учетом разбиений на элементы знаний. Реализация концептуальных направлений позволяет определить элементы содержания обучения во 2-м классе, включая для натуральных чисел от 1 до 100 и нуля: счет чисел, действия сложения, вычитания, умножения и деления; знакомство с таблицами умножения; связи между арифметическими действиями; ряд свойств арифметических действий; измерения и сравнения величин: длины, времени, массы, стоимости; примеры ломаных и многоугольников; обозначение и запись множеств; применения логических рассуждений и выводов; работа с таблицами и столбчатыми диаграммами; примеры алгоритмов арифметических действий, измерений и геометрических построений; представления тестовых задач в одно и два действия при помощи моделей, таблиц, кратких записей и схем. На основании этого разработано содержание учебника для 2-го класса и развиваются идеи, положенные в основу учебника для 1-го класса. Теоретическая часть позволяет учащимся получать ответы на контрольные вопросы, помогает решать одновариантные и многовариантные тесты, задачи и упражнения. Концептуальные направления обучения математике во 2-м классе обеспечивают формирование фундамента вертикали математического образования в 1-11 классах общеобразовательной школы.

Ключевые слова: *начальное общее образование, преподавание, математика, элемент знаний*

Для цитирования: Nikitin A.A., Nikitina O.A. Conceptual Guidelines for Teaching Mathematics in the Second Grade of General Education Schools // Education & Pedagogy Journal. 2024. Issue 3 (11). P. 51–86. doi: 10.23951/2782-2575-2024-3-51-86

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Submitted May 24, 2024

PSYCHOLOGY

UDC 159.9.
DOI: 10.23951/2782-2575-2024-3-51-64

MANIFESTATIONS OF MAGICAL THINKING IN PSYCHOLOGY STUDENTS

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Abstract. Contemporary psychology has shown an increasing interest in exploring alternative methods by which people rationalize their perceived reality. This research trend is a reaction to the growing prevalence of unconventional and extravagant approaches to self-development that explain psychological problems and suffering. It is also a response to the growing demand from clients for 'exclusive' and extraordinary self-improvement practices and crisis management solutions triggered by instability and change in various areas of public life. These practices, based on magical forms of perception and thinking, are increasingly becoming part of psychological services offered not only by pseudopsychologists or charlatans but also by business- and money-oriented psychologists. In addition to the conceptualization and theoretical exploration of magical thinking, there is a growing need to identify its various manifestations in modern life. This includes the identification of meaningful and behavioral markers to assess the degree of normality or abnormality of its manifestations.

This article presents theoretical insights and empirical findings on psychology students' attitudes toward magical thinking. The study shows that the intensity of magical thinking decreases with progressing education and that students are more critical of the relevance of magical thinking for their future professional practice. Nevertheless, belief in paranormal phenomena is still widespread among students. The study participants believe that magical thinking occurs as a resilient cultural phenomenon in their everyday and educational practice. They also recognize its potential application in professional psychology, albeit in limited instances. Although their education influences the extent of magical thinking, it is not the decisive factor, as other studies have shown. Interest in magical practices, occult beliefs, and superstitions does not completely disappear after graduation. This interest could be due to the ongoing methodological crisis in practical psychology, which has not yet completely detached itself from esoteric practices rooted in magical thinking.

Keywords: *mindset, professional thinking, magical thinking, education, practical psychology*

For citation: Kokorina A.V., Nelyubin N.I. Manifestations of Magical Thinking in Psychology Students. *Education & Pedagogy Journal*. 2024;3(11):51-64. doi: 10.23951/2782-2575-2024-3-51-64

The basis for the scientifically sound and reflective use of research and psychotechnical methods in the professional practice of a psychologist lies in professional thinking. Developing this type of thinking enables psychologists to recognize and resolve complex cognitive contradictions and ethical dilemmas; to understand the deeper emotions and experiences of others that are not directly observable; to develop generalized and mediated accounts of the realities under study; to use valid and scientifically supported explanatory models; develop appropriate strategies for providing psychological help; select effective tools for symbolically representing and externalizing difficult-to-express client states; make meaningful connections between their worldview and lifestyle as they manage their professional identity crises.

