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CONTENT

ECONOMIC SCIENCES

PEDAGOGICAL SCIENCES

PHILOLOGICAL SCIENCES

PHILOSOPHICAL SCIENCES

нию информационно-коммуникационных технологий в государственном и муниципальном управлении.

Список источников

1. Штрик А. А. Влияние информационных технологий на рост глобализации, конкурентоспособности и прозрачности национальных экономик // Информац. технологии. 2020. No 5. С. 2 (прил. к журналу).
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ЕКОНОМЕТРИЧНИЙ АНАЛІЗ ЗМІН РОЗМІРУ ЗАРОБІТНОЇ ПЛАТИ НАСЕЛЕННЯ УКРАЇНИ

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ECONOMETRIC ANALYSIS OF CHANGES IN THE SIZE OF WAGES OF THE POPULATION OF UKRAINE

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Анотація

У статті проведено економетричний аналіз змін заробітної плати, що передбачає дослідження ступеня впливу рівня безробіття, капітальних інвестиції та депозитів фінансових установ. Доведено, що дані показники формують понад 95% впливу на рівень заробітної плати, найбільш вагомим є показник капітальних інвестицій; мультиколінеарність у моделі відсутня. Досліджено еластичність фактору заробітної плати по відношенню до обраних факторів. Рівень еластичності знаходиться у межах від 1% до 4%. Найвищим рівнем еластичності відповідає фактор розміру депозитів банків.

Abstract

The article presents an econometric analysis of changes in wages, which provides a study of the degree of impact of the unemployment rate, capital investment and deposits of financial institutions. It is proved that these indicators form more than 95% of the impact on the level of wages, the most important is the indicator of capital investment; multicollinearity in the model is absent. The elasticity of the wage factor in relation to the selected factors is investigated. The level of elasticity is in the range from 1% to 4%. The factor of bank deposits corresponds to the highest level of elasticity.

Ключові слова: модель, заробітна плата, рівень безробіття, капітальні інвестиції, депозити фінансових установ, економетричний аналіз, мультиколінеарність, еластичність.

Keywords: model, wages, unemployment rate, capital investments, deposits of financial institutions, econometric analysis, multicollinearity, elasticity.

The concept of wages has ranked one of the main places in the research of economists. In the process of evolution of economic thought in society, a system of views of scientists on the essence of wages and the factors that determined its overall level and changes was formed. The content of the term "salary" has changed. If D. Ricardo [8] understood wages only as a monetary expression of the minimum means of subsistence, then modern authors interpret this concept as a means of satisfying both material and spiritual needs, as a tool to stimulate work.

The Ukrainian labor market has changed: now most of its segments are dominated not by employers but by job seekers, for most of whom the size of wages is the most important motivating factor at the provision of employment.

Wages are one of the main factors of socio-economic life of each country, team, person. High wages can have a beneficial effect on the economy as a whole, ensuring high demand for goods and services. Finally, high wages stimulate the efforts of business leaders to make effective use of human resources, to modernize production. Among the most important issues now is also the problem of eliminating excessive differentiation in the remuneration of managers and other employees, which is one of the causes of tensions in the social and labor sphere [10].

The presence of a significant number of workers living below the poverty line threatens the social stability of the state, does not motivate workers to work productively. Nominal salary is the amount of money accrued to an employee for work performed. It reflects the employer's labor expenditure, it is important primarily for the employer and the state, as it is a direct object of taxation and collection of contributions to social insurance funds. Real wages are the real purchasing power of the amount of money received by an employee for work performed. It is defined as the difference between the amount of nominal wages and the total amount of penalties (taxes, contributions to social funds, etc.) and is adjusted according to the inflation rate. Real wages reflect a set of material, cultural benefits, as well as services that an employee can purchase for a nominal wage.

