Interdisciplinary Unit In Mathematics and Physical Education

INTRODUCTION

My Project is directed on two different subjects – Mathematics and Physical Education. That is why my project has a lot of aims, which are connected not to only one science. My mathematical aims are to collect and display data using a variety of representations, to interpret and analyze the findings using statistics, to determine the physical fitness of the class using statistics and to compare your fitness level with the mean values for the class and analyze my overall fitness. There are also aims connected to Physical Education, I will tell about them in the second report for Physical Education. I think this project is linked with one Area of Interaction is Health and Social Education, because during the project we did sport exercises, we knew ours sport abilities and overall sport abilities of typical 10 grade's student, we thought about sport program for ourselves and for others to improve our sport skill and health.

INVESTIGATION

How did I get the data?

On the PE lesson my class and me collected some data about our physical abilities. The data were – pulse, endurance, speed, push-ups, sit-ups and flexibility. For measuring the pulse we with special medical tool, and for endurance our trainer counted how long we are running 400 km, for speed we ran 30 meters and our trainer counted how many second did it take. Also on the lesson of PE our trainer counted how many qualitative push-ups and sit-ups did we complete in one minute. We sat on the floor and pulled our hands forward to the marks – this exercise showed our flexibility. On the PE we also measured the weight and the height. All data I put in the table from the biggest till the smallest.

OUR CLASS' SCORES

(My scores are bold)

	P	Endurance	Speed	Push-ups	Sit-up	Flexibility	Height	Weight
	64	2,48	4,28	17	27	4	154,5	47
	68	2,49	4,3	24	28	11	155	48
	73	2,5	4,48	24	29	11	162	48
	80	2,52	4,5	25	30	12	163	49,5
	80	2,54	4,65	25	32	12	163	51
	80	2,56	4,79	27	32	12	164,5	51
	84	2,57	4,9	**28**	32	16	166,5	53
	84	2,58	4,9	30	33	16	168	55
	86	2,7	**5**	30	33	19	168	56
	87	2,8	5	33	33	**20**	170	56
	88	**2,8**	5,1	35	35	20	170	60
	90	3,01	5,1	36	35	20	170	60
	90	3,04	5,17	41	35	22	170,5	60
	90	3,12	5,2	43	35	23	171	**62**
	92	3,13	5,2	45	37	24	171,5	62
	95	3,2	5,2	48	37	26	**172**	65
	96	3,39	5,2	48	**39**	28	172	65
	98	3,4	5,4	49	39	28	174	66
	100	3,43	5,4	51	40	30	175	69
	101	3,59	5,6	54	45	30	183	80
	105	4,02	5,7	56	49	35	186,5	84
mean	87,2	3,25	5,003	36,5	38	19,95	169,1	65,5
median	88	2,8	5,1	35	35	20,00	170,0	60
mode	80 and 90	2,8	5,2	24,25,30 and 48	35	12 and 20	170	60
stdev	10,6	0,44	0,4	11,6	5,4	7,9	7,6	9,9
range	41,0	1,54	1,42	39	21	31	32	37

Central tendencies

Then I calculated and displayed the mean, median, mode, range and standard deviation for each set of class data.

MEAN is one of the more common statistics. And it's easy to compute. All you have to do is add up all the values in a set of data and then divide that sum by the number of values in the dataset. For example:
Sam did 40 sit – ups, Mary 29 sit-ups and Eddy 30 sit-ups, so **mean** is (40+29+30)/3=33.

MEDIAN is statistic that tells you something about something in the middle.
Again, this statistic is easy to determine because the median literally is the value in the middle. Just line up the values in your set of data, from largest to smallest. The one in the dead-center is your median.

MODE is statistic of central tendency that show the most frequent meaning.

The **standard deviation (STDEV)** is a statistic that tells you how tightly all the various examples are clustered around the mean in a set of data. When the examples are pretty tightly bunched together and the bell-shaped curve is steep, the standard deviation is small. When the examples are spread apart and the bell curve is relatively flat, that tells you you have a relatively large standard deviation.

It is calculated by the formula: **STDEV**= √ ([(x1-mean)+(x2-mean)+(x3-mean)]/n)

RANGE is the simplest possible measure of spread and is the difference between the upper extreme value and the lower extreme value.