Regardless of whether deductive or inductive methods predominate in explaining psychological phenomena, a professional psychologist constructs a scientifically grounded understanding of psychological reality both as a researcher and as a practitioner. Thus, a crucial aspect of a psychologist's professionalism is their sensitivity to various irrational and egocentric biases and naïve and banal beliefs. These factors can intrude into professional thinking and lead to significant distortions in professional activity.

Due to the instability and change in the modern world, there is a growing demand in society for alternative explanations for mental health problems and suffering. This demand often includes highly unconventional practices to manage these conditions, rooted in magical worldviews and ways of thinking. The collective consciousness is highly contradictory and mixes materialistic perspectives with occult beliefs. This deep-rootedness complicates efforts to rationalize and modernize our collective mindset [15, p. 134].

A. Tkhostov and A. Nelyubina explain this assertion as follows: First, the media have popularized magical themes and often romanticized the image of magicians and psychics. Second, there is a growing disillusionment with the rational, science-based worldview, which has been unable to explain the various anthropological, natural, and technological catastrophes that humanity has faced in the new millennium. Third, amidst the mass cultural homogenization of modern life, there is an increasing trend toward the desire for uniqueness, which serves as an overcompensation for the fear of being ordinary [10].

These factors explain the proliferation of magical thinking among the general public and practicing psychologists seeking to diversify their psychological offerings. Due to the increasing emphasis on the monetization of services within the professional psychology community and gnoseological attitudes such as eclecticism and methodological nihilism, elements of magical thinking are firmly rooted in the methodological toolbox of the new generation of practicing psychologists.

The term 'magical thinking' is used by scholars from various disciplines, including anthropology, history, cultural studies, psychology, and psychiatry, making it difficult to find a clear definition in contemporary interdisciplinary discourse. In order to clarify the semantic boundaries of this concept, it is helpful to look at studies that focus on the cultural-historical aspects of magical thinking. Sir James Frazer was one of the first to describe magical thinking, its principles, and its structure in communities at a relatively low socio-historical and cultural development level. He argued that magical thinking is based on two fundamental laws: the law of similarity and the law of contact. Frazer wrote: "From the first principle, the law of similarity, the magician concludes that he can produce any desired effect simply by imitation. From the second principle, he concludes that whatever happens to an object will also affect the person who has once come in contact with that object (e.g., with a part of the body or otherwise)" [11, p. 20]. These principles imply that a person who engages in magical thinking believes in the power of imitation (of natural elements or animals) and the ability to transfer magical effects from substitute objects to the original object or another person. These beliefs resemble the characteristics of the naïve, egocentric thinking of children who believe in the omnipotence and inevitability of their own ideas and intentions.

In the early twentieth century, the French anthropologist Lucien Lévy-Bruhl introduced the concept of prelogical mentality in his work Primitive Mentality. This type of thinking, according to Lévy-Bruhl, is not receptive to logical contradictions and focuses exclusively on mystical explanations for events. He argued that this does not indicate an inability to abstract but rather that this abstraction takes on a mystical form. Magical thinking, as Lévy-Bruhl describes it, attempts to make connections: "The Primitive Mentality primitive's mind views the matter very differently, however All, or nearly all that happens is referred by him, as we have just seen, to the influence of mystic or occult powers such as wizards, ghosts, and spirits. In acting thus, his mind doubtless obeys the same mental instinct as that which guides us." [6, p. 129]. However, Lévy-Bruhl did not believe that this form of thinking had been completely replaced by logical thinking in modern man. He explained: "There are not two different forms of thinking in humans – a prelogical and a logical one, separated by an impenetrable wall. Rather, there are different structures of thought coexisting within the same society and often, perhaps always, within the same consciousness" [6, p. 36]. This suggests that sensitivity to mystical experiences, irrational explanations, and causal attributions is a deeply ingrained aspect of human cognition. But why does this form of thinking persist in a world dominated by advanced technologies and scientific innovations? Mircea Eliade offers a fascinating perspective on this. He argues that in the modern wave of occultism, 'initiation' – whatever meaning is ascribed to the term – plays a crucial role. It confers a new status on the initiate, giving them a sense of being 'chosen' and setting them apart from the anonymous and lonely masses. Furthermore, in many occult circles, initiation also has a supra-personal function, as it is assumed that every new initiate contributes to the renewal (renovatio) of the world [14, p. 108].

