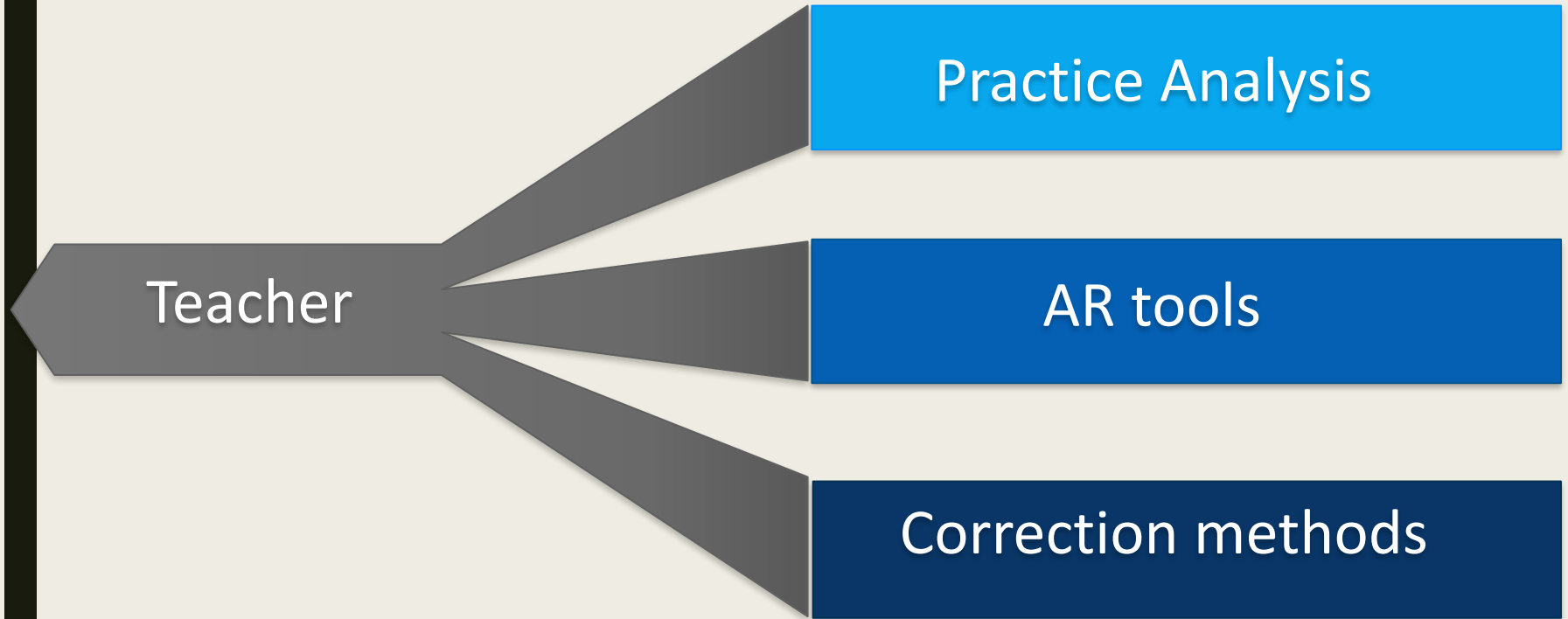


Correlations of the level of knowledge in mathematics and physics based on the method of paired comparison