Best representation of data

I found all central statistics of all data, and concluded that:

- I think that for PULSE measure of central tendency that represent it is mean or median (they are nearly the same), because mode shows 80 which is 3 student's result, but there is 90 which result of 3 students as well, and mean and median shows 87,2 and 88 – results which is between 80 and 90, other central tendencies gave very low result.
- To know the central tendency of SPEED is better to use mean, median and mode, because here they are nearly the same, so it does not matter, also other central tendencies is too low.
- The central tendency of PUSH-UPS best of all represented by mean and median (they have absolutely the same results – 36,5), mode is bad because it gave too many results, STDEV gave very low result, and range gave close, but not very much result.
- Mean, median and mode are best in measuring central tendency of SIT-UPS, STDEV and range didn't give suitable result.
- To know the central tendency of FLEXIBILITY mean or median because mode gives 2 results, STDEV and range gave unsuitable results again.
- The central tendency of HEIGHT best of all represented by mode, mean and median (they are nearly the same) other central tendency is too low.
- In my opinion mean is best in measuring central tendency of WEIGHT because mode and median a little bit smaller, but this difference is plays a big role (5 kg), range and STDEV gave low results as usual.

- For ENDURANCE the best central tendency I think is mean, because endurance meanings is very different so made can be not exist, also because it is very different mean is most correct, median shows not very good result.

Making of table of frequency and histogram

I've made a frequency table for each data, where is presented how many people have results in one period. For example how many students have results of sit-ups between 31 and 35 - there is10 students.

Here are frequency tables of data I've collected.

Bin	*Frequency*
20	1
25	4
30	4
35	2
40	1
45	3
50	3
55	2
More	1
push up	

Bin	*Frequency*
30	4
35	10
40	5
45	1
50	1
More	0
Sit up	

Bin	*Frequency*
5	1
10	0
15	5
20	6
25	3
30	5
35	1
More	0
Flexibility	

Bin	*Frequency*
155	2
160	0
165	4
170	6
175	7
180	0
185	1
More	1
height	

Bin	*Frequency*
50	4
55	4
60	5
65	4
70	2
75	0
80	1
85	1
More	0
Weight	

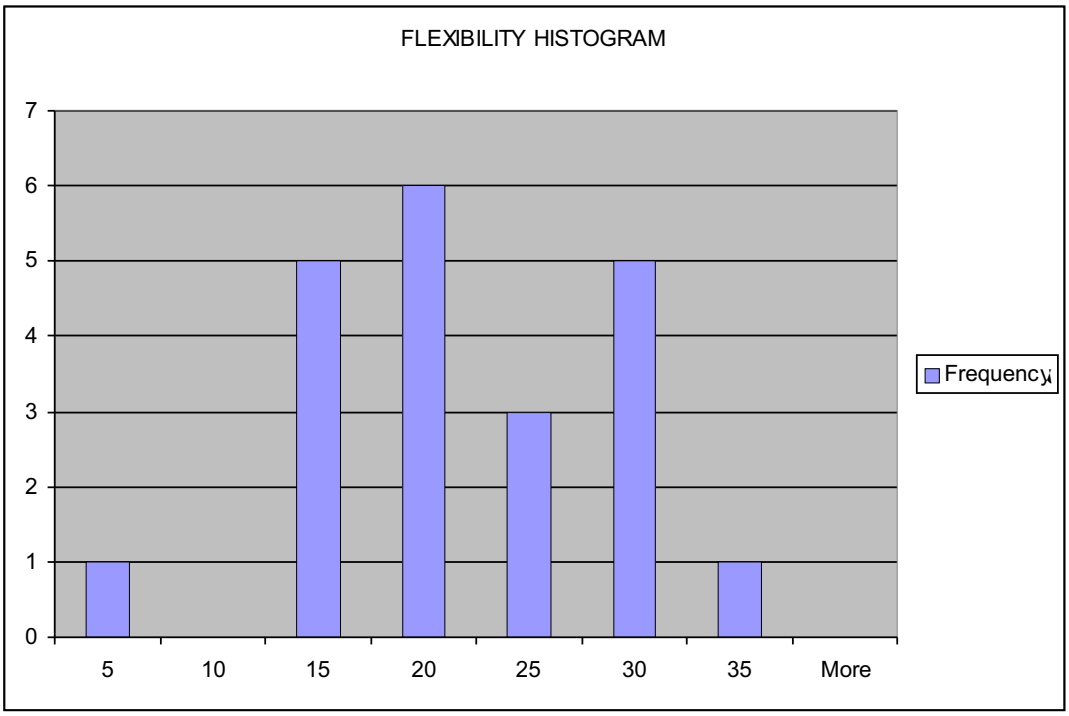
Bin	*Frequency*
65	1
70	1
75	1
80	3
85	2
90	6
95	2
100	3
105	2
More	0
pulse	

Bin	*Frequency*
2,5	3
3	8
3,5	8
4	1
More	1
endurance	

Bin	*Frequency*
4,5	4
5	6
5,5	9
6	2
More	0
Speed	

Then I've made a histogram of the flexibility. Histogram is a graphical representation of a frequency distribution. For example in my histogram you can see that there are 6 people whose flexibility is from 16 to 20, and there are no one whose flexibility is from 6 to 10.