Income policy has a double effect on inflation. By limiting the size of price and wages increase, income policy reduces the growth of production costs, the prices of which include such values. This hinders the self-development of inflationary processes and restrains their intensity. At the same time, the increase in prices for goods and wages determines the changes of household incomes, which contributes to limiting effective demand. Therefore, the income policy is often used in conjunction with deflationary policies, a set of measures taken by the state to control inflation and improve the balance of payments (a system of indicators that characterize the relationship between the amount of actual cash inflows from abroad and the amount of payments to other countries (quarter, month) or on a certain date). Administrative price regulation as an instrument of anti-inflation policy can be used in a transitional period, i.e. only as a temporary element to overcome speculative and extemporaneous processes. To conduct revenue policy, the state may create special temporary bodies or use traditional structures, such as the Ministry of Finance of Ukraine. It is considered that the revenue policy is most effective when representatives of three stakeholders are involved in regulation: the state, enterprises and trade unions. Life quality improvement of the broad segments of the population, ensuring common social standards throughout Ukraine are the ultimate objectives of the state policy. At the same time, the quality of life is the result of a number of objective and subjective factors, which are both national and regional in nature.

The reasons for the current differentiation of the population in terms of income are both in sectoral differentiation in wages and the difference in other incomes based on property inequality due to privatization, as well as unequal access to public and state property. The socially unfair system of distribution of monetary income between different income groups indicates that the use of GDP is focused mainly on the interests of a small group of the population, which remains a factor of instability in society.

Examining the current problems of the impact of wages on the general economic policy of enterprises, it should be noted that the main place in the list of the main functions of wages should belong to the optimization function. The level of wages in the national economy depends on the following macroeconomic indicators:

- the volume of output by industries;
- the ratio between the intermediate consumption of manufactured products by industries and value added or gross domestic product;
- distribution of GDP for wages, indirect taxes, subsidies and profits;
- the number of population and its active part employed in the economy [9].

The growth of the share of social transfers had a positive effect on the changes in household savings. It is significant that relatively high inflation rates did not restrain the growth of savings. The negative aspect of such trends is that the growth of savings is not transformed into investment. The first and main reason for the low level of public participation in the investment process is the small amount of free funds (savings) of the population due to low incomes. Secondly, there is a significant distrust of the population in financial institutions: banks, investment companies, pension funds, insurance companies. It should be noted that this factor is very serious, as over the last decade the population has repeatedly suffered losses due to various financial frauds. To overcome the negative attitude of the population to the activities of financial institutions, it is necessary to make significant efforts both by the government and by the financial institutions themselves.

Based on the main characteristics of the studied economic area, the econometric model of changes in the expenditures of the population of Ukraine can be represented by the following specification:

$$y = f(x1, x2, x3) \quad (1)$$

where

- y is the average monthly nominal salary in Ukraine, UAH;
- $x1$ is unemployment rate in Ukraine,%;
- $x2$ is capital investments, UAH billion;
- $x3$ is household deposits attracted by deposit-taking corporations (banks), UAH mln.

The information background for developing and estimating the econometric model of changes in the expenditures of the population of Ukraine is given in Table 1.

Table 1

Informational background for calculating the costs of the population of Ukraine

No.	Period	y	x1	x2	x3
		Average monthly nominal salary, UAH.	Unemployment rate in Ukraine,%	Capital investments, UAH billion	Household deposits attracted by deposit-taking corporations (banks), UAH mln.
1	2010	1 806	6.4	272.1	12.027
2	2011	1906	8.8	192.9	12.292
3	2012	2239	8.1	189.1	12.274
4	2013	2633	7.9	259.9	12.525
5	2014	3026	7.5	293.7	12.646
6	2015	3265	7.2	267.7	12.819
7	2016	3480	9.3	219.4	12.999
8	2017	4195	9.1	273.1	12.944
9	2018	5183	9.3	359.2	12.926
10	2019	7104	9.5	448.5	13.005

* Source: formed by the author according to [5]

As shown in Table 1, the resulting features are the average monthly nominal wage in Ukraine in UAH. The data extraction is equal to 10 years, i.e. 2010 – 2019. i.e., the estimated current period is equal to 1 year. The main array of information was obtained from public information of the State Statistics Service of Ukraine, macroeconomic indicators and the consolidated budget of Ukraine.

