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Principal Moderator Feedback

Summer 2012

GCSE Statistics 2ST01
Controlled Assessment 5ST02
Paper 01

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GCSE Statistics 2ST01
Principal Moderator Feedback – Controlled Assessment

Introduction

Candidates responded well to the three themes available this year with about the same number in each theme.

The assessment of this module did not appear to be an issue for the vast majority of centres. Generally the planning stage of the assessment was clearly distinguishable from the other stages of the assessment and most teachers gave detailed and appropriate feedback to their students. It should be noted, however, that **all** suggested changes to the candidates' initial plan should be documented on the Student Record Form and that any actual changes should be commented on by the student.

Generally the work from centres was well presented, neatly packaged, and arrived on time, but many centres continue to have difficulties dealing with the paper work surrounding the recording of results, and what to include in the moderator sample.

Moderators expended a considerable amount of time and energy in chasing up centres that had not included all the necessary requirements with the samples. A check list is suggested at the end of this report to assist centres in preparing samples for next year's submission.

Administration issues

Due to the complexity of the paper work the following check list is offered to teachers and Examinations Officers to assist them in preparing samples for next year's submission.

1.) Have the marks been entered correctly on the OPTEMS?

2.) Does the sample contain all the starred candidates on the OPTEMS?

3.) Has absent candidates' work been replaced by equivalent pieces of work?

4.) Does the sample contain the tasks with the highest and lowest marks?

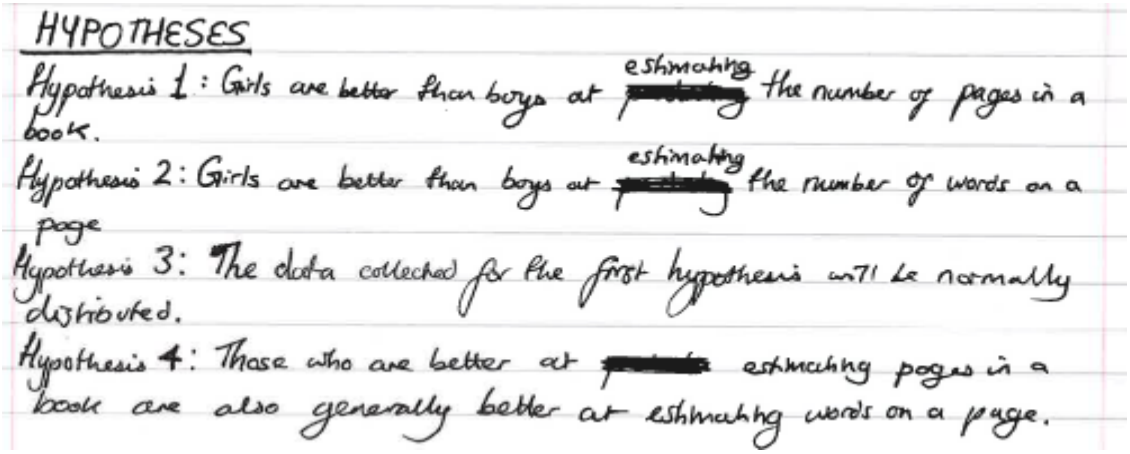
5.) Has the work been authenticated by both the teacher and the student? (Two signatures are required on the Student Record Form).

Specific comments

Strand 1: Planning

Moderators noted a general improvement in the way centres dealt with the Planning stage of the assessment. Many teachers provided excellent and appropriate feedback to candidates enabling them to pursue investigations commensurate with their ability and, in many cases, the feedback was well documented on the Student Record Form.

As in previous sessions, many candidates attempted investigations involving the use of multiple hypotheses. Candidates should be advised that to gain full credit for this approach they need to make some attempt to analyse the interrelationships between the various hypotheses. In most cases it appeared as if the hypotheses were merely a vehicle to get as many techniques into the investigation as possible.



HYPOTHESES

Hypothesis 1: Girls are better than boys at estimating the number of pages in a book.

Hypothesis 2: Girls are better than boys at estimating the number of words on a page

Hypothesis 3: The data collected for the first hypothesis will be normally distributed.