In contemporary Western psychology, magical thinking has become a popular object of study in terms of its conceptualization and its phenomenology in various aspects of human life. K. Iserson defines it as a cognitive process reinforced by subjective beliefs, faith in supernatural causality, and the efficacy of rituals that strengthen a person's hope for a positive outcome of difficult life situations. However, cultivating such a mindset can have negative consequences for health, such as delayed medical intervention or rejection of scientific treatments [16]. A. Qamar considers magical thinking as a classical concept within cognitive anthropology. The author describes it as a utilitarian cognitive framework that serves as a gnoseological platform for practicing occult practices and magical and religious beliefs, reinforcing these beliefs' perceived efficacy and functional significance in a person's life [17].

A. Kholmogorova defines magical thinking as the result of two main processes: "a disturbance in the process of de-idealization, on the one hand, and a defense mechanism against a threatening reality with which stable cooperative relationships have not been established, on the other. Unrealistic and exaggerated expectations of oneself and others are the flip side of this phenomenon, where the notion of omnipotence cannot be abandoned in time; rather, the individual clings to it, neglecting to strengthen connections with reality" [12, p. 81].

E. Subbotsky points to the compensatory function of magical thinking. Since medicine, technology, and education do not provide definitive answers to the ultimate question of the non-biological meaning of human existence, magical thinking serves as a resource that fills the existential gaps that arise in the soul of modern man [8]. A similar view is held by E. Bayramova and S. Enikolopov, who state: "Magical thinking is a part of the consciousness of many modern adults. It helps form new rational constructs and models that make the world seem safer, more suitable, and more appropriate for the individual. It also promotes positive fantasizing that creates productive illusions that help people overcome difficult life situations" [1, p. 6].

If the concepts of magical thinking are supplemented with the ideas of L. Vygotsky [3] and Y. Lotman [7], one could argue that magical thinking is an atavistic remnant of archaic forms of cognition (pre-logical systems of constructions embedded in cultural texts) that persist in the semiotic realm. This form of thinking develops alongside rational thinking through cultural evolution. This can occur through identification with a fairy tale or with literary figures and significant adults who embody pre-logical thinking and mystical worldviews, as well as through the reinforcement of the compensatory role of fantasy and the reinforcement of notions of personal omnipotence and exceptionality. Magical thinking becomes more pronounced when scientifically and rationally based ways of explaining and linking events lose effectiveness or are devalued to maintain the illusion of control over those events. Whether this trend is related to cognitive simplicity or complexity remains an open question. In our view, magical thinking represents an alternative set of constructs (which can be quite complex) that reinforce a sense of uniqueness and omnipotence and foster a belief in the ability to control phenomena in the human and natural world and influence the causal determination of events through symbolic action and ritual. Of course, this is not 'thinking' in the strict sense of the word, for it involves neither the ideal (conceptual rather than imaginative) transformation of an object nor its subsequent objectification as an abstract model or concept that captures its essential content and functional properties, which remain hidden from sensory, non-problematic perception.

Amidst the persistent and far from a conclusive theoretical understanding of the phenomenon of 'magical thinking,' there is currently a wave of research interest in its various manifestations in the modern individual's life. Studies are investigating its characteristics in both normative and pathological contexts [12, 13], identifying its semantic markers and cognitive-personality predictors [9], and exploring its mediating role in the formation of the individual's understanding of illness concepts [10, 16].

Our empirical study focused on identifying the forms of magical thinking among psychology students at different stages of their education. We hypothesized that students would rely less on mundane and unscientific explanations for various phenomena in daily life and professional contexts as they progressed in their careers. Our primary hypothesis was that magical thinking would be more prevalent in first-year undergraduate students and less commonplace in more advanced psychology students.

Seventy-two students participated in the study from the 1st to the 4th year of study at the Faculty of Psychology and Pedagogy of Omsk State Pedagogical University. To explore the characteristics of magical thinking among psychology students, we used the following methods: a questionnaire to assess students' views on magical thinking (by A. Kokorina, N. Nelyubin), the Paranormal Belief Scale (J. Tobacyk, adapted by D. Grigoryev), and the Magical Ideation Scale (M. Eckblad and L. Chapman, adapted by E. Bayramova, S. Enikolopov).

The questionnaire was divided into three sections: Magical thinking in daily life, a psychologist's professional practice, and training. The results provided information about the students' attitudes toward magical thinking and its possible application in their personal lives, academic activities, and professional work as psychologists.