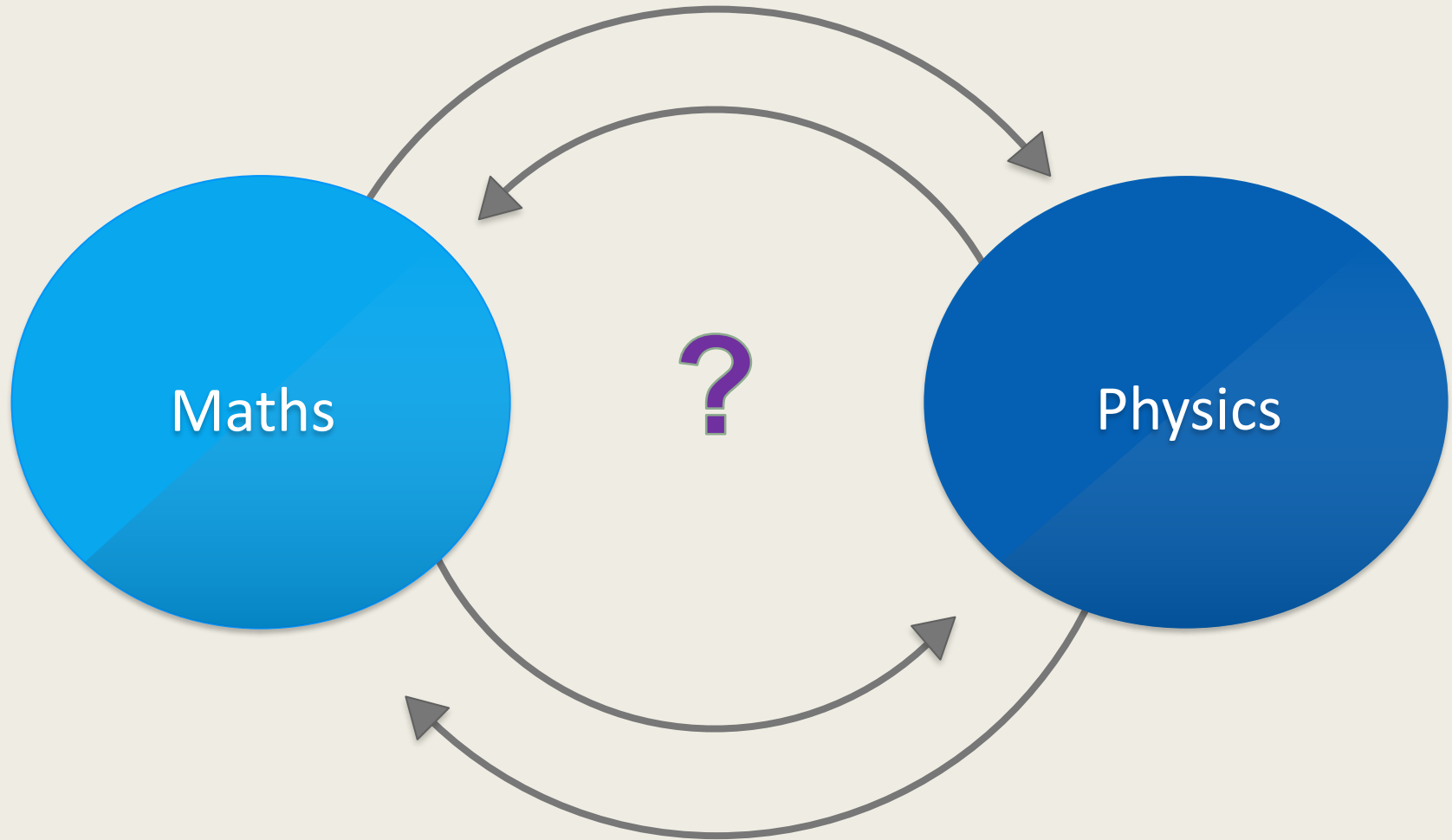
A. Medvedeva

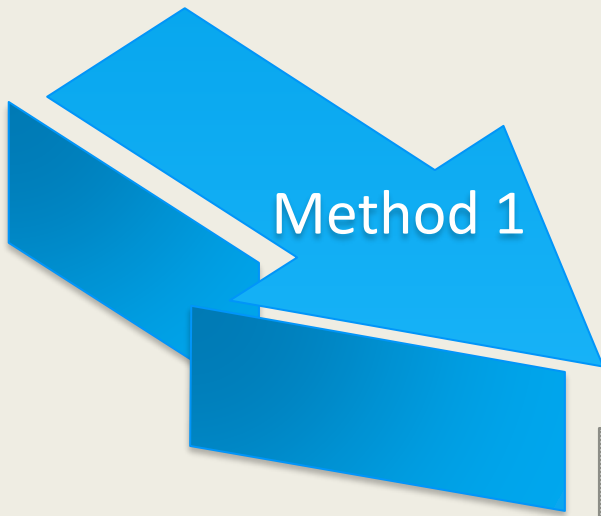
Nazarbayev Intellectual School physical
and mathematical direction
Aktobe