Hypothesis 4: Those who are better at [redacted] estimating pages in a book are also generally better at estimating words on a page.

In this extract above, the candidate proposes to investigate four apparently different hypotheses which are more like four mini investigations rather than a single investigation pursuing an overarching objective.

The most successful candidates were those who were able to develop discussions involving a degree of complexity. This was usually achieved by considering (a) interrelated hypotheses e.g. H1 set up to investigate the variables A and B, H2 set up to investigate the variables B and C, H3 set up to investigating the variables C and A, together with an attempt to synthesise all three hypotheses into an overarching conclusion, or (b) a sequence of related activities, eg if P then Q, if Q then R, if R then S etc.

The next 2 pages are an extract from a controlled assessment from this summer.

CALCULATIONS AND DIAGRAMS

Hypothesis One

Girls are better at remembering a pattern than boys.

The calculations and diagrams I will need for this are:

- The mean
- ~~The~~
- Standard deviation
- Box plots

I am going to work out and compare the two means for all the boys and all the girls. Having taken out the outliers, I will add up all the scores and divide them by 30.
I will display the two pieces of data on a bar chart because this visually the best way to compare them. It is also the most obvious choice because the variables are categoric and continuous.

To measure the spread I will use standard deviation. I decided to use this because all the values are used and my data should be fairly symmetrical.
The formula for standard deviation is:

$$\sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

The Σf is the total number of people you sample.
Σfx^2 is the sum of the frequency density squared. I will find the frequency density

by looking at the frequency density table I need for hypothesis 2.

I have already found the IQR, upper and lower quartiles, and the outliers. I will use all these for a box plot. I also need to find the range which is another measure of spread. To do this I will take the lowest value from the highest value.
I decided to use box plots because they are visually easy to compare, side by side.

(8)

Hypothesis 2

To work out normal distribution I will also need to do a frequency density table and a histogram.

The frequency density table will look like the one below

Score (for Girls)	Frequency	Class width	Frequency Density
$0 > n \geq 5$		5	
$5 > n \geq 8$		3	
$8 > n \geq 10$		2	
$10 > n \geq 12$		2	
$12 > n \geq 15$		3	
$15 > n \geq 20$		5	
$20 > n \geq 25$		5	

I have used unequal class widths to make the histogram more effective.

The frequency is the number of people who got a score in that class width.
The frequency density is found by dividing the frequency by the class width.

I will draw a histogram with the information in the table. The frequency density is the height of the bars and the class width is the width of the bars.

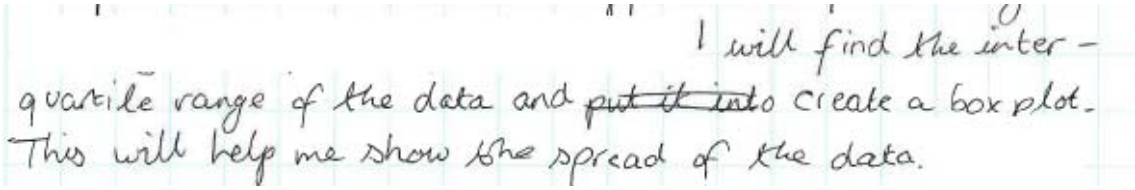
I have already worked out the standard deviation for hypothesis one, as well as the mean. If I multiply the standard

deviation by 2 and add this to and take away from the mean, (9) 95% of the data should lie within this. Within 3 standard deviations of the mean virtually all the data should lie (99.8%).

Here the candidate begins to show evidence that they are able to plan a sequence of related activities. In the first hypothesis they plan to remove outliers and then to calculate and compare the means and standard deviations of two

distributions, and in the second hypothesis they plan to use these calculations to do a further calculation to show normality in the data.