When asked about the relevance of magical thinking in psychological practice, the responses were as follows: 44% of first-year students, 87% of second-year students, 61% of third-year students, and 61% of fourth-year students believe that while magical thinking should be considered as a factor influencing behavior and psychological processes, it should be distinguished from scientific approaches in psychology and should not be used as a basis for professional interventions. 13% of first-year students, 7% of second-year students, 22% of third-year students, and 22% of fourth-year students believe that psychology should be based strictly on scientific methods and empirical data and exclude magical thinking. 25% of first-year students, 7% of second-year students, 5% of third-year students, and 13% of fourth-year students acknowledged that magical thinking might play some, though not a decisive, role in psychological practice in some cases. 19% of first-year students, 11% of third-year students, and 4% of fourth-year students believe that magical thinking is a cultural and social phenomenon that can influence behavior and beliefs and, therefore, could have applications in psychological practice.

Of the respondents, 31% expressed a willingness to incorporate magical thinking into their professional practice, while 69% said they were not inclined to do so. When the responses were broken down by year of study, the following trends emerged: 44% of first-year students, 33% of second-year students, 28% of third-year students, and 22% of fourth-year students were open to using magical thinking in their practice.

The reasons they gave for using magical thinking in their professional practice included: 45% cited the client's desire to engage in magical practices. 77% stated that a mystical or magical worldview dominates over a scientific one in their clients. 36% mentioned their clients' resistance to accepting scientific explanations for their problems. 45% pointed out that their clients often trust magical practices more than psychological practices. 14% referred to the higher income of specialists who use such practices.

Of the total sample, 69% of respondents indicated that they did not intend to use magical thinking in their professional practice. Despite this general skepticism, responses to the question about exceptional cases in which magical thinking might be considered revealed that 26% indicated that they would resort to magical thinking if the client specifically asked for such practices. 40% would consider using magical rituals if they found that the client's mystical or magical worldview dominated over a scientific perspective. 32% would use magical practices if the client refuses to accept science-based explanations for their suffering. 20% would turn to magical thinking if they find that their clients trust magical practices more than psychological practices. 6% would consider it if they saw that specialists in esoteric fields earn significantly more than psychologists. Only 18% of respondents maintained their stance that they would never allow magical thinking to influence their professional activities.

The answers to the question about the effects of magical thinking on educational activities deserve special attention. The opinions of the respondents were divided into two opposing groups. About 23% of the surveyed students expressed positive opinions about the influence of magical thinking on educational preparation. They pointed to possible positive changes, such as an improvement in the psycho-emotional state of participants in educational interactions (13%), a better understanding of the human psyche (4%), and more success in overcoming academic and educational challenges (6%).

Negative consequences cited by 77% of respondents included creating an unproductive educational environment (31%), risk of making poor decisions in academic and professional activities (49%), a lack of critical thinking (50%), and breaches of professional ethics in academic and professional contexts (58%). Only one student was undecided.

Responses regarding the possible use of magical thinking to teach or motivate students were distributed as follows: 29% of respondents indicated that using magical thinking in teaching and exams could help create a positive mindset. 22% said it could increase student engagement and make the learning process more memorable and unique, which could help retain material better. In addition, 13% of respondents mentioned that understanding the psychological mechanisms of magical thinking could help develop critical thinking. 6% felt that magical thinking can be used to explain complex concepts and ideas in psychological science. However, 29% of respondents emphasized the need to conduct the educational process strictly within a scientific framework. Meanwhile, 25% of students were undecided.

The goals that students want to achieve through magical thinking include: Self-knowledge and personal development (24%), finding answers to complex questions and solving problems (26%), finding the meaning of life (10%), improving personal resources and skills (24%), improving physical and emotional well-being (25%), connecting with higher powers or spiritual beings (6%), strengthening spirituality (7%), and resolving interpersonal conflicts (7%). In addition, 42% of the students surveyed stated that they do not use magical thinking in their daily lives.