Action Research



Correlations of the level of knowledge in mathematics and physics

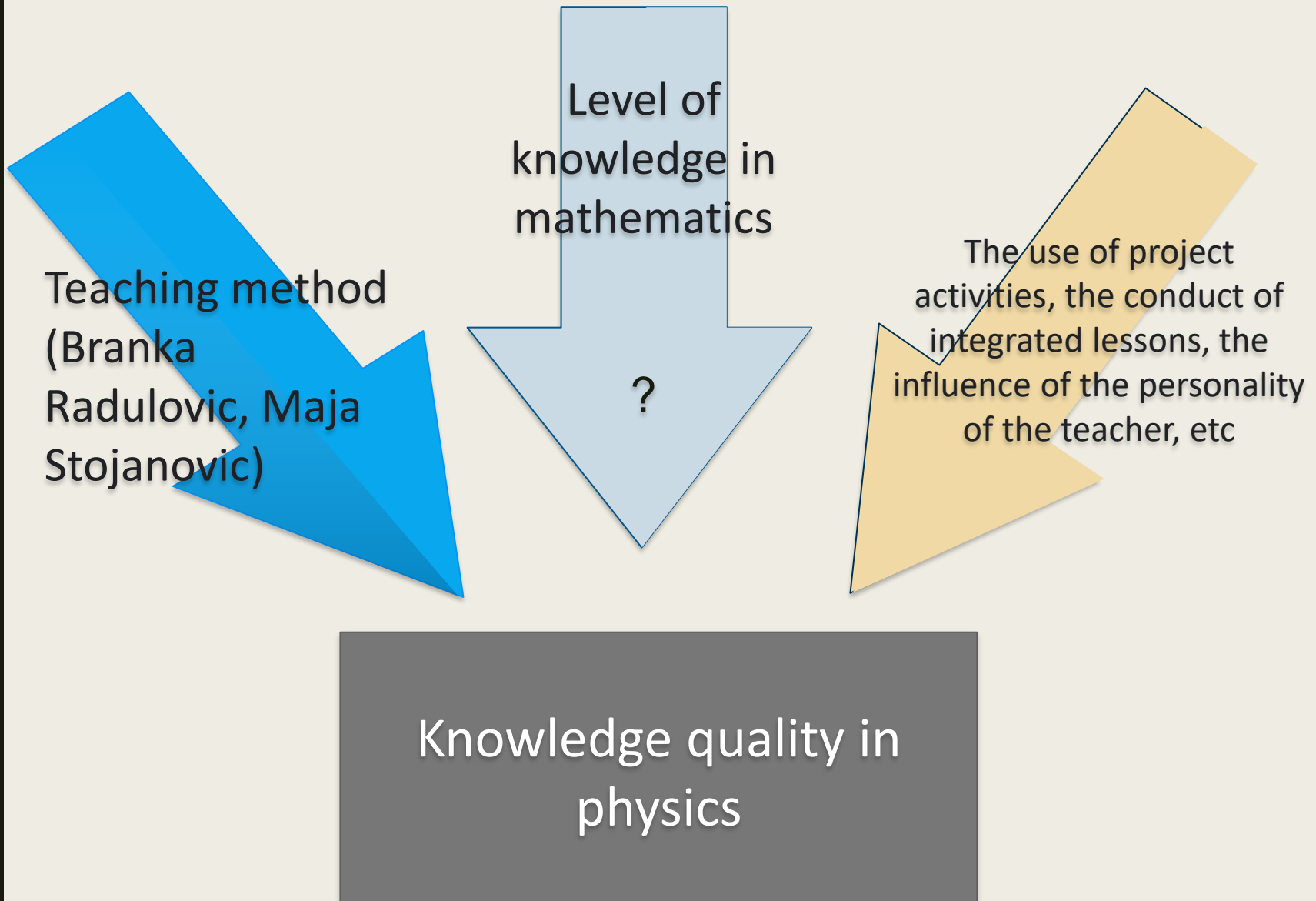




H_0



Factors



Methods of data processing on the research question

Fisher's criterion
(Jianjun Wang)

Dispersion analysis,
retrospective analysis
and the

Scheffe criterion
(Branka Radulovic, Maya
Stoyanova)

Paired comparison
method
in this work

Normal distribution of a
random variable, taking into
account the standard
deviation

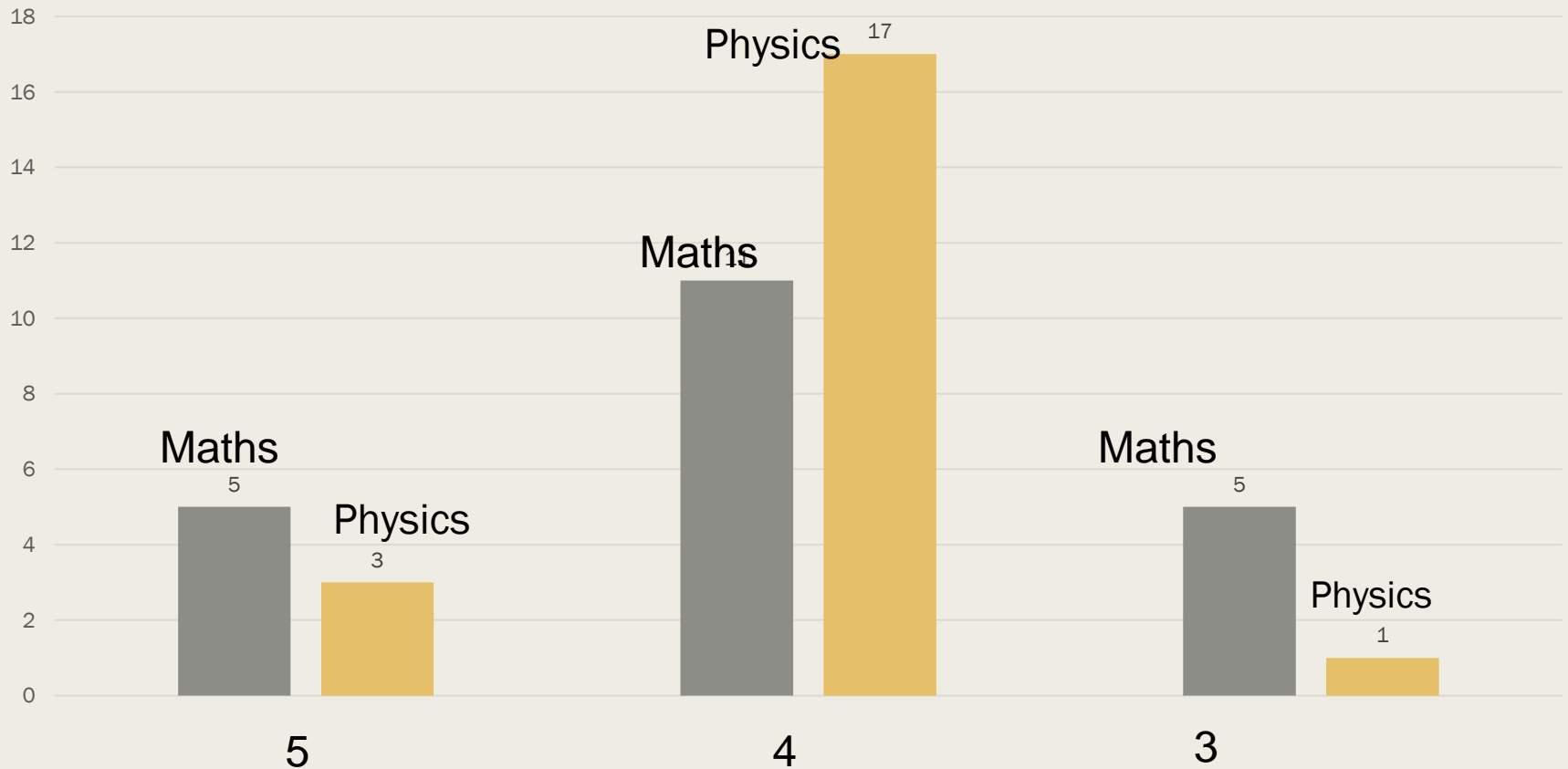
(Jihe Chen, Jerito Pereira,
Ying Zhou, Xinxin Li,
Maximus Tamur)

