Maths statistics coursework

Hypothesis: Generally girls have a higher IQ than boys and therefore have a higher total of KS2 (Key Stage 2) results. However, year 7 KS2 results are higher than the year 11's KS2 results. I firstly believe girls have a higher IQ than boys as girls find it easier to concentrate and are more able to work hard over a long period of time.

This therefore would affect their KS2 results, as it would mean girls are more able to retain all the information needed in SATs. Although, I think year 7's KS2 results will be higher than year 11's as the tests have become easier over the five years and the teaching has become better too. PlanFirst of all I will filter my data so that I am only left with data for all the year 11s and all the year 7s. I then will delete all the inappropriate columns of data i.

e. favourite subject, leaving me with the following columns: Year Group, Gender, IQ, English, Maths and Science KS2 resultsBoth these steps will remove any data that is unnecessary in my investigation so that I am left with only suitable data making it easier and quicker for me to use the records. Following this I will look through the data for any anomalies such as a child achieving a level 7 in their KS2 SATs as this is not possible with the tests taken. I would also exclude any records with some data not present.

If there are any I will delete them so that my data is accurate and therefore my final conclusion will be truthful. Once I have done this I will count the total number of year 7 girls I have left along with the total number of year 7 boys, year 11 girls and year 11 boys. Subsequently I will find the sum of these figures so that I can use stratified sampling with the equation:(Number in strata/population) x sample sizeI will use stratified sampling as the

number of pupils in each year group is different. By using this method I will be getting a representative proportion of each year group making my data fair. Once I have calculated the sample size for each strata I will use random sampling (using the Ran# button on the scientific calculator) to select the calculated number of pieces of data from the strata.

However, before that I will set my calculator to be fixed on zero decimal places in order to avoid having to round numbers which would increase the chances of repeated figures. Before I begin to use the data to prove my hypothesis I will first add an extra column on to my table of data. This will be a column with the total KS2 results of each child. This is so no workings out will have to be done with later graphs.

Once I have completed this I will have all the data I need. My first step in my investigation will be to produce a cumulative frequency graph of girls and boys IQ. On the same graph I will have two lines – one for males IQs and one for females IQs. This will make comparing the two easier and will mean my conclusion is likely to be more accurate. I have chosen to use a cumulative frequency graph as it gives you a general idea of any trends. It also allows you to see the median IQ for each gender along with inter-quartile range.

This is essential as the inter-quartile range excludes extremes that could affect the data, whilst the median highlights the IQ in the middle of all the data if it were in ascending order. Subsequently I have decided to produce a box and whisker diagram of girls and boys IQs. This is simply to make the inter-quartile range clearer so that any extremes are obvious. It is also to show how the data is spread around the median, i. e.

whether there is a small range above the median or not. This is necessary to see whereabouts the majority of results lie. After this I have chosen to produce a stem and leaf diagram of girls and boys IQ. This is because a stem and leaf diagram has the same advantages as a bar chart i.

e. using clear bars to show the distribution of data, whilst also retaining the original data so mode, median and mean can be calculated from it. This is needed as the mode shows the most common results, the median shows the middle value when the data is in order and the mean shows a representative figure for the data you have collected. All these diagrams will either prove or disprove the first part of my hypothesis – that girls have a higher IQ than boys. So the next stage will be to compare the IQs of boys and girls to their total KS2 results. I will do this by using a scatter diagram as this enables me to draw a line of best fit making the relationship between IQ and total of KS2 results, if any, clear.

To then investigate how this affects the two sexes KS2 results I will draw another cumulative frequency graph. This is to get a general picture as to whether there is a link between girls having higher IQs than boys meaning they must have higher KS2 results too. This will make my end conclusion more reliable as the median and inter-quartile range can also be calculated from this graph. Following this I will set to prove that year 7’s KS2 results are higher than year 11’s KS2 results. I shall do this in the same way I proved the first part of my hypothesis. I will start with a cumulative frequency graph of year 7’s KS2 results and year 11’s too.

This is for the same reasons as I used the same type of graph in the first part of my investigation. As before, I will use a box and whisker to show the same data as on the graph but with extremes being made obvious. Then I will produce a stem and leaf diagram of the year 7's KS2 results against the year 11's KS2 results. Once again this is for the same reasons as when I used the same type of diagram in the beginning. Finally, when investigating my hypothesis I have to remember factors that may affect my conclusion. One such factor is age.

Therefore with every graph and diagram I will draw one for year 7's data and one for year 11's. This way age will not affect my conclusion and I can also look at how age affects IQ as well. Collecting dataThese are my calculations when working out the proportion of data I should take from each strata using stratified sampling: Proportion of strata to be taken= (Number in strata/population) x sample sizeStrataNumber of students/ Number in strataYear 7 girls131Year 7 boys151Year 11 girls86Year 11 boys84452 – populationProportion of strataRounded numberYear 7 girls57. 9646017758Year 7 boys66. 8141592967Year 11 girls38. 0530973538Year 11 boys37.