When investigating the possible reasons for turning to magical practices, the distribution of responses by course level was as follows: "When experiencing stress, anxiety or similar conditions and looking for ways to calm down and let go of negative emotions": 63% of first-year students, 47% of second-year students, 72% of third-year students and 60% of fourth-year students. "If you are having problems in a relationship and are looking for ways to resolve them": 13% of first-year students, 20% of second-year students, 39% of third-year students, and 26% of fourth-year students. "When seeking help to heal physical or emotional ailments that do not respond to conventional treatments": 38% of first-year students, one second-year student, 39% of third-year students, and two fourth-year students. "When I am trying to understand the meaning and direction of my life and when I am seeking inspiration and guidance,": 25% of first-year students, 47% of second-year students, 22% of third-year students, and 21% of fourth-year students. "When I want to improve my intuition and develop psychic abilities": one first-year student, three second-year students, and two fourth-year students. "If I am trying to attract prosperity, success, and abundance into my life": one first-year student, three second-year students, three third-year students, and one fourth-year student. "When I seek inner peace and harmony and want to learn to control thoughts and feelings": four first-year students, four second-year students, 28% of third-year students, and one fourth-year student. "Looking for answers to deep philosophical and spiritual questions about the meaning of life and existence": three first-year students, five second-year students, five third-year students, and three fourth-year students. "If you need help processing past trauma or emotional blocks": 25% of first-year students, three second-year students, three third-year students, and two fourth-year students. "Would not use magical thinking under any circumstances": Two first-year students, two second-year students, one third-year student, and three fourth-year students.

In response to the question, "Have you noticed any positive changes in your life as a result of using magical thinking?" the following results were reported: 17% of students observed an improvement in their physical and emotional well-being. 19% reported success in achieving goals and solving problems. 14% noted an increase in happiness and overall well-being. 13% experienced spiritual growth. 22% reported a better understanding of themselves and their desires. 13% noted improved relationships with others. 14% felt a greater sense of safety and security. 2 students reported feeling more authority and respect. However, 44% of respondents either did not notice any positive changes or did not engage in magical thinking.

Most of the psychology students surveyed believe that magical thinking occurs in their everyday lives and education and might also appear in professional psychological work. However, they emphasize the need to separate magical practices from psychological methods. The interviewees regard magical thinking as an enduring cultural phenomenon influencing behavior and beliefs. Therefore, it should be considered when working with clients susceptible to mystical experiences and esoteric beliefs. The participants believe professional psychologists should strictly adhere to scientifically validated methods and avoid incorporating magical thinking into their practice.

Most psychology students surveyed incorporate magical thinking into their everyday life and training. Almost a third of respondents are open to using elements of magical thinking in their professional practice after graduation. Students are attracted to the image of a psychologist who uses magical thinking and esoteric methods in their work. However, their main motivation for seeking such a specialist would be to evaluate the effectiveness of esoteric practices and explore the similarities and differences between professional psychological methods and esoteric practices.

We administered a paranormal belief questionnaire to respondents to test our hypothesis further. This allowed us to assess not only the overall level of magical thinking but also the intensity of its components. The mean scores of the psychology students' paranormal beliefs are shown in Table 1.

The overall level of paranormal beliefs among first-, second-, and third-year students is relatively consistent, ranging from 71 to 78 out of 182 points. In contrast, fourth-year psychology students have the lowest level of paranormal beliefs, with an average score of 57.

Traditional religious beliefs are lower for second- and fourth-year students than for first- and third-year students. Overall, however, the mean group values for this parameter are higher than those observed in the sample to which the methodology was initially adapted (according to the data of D. Grigoryev [4]). These changes are probably not due to professional training but rather reflect the students' personal religious beliefs, which are relatively stable and do not conflict significantly with professional views.

The level of belief in witchcraft is equally high for first-, second-, and third-year students, while it decreases significantly for fourth-year students, although their scores are still above the normative values. This might be because first- to third-year students may still have less stable professional beliefs, while fourth-year students begin to seriously consider issues of professional ethics and the limits of competence. Beliefs in prediction, psi abilities, and extraordinary life forms are also lower among fourth-year students than their peers, but the difference is not as pronounced. Fourth-year students are likely more aware of the limited effectiveness and relevance of these practices in both academic and everyday contexts, and they emphasize the importance of adhering to the norms and principles of professional psychological help. Overall, the mean values for each year are higher than the normative scores. The tendency towards superstition is equally high among students of all years and is almost twice as high as the average values for this indicator in the population. This trend can be explained by the usual student traditions, precautions, and protective rituals that prevail in the student environment. Superstition is one of the enduring student traditions and is often seen by students as entertainment and a means of relieving exam stress.