Correlation
level

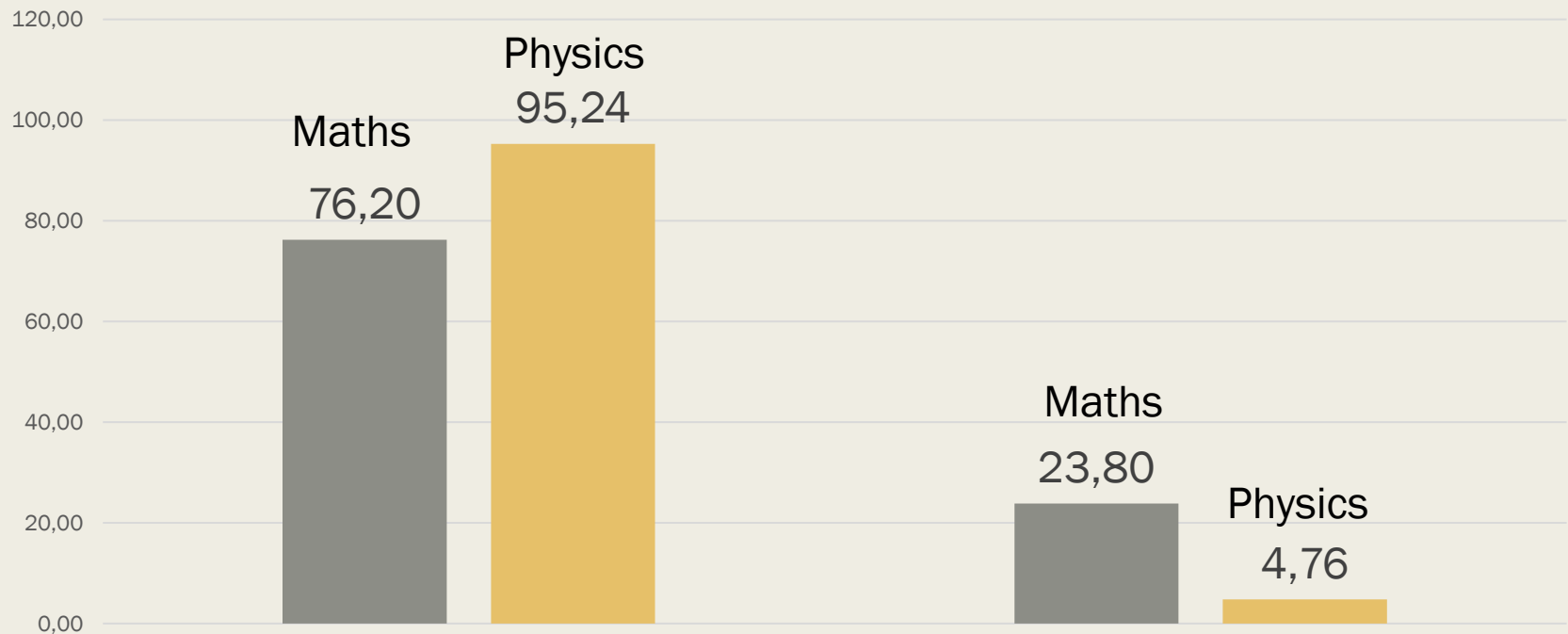
The purpose of the study is to identify the level of relationship between assessment in mathematics and physics; find out the question of the influence of the level of knowledge in mathematics, on the level of knowledge in physics; find out the presence of other factors that affect the level of knowledge in mathematics and physics.

Hypothesis: with a high level of correlation between mathematics and physics, there is reason to believe that the level of knowledge in mathematics affects the level of knowledge in physics.