Bin	*Frequency*
5	1
10	0
15	5
20	6
25	3
30	5
35	1
More	0
Flexibility	



Making of scatter plots and calculation of correlation

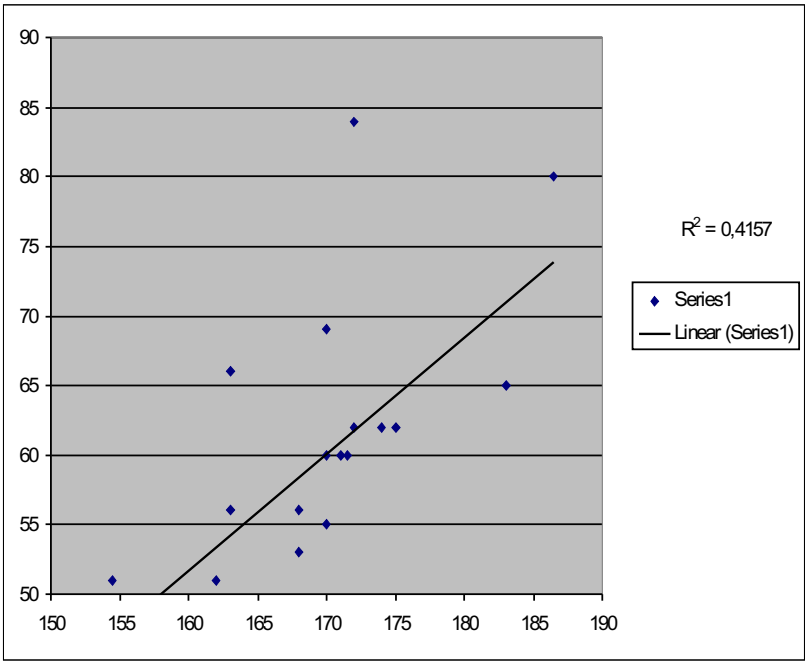
I made a plot of height versus weight; and increase in pulse rate with exercise versus endurance. In Microsoft Excel there is a special program for doing it, also this program calculate the correlation (R squared). Correlation is a statistical relationship between two variables such that high scores on one factor tend to go with high scores on the other factor (positive correlation) or that high scores on one factor go with low scores on the other factor (negative correlation).Here is a formula for calculating correlation:

$$\text{Correlation}(r) = N\Sigma XY - (\Sigma X)(\Sigma Y) / \text{Sqrt}([N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2])$$

I find it is too complex and you can just calculate using computer.

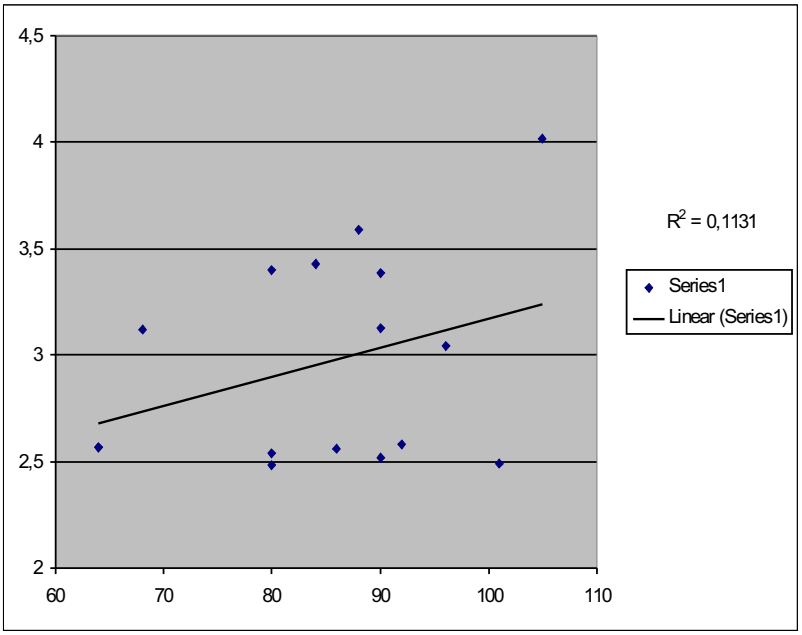
Height versus Weight scatter plot

Height	Weight
154,5	51
155	47
162	51
163	56
163	66
164,5	48
166,5	48
168	53
168	56
170	69
170	55
170	60
170,5	49,5
171	60
171,5	60
172	84
172	62
174	62
175	62
183	65
186,5	80



Correlation is positive and it means that height and weight depend on each other.