The object of the study is the average monthly nominal wage [1, 3] for 2010 – 2019 period. The results of the analysis of changes in the average monthly nominal wage are shown in table 2.

Table 2

Average monthly nominal wage, UAH, 2010-2019

Period No.	Years	Average monthly nominal salary, UAH.
1	2010	1 806
2	2011	1906
3	2012	2239
4	2013	2633
5	2014	3026
6	2015	3265
7	2016	3480
8	2017	4195
9	2018	5183
10	2019	7104
Basic estimators		
No.	Evaluation class	Value
1	amount	34837.000
2	average	3483.700
3	average absolute incremental value	588.667
4	average growth ratio	1.164
5	variance	2433425.610
6	mean square deviation	1559.944
7	coefficient of variation	44.778

* Source: calculated by the author according to [5]

According to these calculations (Table 2) in the period 2010 – 2019 period, the average expected value of the average monthly nominal wage was UAH 3483.7. The average absolute increase of this indicator showed that for this period the average annual increase was UAH 588.6. and amounted to 116.4% growth. The average deviation of the indicator from the average expected value was UAH 1,559.9, which is equal to 44.8%.

The results of the analysis of changes of the unemployment rate in Ukraine are shown in Table 3. According to these calculations (Table 3) in 2010 – 2019 period, the average expected value of the unemployment rate in Ukraine was 8.3%. The average absolute increase of this indicator showed that for this period the average annual growth rate was 0.34% and amounted to 104.5% growth.

Table 3

Unemployment rate in Ukraine, %, 2010 – 2019

Period No.	Years	Unemployment rate in Ukraine, %
1	2010	6.4
2	2011	8.8
3	2012	8.1
4	2013	7.9
5	2014	7.5
6	2015	7.2
7	2016	9.3
8	2017	9.1
9	2018	9.3
10	2019	9.5
Basic estimators		
No.	Evaluation class	Value
1	amount	83.100
2	average	8.310
3	average absolute incremental value	0.344
4	average growth ratio	1.045
5	variance	0.999
6	mean square deviation	0.999
7	coefficient of variation	12.027

* Source: calculated by the author according to [5]

The average deviation of the indicator from the average expected value is 0.999, which is equal to 12.03%. The results of the analysis of changes of capital investment in Ukraine [4, 10] are shown in Table 4. According to these calculations (Table 4) in 2008 – 2017 period, the average expected value of capital investment was UAH 277.56 billion. The average absolute increase of this indicator showed that during this period the average annual decrease was UAH 19.6 billion. and amounted to 105.7% growth. The average deviation of the indicator from the average expected value amounted to UAH 74.15 billion, which is equal to 26.7%.

The findings of the analysis of changes of household deposits attracted by deposit-taking corporations (banks) in Ukraine are shown in Table 5. According to these calculations (Table 5) in 2010 – 2019 period, the average expected value of household deposits attracted by deposit-taking corporations (banks) in Ukraine was UAH 12.64 million.

Table 4

Capital investments in Ukraine, 2010-2019, UAH billion

Period No.	Years	Capital investments, UAH billion
1	2010	272.1
2	2011	192.9
3	2012	189.1
4	2013	259.9
5	2014	293.7
6	2015	267.7
7	2016	219.4
8	2017	273.1
9	2018	359.2
10	2019	448.5
Basic estimators		
No.	Evaluation class	Value
1	amount	2775.600
2	average	277.560
3	average absolute incremental value	19.600
4	average growth ratio	1.057
5	variance	5497.994
6	mean square deviation	74.148
7	coefficient of variation	26.714

* Source: calculated by the author according to [5]

The average absolute increase of this indicator showed that for this period the average annual growth of the indicator was UAH 0.109 million and amounted to 100.9% growth. The average deviation of the indicator from the average expected value amounted to UAH 0.333 million, which is equal to 2.63%. The remarkable thing is that the coefficient of variation characterizes the level of risk of deviations within the critical norm of financial risks [9]. It should be noted that this indicator has the lowest degree of economic risk, as the coefficient of variation does not exceed 10%.