Number of students by nomination marks



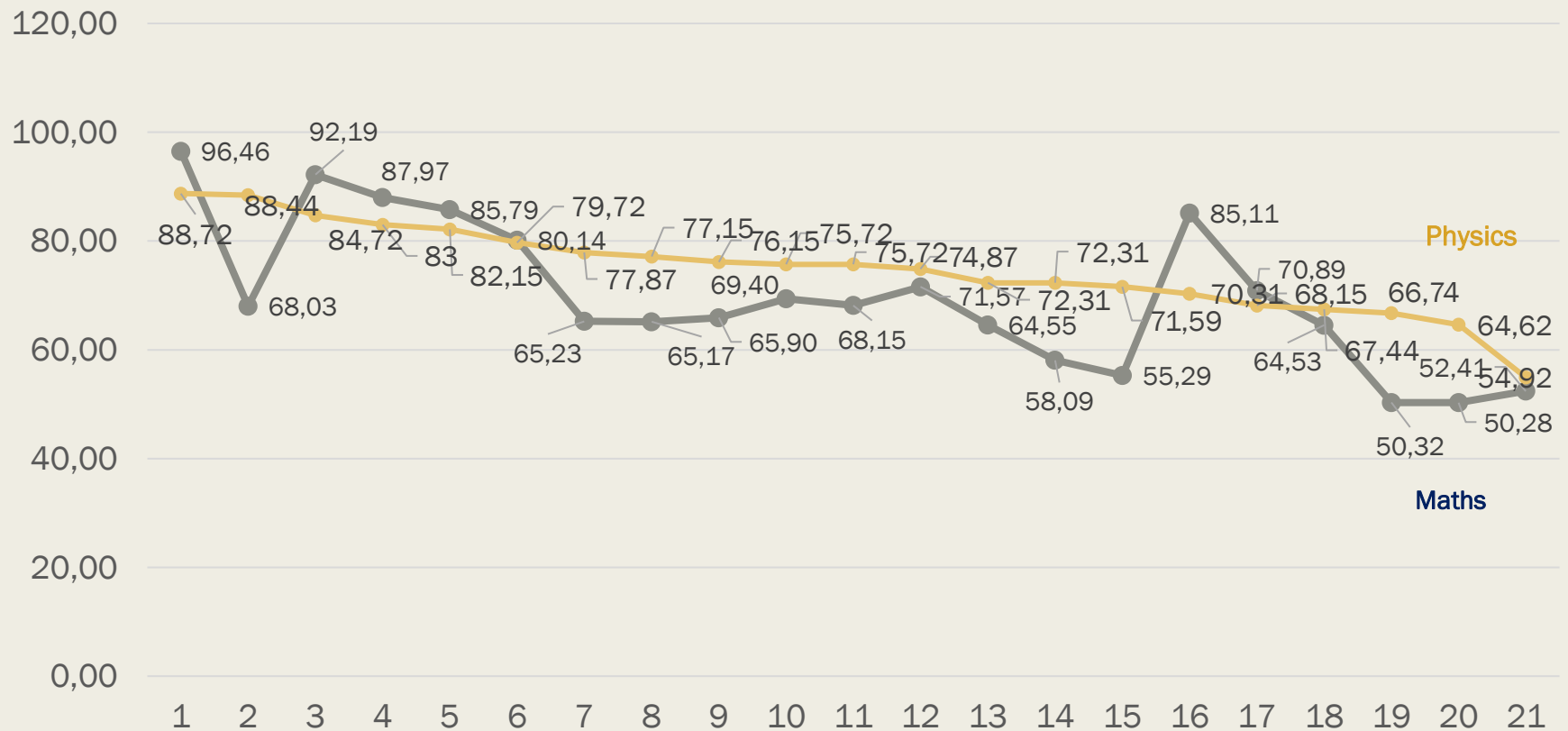
The quality of academic performance in mathematics and physics among a group of students in grades 10 for the 3rd quarter



Rank student on mathematics	Surname and student's name	Progress in% in mathematics	Rank student on physics	Surname and student's name	Progress in% in physics	Matched Values	
						Math rank	Rank in physics
1	M.E.	96,46	1	M. E.	88,72	1	1
2	M. Ə.	92,19	2	Ma. E.	88,44	11	2
3	Б. Д.	87,97	3	M. ə.	84,72	2	3
4	X.K.	85,79	4	Б. Д.	83	3	4
5	A. З.	85,11	5	X. K.	82,15	4	5
6	Б. А.	80,14	6	Б. А.	79,72	6	6
7	У. А.	71,57	7	К. С.	77,87	13	7
8	Т. А.	70,89	8	А. А.	77,15	14	8
9	А. Е.	69,4	9	Бо. А.	76,15	12	9
10	Д. Р.	68,15	10	А. Е.	75,72	9	10
11	Ma. E.	68,03	11	Д. Р.	75,72	10	11
12	Бо. А.	65,9	12	У. А.	74,87	7	12
13	К. С.	65,23	13	Ш. А.	72,31	15	13
14	А. А.	65,17	14	Б. Л.	72,31	17	14
15	Ш.А.	64,55	15	Б. М.	71,59	18	15
16	А. Т.	64,53	16	А. З.	70,31	5	16
17	Б. Л.	58,09	17	Т. А.	68,15	8	17
18	Б. М.	55,29	18	А. Т.	67,44	16	18
19	М. Д.	52,41	19	К. Д.	66,74	20	19
20	К. Д.	50,32	20	А. К.	64,62	21	20
21	А.К.	50,28	21	М. Д.	54,92	19	21