1681415937- With sample size of 200I feel this is an appropriate sample size as the lowest proportion is just over 30. This is a good size as if it was any less there would be too little data to get reliable results. It is also suitable as if the highest proportion was any higher there would be too much data to use meaning mistakes would be more likely. Final tables of dataKS2 ResultsTotal of KS2Year GroupGenderIQEnglishMathsScienceresults7Female100444127Female10445

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7 (Table 1)- IQ of boys in year 7 (Table 2)IQFrequencyCumulative Frequency60; IQ; 701170; IQ; 801280; IQ; 904690; IQ; 1001521100; IQ; 1104061110; IQ; 120667120; IQ; 130067130; IQ; 140067Once I had completed this graph I realised it wasn't a true and accurate reflection of the year 7's IQs due to there being a different number of boys and girls in the year group. This meant any comparisons could be affected by the strata size.

Therefore I decided to complete another cumulative frequency graph but with the cumulative percentage of the sample instead of simply the cumulative frequency. This way I will be able to see the cumulative frequency as a percentage of the whole strata so strata size doesn't affect my results.- IQ of girls in year 7 (Table 3)IQFrequencyCumulative FrequencyPercentage of total60

83120

04110

5190

This indicates the girls have an overall higher IQ as their curve is nearer the higher end of the IQ scale. From this graph I have also noticed that there are a number of boys with IQs lower than the lowest scoring girl. At the other end of the curve there are a number of girls with higher IQs than the highest scoring boy. This would seem to support my hypothesis that girls have a higher IQ than boys and this is further supported by the median for the girls' data being 106 and the boys being lower at 103. 5.

To make clear this point and the inter-quartile ranges I then decided to draw box and whisker diagrams for both genders. From these it can be seen that whilst both genders have very similar overall ranges and inter-quartile ranges, the girls IQs are obviously higher. This is shown firstly by the girls median being higher than the boys but also by the top 25% of boys having scores very close to the median, whereas the top 25% of girls have scores much more in excess of the median. This is demonstrated by the boys' highest score being 9. 7% above their median and the girls' highest score being a significantly larger 24.

5% above their median. At the opposite end of the ability range the bottom 25% of boys cover a greater range of scores than the bottom 25% of girls. This results in the boys lowest score being much lower than the girls' lowest score, so the boys' lowest score is 34% below the median and the girls is a smaller 16% below it. Both these diagrams show a clear trend however, to retain the original data and to calculate the mode and the mean I then have chosen to draw a stem and leaf diagram to compare boys and girls IQs in year 7. Even though the length of bars cannot be compared with these diagrams due to the differently sized stratas, obvious patterns can be seen. Firstly it is noticeable that the majority of the girls' data is at the higher end of the IQ scale whereas the majority of boys are at the lower end.

This is further shown by five girls scoring higher marks than the highest scoring boy and five boys scoring lower than the lowest scoring girl. This is then supported by the mode, median and mean which are all slightly higher for the girls compared to the boys. Year 7's data appeared to prove my hypothesis however year 11's results were more confusing. The cumulative

frequency graph shows that the bottom 50% of girls have scored higher IQs than the bottom 50% of boys as the curve that represents the girls' data at this point is further to the right and so nearer the upper end of the IQ scale. However, for the top 50% the picture is reversed. This is shown by the boy's curve now being to the right of the girls.

As the curves do not make a trend very clear and the median for each gender are very close together I have decided to draw a box and whisker for each strata to compare the spread of data. Immediately from this I can see the boys have a much larger overall and inter-quartile range than the girls. With both cases however the median is nearly in the middle of the two extremes leaving me with no real picture which gender achieves higher IQs. Although, it is clear you are more likely to find boys with a very high or very low IQ whereas girls are more likely to be within a narrower band.

To see if a clearer picture can be given I have next decided to draw a stem and leaf diagram to compare year 11s data. From this the same conclusion is drawn that boys have a greater range of data than girls. The mode is of very little use here as there are four different answers for the boys' data. The mean and median are contradictory as one is higher for the girls and the other is higher for the boys. Also the difference between each measure is very small and probably not significant.

Therefore in year 7 my hypothesis appears to be correct as girls have higher IQs than boys however by year 11 this has changed as it is no longer clear which gender achieves higher IQs. Cumulative frequency graph to compare boys and girls total KS2 results in year 7- Total KS2 results of girls in year

7Total of KS2 resultsFrequencyCumulative FrequencyPercentage of total5; C; 80008; C; 108813. 7910; C; 12162441. 3812; C; 14224679. 3114; C; 161258100- Total KS2 results of boys in year 7Total of KS2 resultsFrequencyCumulative FrequencyPercentage of total5; C; 8334. 488; C; 1081116.