The analysis showed that all indicators, including the result (salary) have a clear upward trend. The model is estimated on the basis of calculations of partial correlation coefficients and regression parameters calculated by the least square method (LSM).

Table 5

Household deposits attracted by deposit-taking corporations (banks) in Ukraine, UAH million, 2010 – 2019

Period No.	Years	Household deposits attracted by deposit-taking corporations (banks), UAH million
1	2010	12.027
2	2011	12.292
3	2012	12.274
4	2013	12.525
5	2014	12.646
6	2015	12.819
7	2016	12.999
8	2017	12.944
9	2018	12.926
10	2019	13.005
Basic estimators		
No.	Evaluation class	Value
1	amount	126.456
2	average	12.646
3	average absolute incremental value	0.109
4	average growth ratio	1.009
5	variance	0.111
6	mean square deviation	0.333
7	coefficient of variation	2.637

* Source: calculated by the author according to [5]

Partial correlation coefficients of the econometric model were obtained from the constructed correlation matrix shown in Table 6.

Partial correlation coefficients have the following meaning:

- r (yx1) = 0.6544, the relationship between the factors is medium, straight direction.
- r (yx2) = 0.8794, the relationship between the factors is close, straight direction.
- r (yx3) = 0.7904, the relationship between the factors is close, straight direction.
- r (x1x2) = 0.2911, the relationship between the factors is weak, straight direction.
- r (x2x3) = 0.6700, the relationship between the factors is medium, straight direction.
- r (x1x3) = 0.5220, the relationship between the factors is medium, straight direction.

Estimates of the partial correlation coefficients show that the model is dominated by external connections, i.e. between the factors y←x (i). The internal relations between x (i + 1)←x (i) have a small correlation effect, which does not confirm the presence of multicollinearity in the correlation matrix.

Table 6

Correlation matrix of factors for assessing the impact upon wages of the population of Ukraine

	y	*x1*	*x2*	*x3*
y	1			
x1	0.654469	1		
x2	0.879465	0.291163	1	
x3	0.790449	0.670054	0.522094	1

The linear form of multifactor regression on a multiplicity of three factors in general is as follows:

$$\hat{y} = b0 + b1 \cdot x1 + b2 \cdot x2 + b3 \cdot x3 \quad (2)$$

where

- $\hat{y}$ is the theoretical (regression) value of the average monthly nominal wage, UAH,
- *x*1 is the unemployment rate in Ukraine, %;
- *x*2 is the capital investments, UAH billion
- *x*3 is the household deposits attracted by deposit-taking corporations (banks), UAH mln.
- *b*i is the parameter of the regression equation calculated according to the least square method.

The calculation of the equation of the multifactor

econometric model is performed using the *Data Analysis* Application, which is given in Appendix B. The multifactor model of changes in the average monthly nominal wage in Ukraine has the following form:

$\hat{y}$ = - 18672.8 + 464.2x1 + 14.02x2 + 1139.7x3 (3)

According to the obtained model we have the following characteristics of changes in the *y* factor:

- with an increase in the unemployment rate in Ukraine (x1) by 1%, the average monthly nominal wage will increase by UAH 464.2;

- with an increase in capital investment in Ukraine (x2) by UAH 1 billion the average monthly nominal salary will increase by UAH 14.02;

- with an increase in household deposits attracted by deposit-taking corporations (banks) (x3) by UAH 1 million, the average monthly nominal wage will increase by UAH 1,039.7.

The obtained model is meaningful, which is confirmed by the value of the multiple coefficient of determination R^2 = 0.97265. Factors x (i) have 99.7% of the influence on the resulting *y*, and the other 2.8% of the influence belongs to factors not taken into account in the model.

The multiple correlation coefficient r (y, x1, x2, x3) is 0.98623, which indicates a high level of closeness between the factors. The model is adequate, which confirms the calculations of Fisher's F-statistics. F_{calc}> = F_{theor} (α = 0.05, df1 = 3, df2 = 6), i.e. 71.1412> = 4.76.