Descending indicators of the level of achievement of students in grade 10 in mathematics for the 3rd quarter			Arranged in descending order indicators of the level of progress of students in grades 10 in physics for the 3rd quarter			Descending indicators of the level of achievement of students in grade 10 in mathematics for the 3rd quarter			Arranged in descending order indicators of the level of progress of students in grades 10 in physics for the 3rd quarter				
No№	Full name of the student	Amount in %	No№	Full name of the student	Amount in %	Math rank	rank in physics	No№	Full name of the student	Amount in %	No№	Full name of the student	Amount in %
1	M. E.	96,46	1	M. E.	88,72	1	1	1	M. E.	96,46	1	M. E.	88,72
2	M. Ə.	92,19	2	M. Ə.	84,72	2	2	11	M. Ə.	68,03	11	M. Ə.	88,44
3	Б. Д.	87,97	3	Б. Д.	83	3	3	2	Б. Д.	92,19	2	Б. Д.	84,72
4	X. K.	85,79	4	X. K.	82,15	4	4	3	X. K.	87,97	3	X. K.	83
5	A. З.	85,11	5	A. З.	70,31	5	5	4	A. З.	85,79	4	A. З.	82,15
6	Б. А.	80,14	6	Б. А.	79,72	6	6	6	Б. А.	80,14	6	Б. А.	79,72
7	У. А.	71,57	7	У. А.	74,87	7	7	13	У. А.	65,23	13	У. А.	77,87
8	Т.А.	70,89	8	Т.А.	68,15	8	8	14	Т.А.	65,17	14	Т.А.	77,15
9	А. Е.	69,40	9	А. Е.	75,72	9	9	12	А. Е.	65,90	12	А. Е.	76,15
10	Д.Р.	68,15	10	Д.Р.	75,72	10	10	9	Д.Р.	69,40	9	Д.Р.	75,72
11	Ма. Е.	68,03	11	Ма. Е.	88,44	11	11	10	Ма. Е.	68,15	10	Ма. Е.	75,72
12	Бо.А.	65,90	12	Бо.А.	76,15	12	12	7	Бо.А.	71,57	7	Бо.А.	74,87
13	К. С.	65,23	13	К. С.	77,87	13	13	15	К. С.	64,55	15	К. С.	72,31
14	А. А.	65,17	14	А. А.	77,15	14	14	17	А. А.	58,09	17	А. А.	72,31
15	Ш. А.	64,55	15	Ш. А.	72,31	15	15	18	Ш. А.	55,29	18	Ш. А.	71,59
16	А. Т.	64,53	16	А. Т.	67,44	16	16	5	А. Т.	85,11	5	А. Т.	70,31
17	Б. Л.	58,09	17	Б. Л.	72,31	17	17	8	Б. Л.	70,89	8	Б. Л.	68,15
18	Б. М.	55,29	18	Б. М.	71,59	18	18	16	Б. М.	64,53	16	Б. М.	67,44
19	М. Д.	52,41	19	М. Д.	54,92	19	19	20	М. Д.	50,32	20	М. Д.	66,74
20	К. Д.	50,32	20	К. Д.	66,74	20	20	21	К. Д.	50,28	21	К. Д.	64,62
21	А. К.	50,28	21	А. К.	64,62	21	21	19	А. К.	52,41	19	А. К.	54,92
										69,88			74,89

Correlation of academic performance in physics and mathematics groups of students in grades 10 for the 3rd quarter



Paired comparison method

NoNo	Full name of the student	M.E. Ma.E	M.ə.	Б.А.	Х.К.	Б.А.	К.С.	А.А.	Бо.А.	А.Е.	Д.Р.	У.А.	Ш.А.	Б.Л.	Б.М.	А.З.	Т.А.	А.Т.	К.Д.	А.К.	М.Д.	Total points.	Relative ranking place in physics	Relative ranking place in mathematics	
1	M.E.	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	39	1,5	1	
2	Ma.E	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	39	1,5	11	
3	M.ə.	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	36	2	2	
4	Б. Д.	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	34	3	3	
5	Х.К.	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	32	4	4	
6	Б. А.	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30	5	5	
7	К. С.	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	27	6,5	13	
8	А.А.	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	27	6,5	13	
9	Бо. А.	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	24	7	13	
10	А. Е.	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	21	8,5	6	
11	Д. Р.	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	21	8,5	10	
12	У. А.	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	18	9	8	
13	Ш.А.	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	15	10,5	16,5	
14	Б.Л.	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	15	10,5	17	
15	Б.М.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	12	11	18	
16	А.З.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	10	12	7	
17	Т.А.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	8	13	9	
18	А.Т.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	6	14	16,5	
19	К.Д.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	15	20,5	
20	А.К.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	16	20,5	
21	М.Д.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	19	
																								11,1	
																								8,67	0