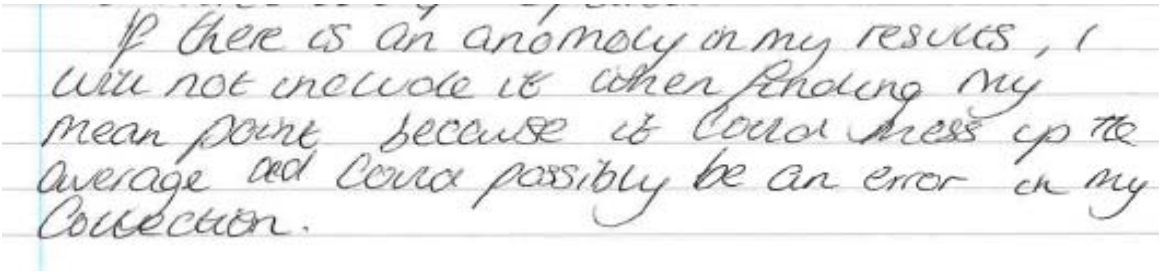
Many candidates were able to give some indication of which techniques they were going to use, but candidates should be advised to choose techniques appropriate to their investigations, and that they should give clear reasons for their particular choice of techniques.


I will find the inter-quartile range of the data and ~~put it into~~ create a box plot. This will help me show the spread of the data.

Here the candidate gives a clear indication of which technique they intend to use but does not explain the particular choice of the technique, e.g. why choose to draw a box plot in preference to say a stem and leaf diagram?

Candidates should also be advised that the apparent difficulty of a technique does not automatically mean that they will be awarded a high mark for using that technique. It is how the techniques are used that determines the quality of the work, e.g. the use of the standard deviation to merely compare the spreads of two data sets is, in principle, no more sophisticated than comparing the spread of two data sets by using the inter-quartile range.

Many candidates were able to anticipate possible problems in the collection of their data, and were able to give a clear strategy for dealing with outliers and anomalies. Candidates should be encouraged to explain their reasons for the removal of poor data in the context of their investigation and the possible impact that the poor data could have on the reliability of the results.


If there is an anomaly in my results, I will not include it when finding my mean point because it could mess up the average and could possibly be an error in my collection.

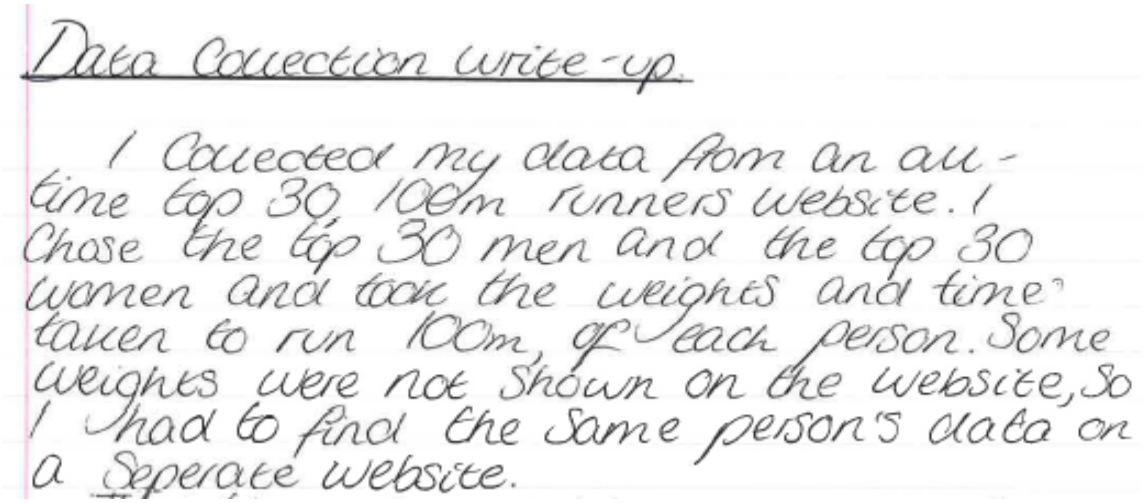
Here the candidate gives a simple reason for not including anomalous data in their calculations.

Simply stating that anomalies will be excluded, or that outliers will be replaced, without giving a reason is not considered to be a high demand activity, even if accompanied by sophisticated techniques for identifying them.