The meaningfulness of the regression parameters is confirmed by the evaluation of Student's t-statistics at degrees of freedom (n-2, α = 0.05) t_{theor} = 2.31.

The meaningfulness of the model parameters showed that they are all meaningful: t_{theor} = 2.31:

- b0: t_{calc} (-3,61)> = t_{theor} (2,31) is meaningful;
- b1: t_{calc} (3,25)> = t_{theor} (2,31) is meaningful;
- b2: t_{calc} (8,37)> = t_{theor} (2,31) is meaningful;
- b3: t_{calc} (2,37)> = t_{theor} (2,31) is meaningful.

Based on the high level of the multiple coefficient of determination and the meaningfulness of the model coefficients, we can conclude that there is no multicollinearity.

Estimation of predictive fluctuations of theoretical and actual values of the model is given in table 7.

Table 7

Estimation of factor influences in econometric model

Period number	Period	Average monthly nominal wage, in Ukraine, UAH	Regression value of the average monthly nominal wage, in Ukraine, UAH.	Deviation of the actual value from the regression one	Lower data range	Upper data range
1	2010	1 806	1815.7815	-10	-28291.3	31922.88
2	2011	1906	2122.0448	-216	-28808.2	33052.32
3	2012	2239	1724.0414	515	-28926.1	32374.16
4	2013	2633	2908.4154	-275	-28255.6	34072.47
5	2014	3026	3333.6753	-308	-27970.7	34638.09
6	2015	3265	3028.2415	237	-28268.8	34325.29
7	2016	3480	3531.4098	-51	-28511.2	35574.06
8	2017	4195	4127.484	68	-28000.2	36255.16
9	2018	5183	5406.2084	-223	-27123.1	37935.51
10	2019	7104	6839.6978	264	-26217.5	39896.86
	amount	34837	34837	0	-280373	350046.8

* Source: calculated by the author according to [5]

As shown by the evaluation results, the range of changes in the values of the parameters is within the following:

b_{lower} <bi <b_{upper}

-31329.49203 <b0 <-6016.146474

115.3644576 <b1 <813.0189936

9.912289507 <b2 <18.09682548

-33.03308035 <b3 <2312.392755

The graph of the range of changes of regression values of the econometric model is given in Fig. 1. In general, for the 2010 – 2019 period, the wages of the population of Ukraine are characterized by gradually stable changes with minor short-term fluctuations [5].