№№	Relative ranking place in physics X	Relative ranking place in mathematics Y	$(X - \bar{X})$	$(Y - \bar{Y})$	$(X - \bar{X}) \cdot (Y - \bar{Y})$	$(X - \bar{X})^2$	$(Y - \bar{Y})^2$
1	1,5	1	-7,17	-10,10	72,35	51,36	101,91
2	1,5	11	-7,17	-0,10	0,68	51,36	0,01
3	2	2	-6,67	-9,10	60,63	44,44	82,72
4	3	3	-5,67	-8,10	45,87	32,11	65,53
5	4	4	-4,67	-7,10	33,11	21,78	50,34
6	5	5	-3,67	-6,10	22,35	13,44	37,15
7	6,5	13	-2,17	1,90	-4,13	4,69	3,63
8	6,5	13	-2,17	1,90	-4,13	4,69	3,63
9	7	13	-1,67	1,90	-3,17	2,78	3,63
10	8,5	6	-0,17	-5,10	0,85	0,03	25,96
11	8,5	10	-0,17	-1,10	0,18	0,03	1,20
12	9	8	0,33	-3,10	-1,03	0,11	9,58
13	10,5	16,5	1,83	5,40	9,91	3,36	29,21
14	10,5	17	1,83	5,90	10,83	3,36	34,87
15	11	18	2,33	6,90	16,11	5,44	47,68
16	12	7	3,33	-4,10	-13,65	11,11	16,77
17	13	9	4,33	-2,10	-9,08	18,78	4,39
18	14	16,5	5,33	5,40	28,83	28,44	29,21
19	15	20,5	6,33	9,40	59,56	40,11	88,45
20	16	20,5	7,33	9,40	68,97	53,78	88,45
21	17	19	8,33	7,90	65,87	69,44	62,49
	$8,67 = \bar{X}$	$11,10 = \bar{Y}$			$\sum(X - \bar{X}) \cdot (Y - \bar{Y}) \approx 460,92$	$\sum(X - \bar{X})^2 \approx 460,67$	$\sum(Y - \bar{Y})^2 \approx 786,81$
						$\sqrt{\sum(X - \bar{X})^2} \approx 21,46$	$\sqrt{\sum(Y - \bar{Y})^2} \approx 28,05$