Strand 2a: Data collection

Generally this strand was not done well. A significant number of candidates treated the data collection strand as merely an exercise to get the numbers they needed to use with their techniques. Only the best candidates had any appreciation that the quality of the data had any implications on the reliability of the conclusions that could be drawn from that data.

Candidates should be encouraged to give more details about the nature and the source of the data they are using. When collecting secondary data they should state the web addresses they are using, including those used to check the accuracy of the data.



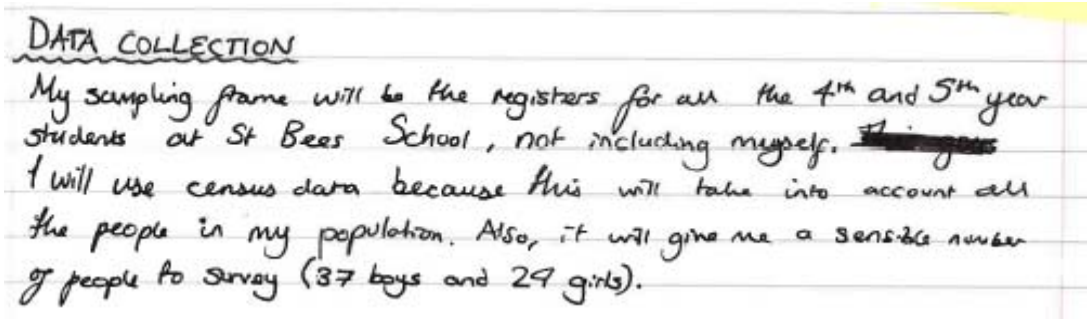
Data Collection write-up.

I collected my data from an all-time top 30 100m runners website. I chose the top 30 men and the top 30 women and took the weights and times taken to run 100m, of each person. Some weights were not shown on the website, so I had to find the same person's data on a seperate website.

Here the candidate explains what data will be used, but does not give any details about the websites that were used, ie the purpose of the websites and the addresses websites.

When collecting primary data candidates should explain how the data was collected and, if working with others, what they did to ensure the data was collected correctly by each participant.

Only the best candidates were able to give a clear explanation of their choice of sampling technique and a detailed account of how that technique was being used to collect the data. In particular candidates should be advised to explain why they chose to take a stratified sample from a small data set when it would appear that the use of the whole data set would be more appropriate.


DATA COLLECTION

My sampling frame will be the registers for all the 4th and 5th year students at St Bees School, not including myself. [redacted]

I will use census data because this will take into account all the people in my population. Also, it will give me a sensible number of people to survey (37 boys and 29 girls).

Here the candidate chooses to use a census and gives a simple reason for the choice.

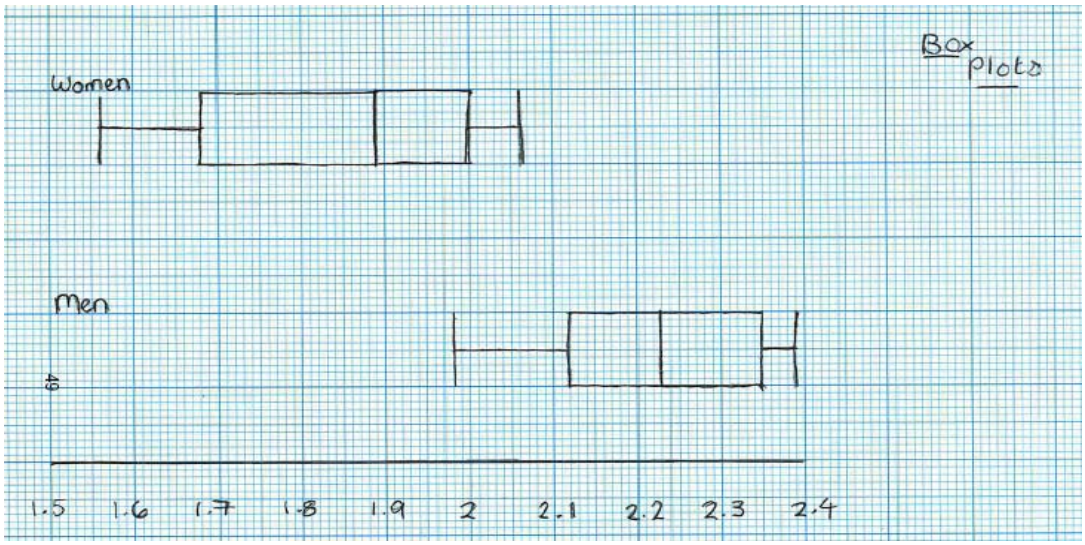
Candidates should give reasons for their choice of sample size, and discuss the possible effect of inaccuracies in the data on the analysis of small samples. This includes the use of small samples in the individual strata of a stratified sample.