A notable finding is the comparison between the Spiritualism Scale and the Psi Ability Scale in first to third-year students. Scores on the spiritualism scale are twice as high as the mean values obtained when the method was adapted. This suggests that students believe more strongly in the ability to communicate with spirits than in their ability to control others' objects, thoughts, and actions.

Table 1

Mean level of belief in the paranormal among psychology students in different years of study

Year of study / Max. Score / H-test	Traditional Religious Belief	Psi Abilities	Witchcraft	Superstitions	Spiritism	Extraordinary Life Forms	Predictions	Overall Level of Belief in the Paranormal Activities
First	16	9	13	7	12	8	13	78
Second	12	9	14	7	11	9	11	71
Third	14	8	14	7	12	8	10	73
Fourth	11	7	9	6	8	7	9	57
Max. Score	28	28	28	21	28	21	28	182
H-test	4.787	4.345	4.345	4.345	4.787	4.869	4.869	5.758

To determine differences in the degree of belief in the paranormal, we used the Kruskal-Wallis H-test. This test is suitable for detecting differences between three or more independent samples. Statistical comparison of the data across all scales for belief in the paranormal revealed no significant differences between students in different years of study.

We used the 'Magical Ideation Scale' to determine the level of magical thinking among psychology students at different academic stages. According to the scale's authors, the average level of magical thinking typically ranges from 4 to 14 points. A high score on the scale (between 20 and 30 points) may indicate possible mental disorders, but such results should be interpreted with caution and may warrant further evaluation by a psychiatrist.

After administering the survey, it was found that the average level of magical thinking for first- and third-year students was 10 points. Second-year students have an average score of 9, which is also within the normal range. The fourth year of study has the lowest average score for magical thinking at 6 points. However, there was considerable variation in individual scores within each year of study: from 0 to 15 for first-year students, from 0 to 22 for second-year students, from 2 to 25 for third-year students, and from 1 to 11 for fourth-year students.

To confirm the main hypothesis of our study, we used the Kruskal–Wallis H-test. The calculation resulted in an H-value of 9.053 ($p = 0.05$). This indicates statistically significant differences in the level of magical thinking of the students in the different years of study.

Summarizing the results obtained, it is clear that belief in various paranormal phenomena is widespread among students, as already noted by A. Yurevich and M. Yurevich. Their survey found that belief in occult phenomena is deeply embedded in the subconscious of students, regardless of the scientific rigor of their education. This supports her finding that young people know that occult phenomena exist but do not fully understand the sources of this knowledge or the process of its creation [15, p. 134]. It is encouraging that both the qualitative and quantitative empirical data suggest that the intensity of magical thinking among students decreases at the end of their training. This trend can be attributed to several factors. First-year students primarily take general education courses in which psychology is introduced only at a basic level. Freshmen cannot yet explain the subjective world of personality and its behavioral and individual-typological characteristics. The further students progress, the more they are immersed in professionally mediated social development, which strengthens the role of professional thinking. This process is associated with a change in "many stereotypes, attitudes, status, identification of oneself with the subject of future professional activity, the formation of personal maturity" [2, p. 97].

The transition from general education to specialized courses leads to a gradual decrease in the level of magical thinking with each successive level of education. Many graduates begin to work in educational institutions, which allows for deeper practical training. Fourth-year students are also conducting more complex research for their final year projects, compared to previous courses, which were often considered 'practice' before moving on to more serious research. This shift requires students to be able to analyze data based on theoretical concepts and explanatory principles of psychology and separates them from the speculations and fantasies of magical thinking.

The further students progress in their education and move into practitioner-oriented and quasi-professional roles, the more selective they must be in their methodological, values-based, and conceptual preferences. Scientific methods and adherence to professional ethics become paramount in their academic and professional activities. A significant part of the specialized courses is devoted to the development of professional thinking, which is crucial for shaping the professional culture of the future professional. Students increasingly engage in reflective practices to evaluate the value and paradigmatic foundations of their own professional thinking and "to understand the role of this thinking within a system of evolving forms of thinking" [5, p. 7]. As a result, magical thinking becomes less frequent, and students realize that it is inappropriate in professional practice.