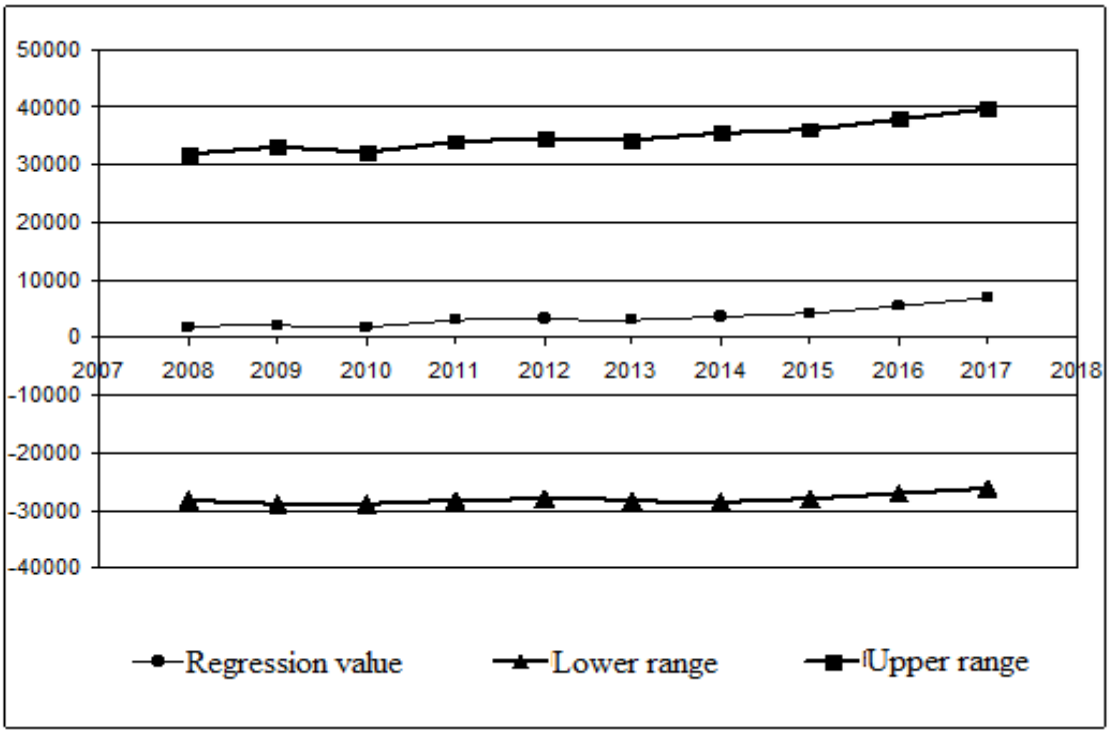

Fig. 1 Graph of the range of changes in the regression values of the econometric model of changes in the average monthly nominal wage

The analysis of deviations of the basic factors on which the model is constructed is investigated on the basis of the averages (Table 8).

Table 8

Estimation of changes of average values of parameters of econometric model

Parameter change	Coefficient	y	x1	x2	x3
середнє	1	3483.7	8.3	277.6	12.6
5%	1.05	3657.9	8.7	291.4	13.3
10%	1.1	3832.1	9.1	305.3	13.9
15%	1.15	4006.3	9.6	319.2	14.5
20%	1.2	4180.4	10.0	333.1	15.2
25%	1.25	4354.6	10.4	347.0	15.8

* Source: calculated by the author according to [5]

As can be seen from Table 8, with a gradual increase in the average expected value of the average monthly nominal wage of Ukraine by 25%, their number can be expected in the amount of 4354.6 UAH. under the following conditions: when the unemployment rate rises to 10.4%, subject to constant other factors; with the growth of capital investments to the level of UAH 347.0 billion. subject to constant shares of other factors; with an increase in household deposits attracted by deposit-taking corporations (banks) to UAH 15.8 million.

The calculation of the elasticity of the factors of the studied model is given in Table 9.

Table 9

Calculation of the elasticity of the factors of the studied model

	beta coefficient	elasticity coefficient
b1	0.30	1.11
b2	0.67	1.12
b3	0.24	4.14

* Source: calculated by the author according to [5]

The findings of the calculations showed that the factors have elasticity within the growth of the level of the corresponding factors x (i) by 1%:

- the size of the average monthly nominal wage of Ukraine will increase by 1.11% with an increase of the unemployment rate by 1%;
- the size of the average monthly nominal wage of Ukraine will increase by 1.12% with an increase of capital investment in Ukraine by 1%;
- the size of the average monthly nominal wage of Ukraine will increase by 4.14% with an increase in household deposits in Ukraine by 1%.

According to the estimate of the beta coefficient, we can conclude that the variable of capital investment has the greatest impact on wages.

Conclusions. Wages are one of the main factors of socio-economic life of each country, team, person. High wages can have a beneficial effect on the economy as a whole providing a high demand for goods and services.

Econometric analysis of changes in wages involves studying the degree of influence on the resulting indicator of such factors as unemployment, capital investment and deposits of financial institutions. It is proved that these characteristics form about 95% of the impact on the level of wages, but the most important is the indicator of capital investment.

The constructed econometric model has a linear shape and a high level of correlation ratio – about 98%. All factors have a direct interaction both with the resulting factor and in the system of internal structure. There is no multicollinearity in the model.

Based on the model developed, changes in the wage factor at certain levels of influencing independent factors x_i were estimated. The elasticity of the wage factor in relation to the selected factors is in the range from 1% to 4%. The factor of bank deposits corresponds to the highest level of elasticity.