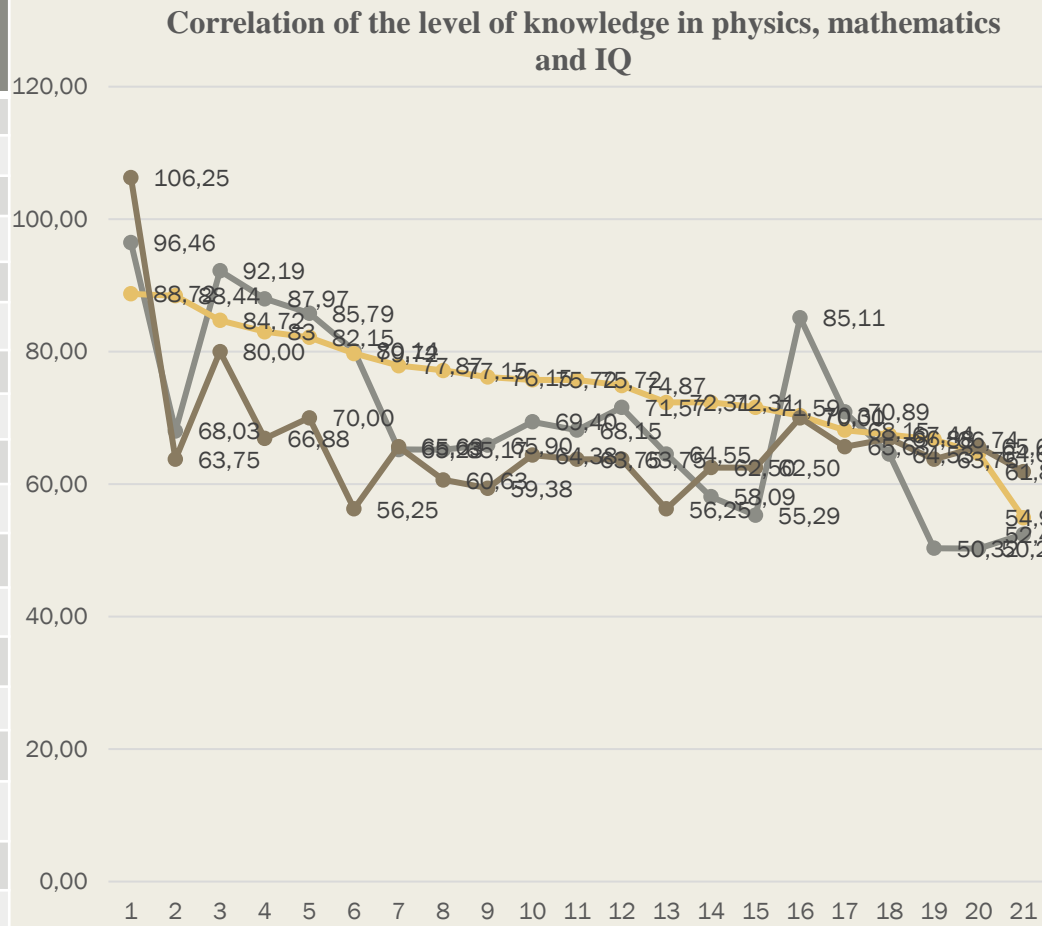
Pearson's rank correlation coefficient

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}} =$$

$$r = 0,765586$$

Conclusion: the correlation between the level of knowledge in mathematics and physics is high. But does this mean that it is the level of knowledge in mathematics that affects the level of knowledge in physics?

Level of knowledge in% in mathematics	Full name of the student	Level of knowledge in% in physics	The level of intellectual development in%
96,46	M. E.	88,72	106,25
68,03	Ma.E.	88,44	63,75
92,19	M. ə.	84,72	80,00
87,97	Б. Д.	83	66,88
85,79	X. K.	82,15	70,00
80,14	Б. А.	79,72	56,25
65,23	K. C.	77,87	65,63
65,17	A. A.	77,15	60,63
65,90	Bo. A.	76,15	59,38
69,40	A. E.	75,72	64,38
68,15	Д. P.	75,72	63,75
71,57	У. А.	74,87	63,75
64,55	Ш. А.	72,31	56,25
58,09	Б. Л.	72,31	62,50
55,29	Б. М.	71,59	62,50
85,11	A. З.	70,31	70,00
70,89	T. A.	68,15	65,63
64,53	A. T.	67,44	66,88
50,32	K. Д.	66,74	63,75
50,28	A. K.	64,62	65,63
52,41	M. Д.	54,92	61,88



Correlation between achievement levels and the level of intellectual development

Level of knowledge in% in mathematics	Full name of the student	Level of knowledge in% in physics	The level of intellectual development in%
96,46	M. E.	88,72	106,25
68,03	Ma.E.	88,44	63,75
92,19	M. ə.	84,72	80,00
87,97	Б. Д.	83	66,88
85,79	X. K.	82,15	70,00
80,14	Б. А.	79,72	56,25
65,23	K. C.	77,87	65,63
65,17	A. A.	77,15	60,63
65,90	Bo. A.	76,15	59,38
69,40	A. E.	75,72	64,38
68,15	Д. P.	75,72	63,75
71,57	У. А.	74,87	63,75
64,55	Ш. А.	72,31	56,25
58,09	Б. Л.	72,31	62,50
55,29	Б. М.	71,59	62,50
85,11	A. З.	70,31	70,00
70,89	T. A.	68,15	65,63
64,53	A. T.	67,44	66,88
50,32	K. Д.	66,74	63,75
50,28	A. K.	64,62	65,63
52,41	M. Д.	54,92	61,88

NoNo	Relative ranking place Physics X	Relative ranking position intelligence quotient Y	$(X - \bar{X})$	$(Y - \bar{Y})$	$(X - \bar{X}) \cdot (Y - \bar{Y})$	$(X - \bar{X})^2$	$(Y - \bar{Y})^2$	$\sqrt{(X - \bar{X})^2(Y - \bar{Y})^2}$
1	1,5	1	-7,17	-8,90	63,82	51,36	79,29	
2	1,5	10	-7,17	0,10	-0,68	51,36	0,01	
3	2	2	-6,67	-7,90	52,70	44,44	62,49	
4	3	6	-5,67	-3,90	22,13	32,11	15,25	
5	4	3,5	-4,67	-6,40	29,89	21,78	41,02	
6	5	18,5	-3,67	8,60	-31,52	13,44	73,88	
7	6,5	8	-2,17	-1,90	4,13	4,69	3,63	
8	6,5	16	-2,17	6,10	-13,21	4,69	37,15	
9	7	17	-1,67	7,10	-11,83	2,78	50,34	
10	8,5	10	-0,17	0,10	-0,02	0,03	0,01	
11	8,5	10	-0,17	0,10	-0,02	0,03	0,01	
12	9	10	0,33	0,10	0,03	0,11	0,01	
13	10,5	18,5	1,83	8,60	15,76	3,36	73,88	
14	10,5	13	1,83	3,10	5,67	3,36	9,58	
15	11	14,5	2,33	4,60	10,72	5,44	21,12	
16	12	3,5	3,33	-6,40	-21,35	11,11	41,02	
17	13	8	4,33	-1,90	-8,25	18,78	3,63	
18	14	7	5,33	-2,90	-15,49	28,44	8,44	
19	15	12	6,33	2,10	13,27	40,11	4,39	
20	16	5	7,33	-4,90	-35,97	53,78	24,06	
21	17	14,5	8,33	4,60	38,29	69,44	21,12	
	8,67	9,90			118,08	460,67	570,31	
						21,46	23,88	512,5647
r=		0,230377						

Indicators of rank correlation coefficients