The analysis shows that although training influences the extent of magical thinking in psychology students, it is not the decisive factor. Students' continued interest in magical practices during their studies may be due to the fact that practical psychology, at its current stage of development, has not yet fully distanced itself from esoteric and other magical practices. In addition, the belief in the efficacy of magical thinking among a significant proportion of students is reinforced by the fact that some prominent psychologists who are successful in the media frequently incorporate various unconventional practices into their work. Blurring boundaries between psychology and esotericism and the inappropriate use of magical practices in professional activities can ultimately lead to professional bias for emerging specialists, diminish public confidence, and create a distorted perception of the psychology profession in the social consciousness.

Beliefs in the efficacy of esoteric practices in the professional activities of psychologists may be reinforced in part during training. Students searching for self-development and support may come across various parapsychological and esoteric teachings and practices and attend additional professional courses and workshops. Misguided insights, errors in establishing event correlations, and vivid experiences can be interpreted as effects of working methods due to a lack of methodological rigor and critical thinking, and they can be taken as evidence of the effectiveness of magical practices. This can lead to their use being justified in future professional activities.

The greatest danger in cultivating magical thinking, both in daily life and professional psychology, is developing a false sense of professional exceptionalism. This mindset can lead to avoiding personal responsibility for professional actions or shifting that responsibility to transcendent forces and entities. Consequently, such an attitude can be projected onto clients seeking psychological help, ultimately undermining the therapeutic process, eroding trust in evidence-based practices, and fostering dependence on unscientific methods that may do more harm than good.

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ФОРМЫ ПРОЯВЛЕНИЯ МАГИЧЕСКОГО МЫШЛЕНИЯ У СТУДЕНТОВ-ПСИХОЛОГОВ

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Аннотация. В современной психологии наблюдается интерес к исследованию альтернативных способов рационализации человеком воспринимаемой действительности. Этот исследовательский тренд является ответом ученых на распространение в общественном сознании альтернативных и экстравагантных способов саморазвития, объяснения психологического неблагополучия и страдания, увеличение спроса заказчиков психологических услуг на «эксклюзивные» и экстравагантные практики саморазвития и совладания с кризисными состояниями, обусловленными нестабильностью и транзитивностью разных сфер общественной жизни. Эти практики, базирующиеся на магических формах мировосприятия и мышления, начинают встраиваться в «меню» психологических услуг не только представителей теневой психологии и шарлатанов, но и в методический арсенал предприимчивых и монетарно-ориентированных психологов. Наряду с осмыслением и концептуализацией достаточно широкого поля явлений, относящихся к магическому мышлению, объяснению его культурно-исторических предпосылок, возникает необходимость выявления его различных проекций в жизнедеятельность современного человека, выделения смысловых и поведенческих маркеров, по которым можно судить о степени нормальности и аномальности формы его проявления.

В данной статье, наряду с результатами теоретического осмысления данного явления, представлены результаты эмпирического исследования отношения к нему студентов-психологов разных курсов. Они свидетельствуют о том, что у опрошенных студентов к окончанию образовательной подготовки снижается интенсивности проявления магического мышления, возрастает критичное отношение к возможностям его применения в собственной профессиональной деятельности. Тем не менее, было установлено, что вера в различные паранормальные явления весьма распространена в студенческой среде. Участники исследования считают, что магическое мышление, как неустранимый культурный феномен, имеет место в их повседневной и образовательной практике, а так же допустили возможность его воплощения в профессиональной деятельности психолога, но в весьма ограниченных случаях. Образовательная подготовка оказывает определенное влияние на уровень магического мышления студентов-психологов, однако она не является решающим фактором, о чем свидетельствуют данные других исследователей. Интерес к магическим практикам, оккультным представлениям и верованиям у студентов-психологов в процессе обучения в вузе не угасает окончательно даже к выпускному курсу. Возможной причиной является затянувшийся методологический кризис практической психологии, которая на данном этапе своего развития еще не окончательно отмежевалась от эзотерических и иных практик, опирающихся на магическое мышление.

Ключевые слова: *мышление, профессиональное мышление, магическое мышление, образование, практическая психология*

Для цитирования: Kokorina A.V., Nelyubin N.I. Manifestations of Magical Thinking in Psychology Students // Education & Pedagogy Journal. 2024. Issue 3 (11). P. 51–64. doi: 10.23951/2782-2575-2024-3-51-64

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Submitted July 9, 2024

Издательство ТГПУ

ISSN 2782-2575

9 772782 257002

Education & Pedagogy Journal