4210; C; 12263755. 2212; C; 14195683. 5814; C; 161167100My next step is to prove that if girls have a higher IQ than boys then they must also have a higher total of KS2 results. To do this I have firstly decided to draw a scatter diagram to show the relationship between IQ and total KS2 results. From my scatter diagrams I can see a strong positive correlation between IQ and total KS2 results. This leads me to believe that girls in year 7 should achieve higher KS2 results than boys as they achieve higher IQs.

To investigate this I decided to draw a cumulative frequency graph of the year 7 girls and boys total KS2 results. This appears to prove my hypothesis as the curve representing the girls' data is to the right of the curve representing the boys' data. It therefore is nearer the higher end of the total KS2 results scale suggesting girls have a higher total of KS2 results than boys. The medians support this further as the girls median is higher than the boys at 12. 4 compared to a lower 11. 8 for the boys.

Cumulative frequency graph to compare total KS2 results of year 7s and year 11sAs before there are a different number of pupils in each strata (each year group). Therefore once again I have decided to draw a cumulative frequency graph but one that shows the cumulative percentage of the sample so the strata size is taken into account when comparing.- Total of KS2 results for

year 7 (Table 9)Total of KS2 resultsFrequencyCumulative FrequencyPercentage of total5; C; 8332. 48; C; 10161915. 210; C; 12426148.

812; C; 144210382. 414; C; 162212510016; C; 180125100- Total of KS2 results for year 11 (Table 10)Total of KS2 resultsFrequencyCumulative FrequencyPercentage of total5; C; 83348; C; 101518210; C; 1221395212; C; 14236282. 6714; C; 16117397. 3316; C; 18275100This leaves just the last part of my hypothesis to prove – that year 7s KS2 results are higher than year 11s KS2 results. To do this I firstly decided to draw a cumulative frequency graph comparing year 7s and years 11s KS2 results. For the majority of the graph the year 7s curve is just to the right of the year 11s curve, suggesting year 7s achieved higher KS2 results.

However, once the score exceeds a total of 14 the year 11s appear to have performed better as their curve is further to the right than the year 7s curve. From this graph I have also noticed one or more of the year 11s scored higher than any of the year 7s. Due to this change only occurring at the very end of the graph, the medians support my hypothesis as year 7s median is slightly higher than year 11s. Although, the difference is very small and so it may not be significant. Following this I have decided to draw box and whisker diagrams for both year groups. These further confirm that one or more year 11s scored higher IQs than the highest scoring year 7.

However, they also highlight that the year 11s data is more spread out than the year 7s as their inter-quartile range is larger. After this I had planned to draw a stem and leaf diagram to compare year 7s and 11s results however,

on starting this I realised there would only be two levels to this. This would have meant a comparison between the two would have been difficult as the bars would have been so long, therefore I decided to leave this diagram out on this occasion. From the two diagrams I did end up using I feel my hypothesis is correct – year 7s did achieve higher KS2 results than year 11.

However, I have noticed there were a few year 11s who excelled themselves. Discussion of resultsMy first cumulative frequency graph for year 7 showed me girls have a higher IQ than boys. This was then supported by the box and whisker diagrams which showed the range of boys and girls IQs to be very similar however, the girls results reached higher IQs than the boys and the boys results reached lower IQs than the girls. Following this the stem and leaf diagram for year 7 confirmed that the girls data is nearer the higher end of the IQ scale than boys. My second cumulative frequency graph for year 11 showed me the bottom 50% of girls in year 11 scored higher IQs than the bottom 50% of boys.

However, this is reversed with the top 50% as here the boys appear to achieve higher IQs. The box and whisker diagrams then demonstrate that both genders have very close medians but the boys have a much larger overall and inter-quartile range than the girls. This is then supported by the stem and leaf diagram as the girls data is in a much narrower band with no real extremes like with the boys data. Following this the scatter diagrams all demonstrate that IQ is related to KS2 results as there is a positive correlation.

This suggests the higher the IQ the higher the total of KS2 results and visa versa. Subsequently the cumulative frequency graph after this shows that girls in year 7 have higher KS2 results than boys in the same year. In my final step the cumulative frequency graph shows me year 7s scored higher KS2 results than year 11s. However, it also shows a few year 11s scored higher than the highest scoring year 7. Finally the last box and whisker diagrams highlight that the year 11s results were more spread out than year 7s.

In conclusion my hypothesis was correct that girls have higher IQs than boys however, by year 11 the picture is less clear as the trend changes at different points in the ability range. My hypothesis is also proven to be true as when girls achieve higher IQs than boys they also achieve higher KS2 results. Finally my hypothesis has been proven again as year 7s achieved higher KS2 results than year 11s but with a few exceptions.