Pulse versus Endurance scatter plot



Pulse	Endurance
68	3,12
90	3,13
80	2,48
105	4,02
90	3,39
64	2,57
84	3,43
101	2,49
90	2,52
64	2,57
86	2,56
96	3,04
80	3,4
92	2,58
80	2,54
88	3,59

Here a correlation is nearly equals to zero. It means that pulse and endurance nearly don't depend on each other.

Comparing data

Boys' and girls' pulse comparing

	Boys	Girls
	68	73
	90	105
	101	90
	90	100
	86	84
	80	98
	64	80
	96	**95**
	92	84
	80	87
	88	88
mean	**85**	**89,5**

I compared boys' and girls' pulse and noticed that girls' average pulse is higher than boys'. For finding central tendency I used mean. I think that mean is the best statistical tendency because it

more accurate comparing with others. Also it is easy to calculate. It is better from mode because mean can be found or calculated always (sometimes there is no mode if there are some meanings which are found the same number of times), and mean is better from median because for its calculation you don't need to put meanings in order from the biggest to the lowest or from the lowest to the biggest.

Comparing of endurance and speed.

	endurance	speed
	148,8	4,28
	149,4	4,3
	150	4,48
	151,2	4,5
	152,4	4,65
	153,6	4,79
	154,2	4,9
	154,8	4,9
	162	**5**
	168	5
	168	5,1
	180,6	5,1
	182,4	5,17
	187,2	5,2
	187,8	5,2
	192	5,2
	203,4	5,2
	204	5,4
	205,8	5,4
	215,4	5,6
	241,2	5,7
mean	**176,8**	**5**

I compared speed per 400 m (endurance) and speed per 30 m. For their comparing I needed to change endurance meaning from minutes to second (because speed per 30 meters we measured in seconds).
Then I need to divide calculated speed per 30 and 400 m to the distance we have ran (400 m and 30 m) to know the average speed per 1 meter.

1) v=176,8/400=0,442 second per one meter
2) v=5/30=0,167 second per one meter

It means when student know that he must to run long distance he doesn't run as fast as he can for keeping energy.
Here I also used mean for measuring central tendency.

REFLECTION

I think that I've done my project accurate and properly. I haven't work with statistics on PC before and after the project I've learnt a lot about them and about making graphs. During the project I tried a various methods of representation of statistic. Best central tendencies for pulse, endurance, speed, push-ups, sit-ups, flexibility, height and weight in investigation. I think that the best central tendency for measuring all kind of data is mean, because mean shows accurate average meaning, and while finding the mean we summarize all data and then divide it to whole number of meanings. That is why I think that mean is most accurate and logic.

Also I learnt to understand how to read histogram and scatter plots. It is not very hard but it is very useful when you need represent scores of a lot of people or to find relationship between data. But about correlation I'd like to add that it isn't always right. For example in America where people are suffer from overweight, people's weight doesn't depend on height.

Also during the project I've learnt to use Microsoft Excel. I didn't use it before and I'm glad that now I know how to use it, because this program can be necessary in my future profession.

During the work there were some problems. First problem is that data can be inaccurate, because for example may be one of the student couldn't do exercises well because of stomachache or other reasons (illness, uncomfortable trainers, etc), also measuring can be incorrect, because we didn't check them. I think that we needed to check them to make data more correct also student should be sure that nothing prevent them to do exercises. Also while working on Microsoft Excel it is problematic to use mode, because, for example, if there are 10, 12, 12, 12, 15, 20, 20, 20, mode shows only 12 because it is first, but there is 20 is also 3 times. So I needed to check the column and add other meanings. Also there was my personal problem – I don't have Microsoft Excel on my PC. So I needed to work with Excel only at school.

It is really very helpfully that we use the computer to calculate some statistics or to draw graphs. Because if we did do it ourselves it would take too many time and results would be incorrect and inaccurate. Although I have done some calculations, graphs, tables by hand.

MIRAS International School

Interdisciplinary Unit In Mathematics and Physical Education

Sanym Paritova
Grade 10

Astana 2007