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PEDAGOGICAL SCIENCES

DEVELOPMENT OF COGNITIVE INTEREST OF PRIMARY SCHOOL CHILDREN BY MEANS OF PROJECT ACTIVITIES

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РАЗВИТИЕ ПОЗНАВАТЕЛЬНОГО ИНТЕРЕСА МЛАДШИХ ШКОЛЬНИКОВ СРЕДСТВАМИ ПРОЕКТНОЙ ДЕЯТЕЛЬНОСТИ

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Abstract
The article reveals the concept of project activity and the features of its implementation for the formation of cognitive interest of primary school students. The results of research work on the formation of cognitive interest of younger schoolchildren through project activities on the basis of the Murmansk budget educational institution "Gymnasium № 7" are presented.

Аннотация
В статье раскрывается понятие проектной деятельности и особенности ее реализации для формирования познавательного интереса младших школьников. Представлены результаты научно–исследовательской работы по формированию познавательного интереса младших школьников посредством проектной деятельности на базе МБОУ г. Мурманска «Гимназии №7».

Keywords: cognitive interest, project, activity, junior school student, volitional effort, learning motive, universal learning actions, project thinking, activity approach.
Ключевые слова: познавательный интерес, проект, деятельность, младший школьник, волевое усилие, мотив обучения, универсальные учебные действия, проектное мышление, деятельностный подход.

Сегодня, когда в России неотъемлемым свойством педагогики выступает развитие творческого потенциала обучающихся, весьма актуальным становится ориентация образовательных организаций на формирование личности обучающихся, повышение их самостоятельной познавательной активности, подготовку к творческой познавательной и общественно-трудовой деятельности, что, безусловно, требует переосмысления методов, форм и содержания работы с младшими школьниками.

Познавательный интерес в трудах психологов и педагогов (Б.Г. Ананьев, И.И. Бецкой, Н.А. Макаренко, А.К. Маркова, Н.Г. Морозова, К.Д. Ушинский, Н.Г. Чернышевский, Г.И. Щукина и др.) освещен достаточно широко, тем не менее, до сих пор остается открытым вопрос - как вызвать у ребёнка устойчивый познавательный интерес к той или иной деятельности, или материалу. Одним из уникальных средств обучения и воспитания, позволяющих сделать интересными и увлекательными не только работу на творческо-поисковом уровне, но и будничные шаги младших школьников по изучению материала, является метод проектов.

Сущность проектной деятельности, ее место в образовательном процессе (А.Л. Блохин, Н.А. Бреднева, Е.А. Гилева, С.А. Ермолаев, Н.А. Забелина и др.) изложены достаточно подробно. Для нашего исследования вызывают особый интерес исследования, раскрывающие особенности использования метода проектов в работе с младшими школьниками (И.И. Баннов, Н.М. Конышева, С.В. Попова, Н.А. Романова и др.). И все же для полного осмысления проектной деятельности, по нашему мнению, следует обратиться к истории вопроса.

Так, использование термина «проект» в образовании восходит к работам Дж. Дьюи [5]. Его модель «школы активности, школы труда» была ориентирована на формирование личности, способной к проявлению инициативы, проектированию маршрута достижения своей цели, к созданию и реализации собственных проектов. Истинным образованием Дж. Дьюи считал все важное, вынесенное и пережитое из конкретных ситуаций, из специально организованного опыта, из «делания» [10].

В 1911 году Бюро воспитания США узаконило термин «проект» применительно к образовательному процессу.

В своей книге 1918 г. «Метод проектов» коллега Дж. Дьюи американский педагог У. Кильпатрик обосновал метод проектов как акт, совершаемый «от всего сердца», как поэтапную деятельность по достижению намеченной цели [12, с. 106-108]. По мнению У. Кильпатрика, знание, полученное ребенком для достижения цели, может выступить средством к новым целям. Связь между приобретенным знанием и новой целью станет источником новых интересов, особенно интересов