

MANN-WHITNEY CRITERION

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КРИТЕРИЙ МАННА-УИТНИ

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Abstract. In the work, a practical problem is solved by Mann-Whitney test. Mann-Whitney test is a statistical criterion used to evaluate differences between two independent samples in terms of any sign of measured quantitatively; it allows to detect differences in the value of the parameter between small samples. This criterion is widely used in psychology for data analysis.

The level of verbal intelligence was researched. Verbal intelligence is the ability to analyze and synthesize speech judgment, to delve into the meaning of words, word-rich conceptual framework. As the subjects, pupils of the 11th class (physical and mathematical and humanitarian specialization, gymnasium №13) were chosen. To check the verbal intelligence of students, psychological test «To Eliminate Redundant» was carried out. The test was assessed by the following criteria: low level (0-32 points), average level (33-52 points), high level (53-60 points).

Table 1

Results of the test of mathematical and physical and humanitarian specializations

Physical and mathematical class (1.1)		Humanitarian class (1.2)	
Pupils	Points	Pupils	Points
A.A.	60	A.A.	58
D.B	58	H.B.	58
A.E.	58	A.P.	58
R.D.	58	K.D.	58
A.A.	58	E.A.	57
A.D.	57	N.B.	57
P.A.	57	I.E.	56
D.B.	56	O.B.	56
T.A.	56	K.A.	56
N.B.	55	D.H.	55
M.O.	55	S.B.	55
D.A.	54	N.Y.	54
T.A	54	A.D.	54
M.T.	49	M.S.	49
D.A.	48	M.O.	49
E.A.	47	B.B.	46
M.E.	47	S.M.	45
A.B.	46	O.N	45
D.C.	45	V.S.	44
A.H	44	A.A.	38
D.M.	44	V.Y.	38
G.A.	38	M.P.	38
K.M.	38	A.G.	38
E.M.	38	H.D.	38
E.A.	38	M.A.	37
H.D.	37	N.A	37
V.T.	37	T.A.	37
O.Y.	37	A.S.	36
M.L.	37	E.S.	35
N.F.	36	M.T.	35

Table 2

Determination of rank

Pupils	Points (2.1)	Rank (2.2)
A.A. (1.1)	60	1
D.B. (1.1)	58	$(2+3+4+5+6+7+8+9)/8=5.5$
A.E. (1.1)		
R.D. (1.1)		
A.A. (1.1)		
A.A. (1.2)		
N.B. (1.2)		
A.P. (1.2)		
K.D. (1.2)		
A.D. (1.1)	57	$(10+11+12+13)/4=11.5$
P.A. (1.1)		
E.A. (1.2)		
N.B. (1.2)		
D.B. (1.1)	56	$(14+15+16+17+18)/5=16$
T.A. (1.1)		
I.E. (1.2)		
O.B. (1.2)		
K.A. (1.2)		
N.B. (1.1)	55	$(19+20+21+22)/4=20.5$
M.O. (1.1)		
D.H. (1.2)		
S.B. (1.2)		
D.A. (1.1)	54	$(23+24+25+26)/4=24.5$
T.A. (1.1)		
N.I. (1.2)		
A.D. (1.2)		
M.T. (1.1)	49	$(27+28+29)/3=28$
M.S. (1.2)		
M.O. (1.2)		
D.A. (1.1)	48	30
E.A. (1.1)	47	$(30+31)/2=30.5$
M.E. (1.1)	46	$(32+33)/2=32.5$
A.B. (1.1)		
B.B. (1.2)	45	$(34+35+36)/3=35$
D.C. (1.1)		
S.M. (1.2)		
O.N. (1.2)		
A.N. (1.1)	44	$(37+38+39)/3=38$
D.M. (1.1)		
V.S. (1.2)		
G.A. (1.1)	38	$(41+42+43+44+45+46+47+48+49)/9=45$
K.M. (1.1)		
E.M. (1.1)		
E.A. (1.1)		
A.A. (1.2)		
B.Y. (1.2)		
M.P. (1.2)		
A.G. (1.2)		
N.D. (1.2)		
N.D. (1.1)		

Pupils	Points (2.1)	Rank (2.2)
V.T. (1.1)	37	$(50+51+52+53+54+55+56)/7=53$
O.Y. (1.1)		
M.L. (1.1)		
M.A. (1.2)		
N.A. (1.2)		
T.A. (1.2)	36	$(57+58)/2=57.5$
N.F. (1.1)		
A.S. (1.2)		
E.S. (1.2)	35	$(59+60)/2=59.5$
M.T. (1.2)		

Sum up the ranks of the values of Physical and Mathematical and the humanitarian specializations:

Ranks of the physical and mathematical class=

$1+5.5+5.5+5.5+5.5+11.5+11.5+16+16+20.5+20.5+24.5+24.5+28+30++30.5+30.5+32.5+35+38+38+45+45+45+45+53+53+53+53+57.5=880$

Ranks of Humanitarian class =

$5.5+5.5+5.5+5.5+11.5+11.5+16+16+16+20.5+20.5+24.5+24.5+28+28+32.5+35++35+38+45+45+45+45+45+53+53+53+57.5+59.5+59.5=940$

For physical and mathematical specialization, the rank is 880, and the rank of the humanitarian specialization is 940.

The rank of physical and mathematical class < the rank of the humanitarian class → rank sum of the humanitarian class is greater.

Determine the empirical value of Mann-Whitney by the equation:

$$U_{emp} = (n_1 \cdot n_2) + \frac{n_x(n_x+1)}{2} - T_x$$

where n_1 - the number of subjects in physical and mathematical specialization; n_2 - number of subjects in the humanitarian specialization; T_x - greater of the two rank sums; n_x - number of subjects in the specialization with the greater rank sum.

Substitute the data into the formula and get:

$$U_{emp} = (30 \cdot 30) + \frac{30 \cdot (30+1)}{2} - 940 = 900 + 465 - 940 = 425$$

Conclusion: According to the table of critical values of Mann-Whitney criterion, the critical value was determined and it turned out to be equal. Therefore, the comparison of the physical and mathematical specialization and humanitarian specialization is impossible to carry out as the results are the same. The cause of the sameness is the fact that the test was of the average level and to really understand what specialization has verbal intelligence, tests of the higher level of complexity should be carried out.

References

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