Strand 2b: Processing and analysing

Generally this strand was done well. Most candidates were able to select appropriate techniques to analyse the data they had collected.

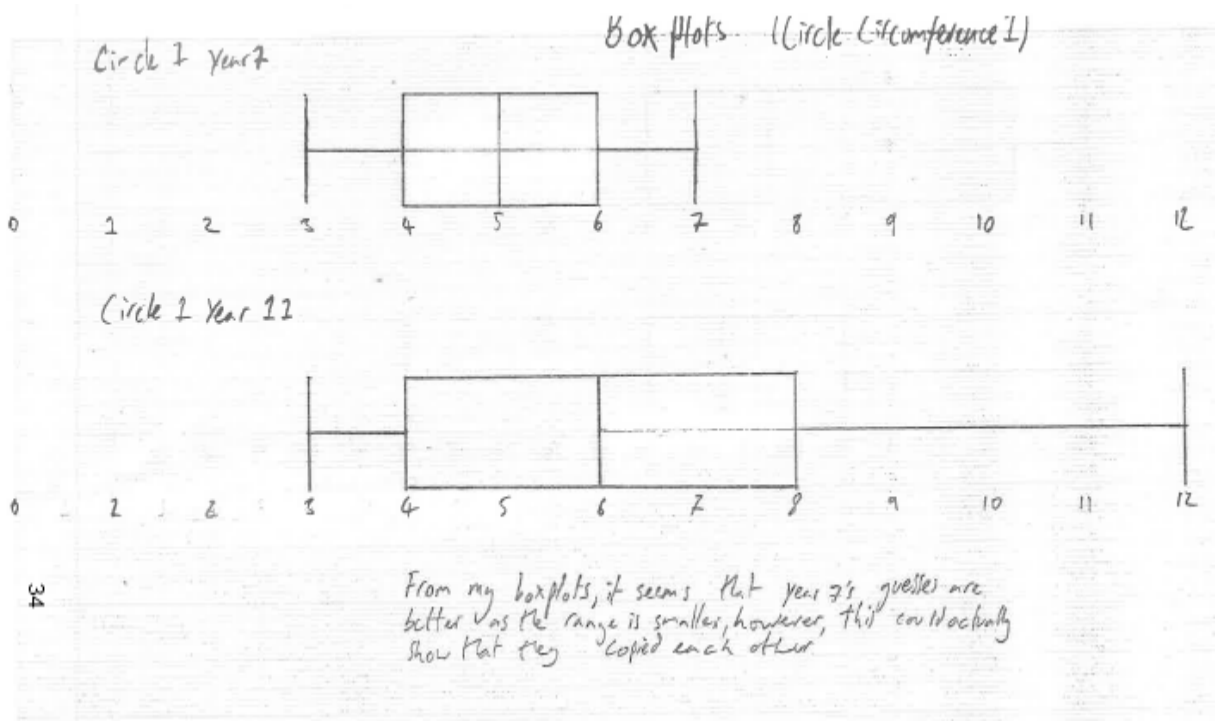
A significant number of those candidates using IT to generate graphs for comparison were unable to use the IT packages effectively to set up the graphs for the intended comparison, eg the use of different scales on the axes of box plots and the inappropriate use of (0, 0) as the origin of scatter graphs. The use of IT to calculate statistical parameters is encouraged, but candidates should be advised to explain the purpose of these calculations in the context of their investigation, eg the calculation of a line of best on a scatter graph can have little meaning unless it is justified to do so, and, once calculated, is put to a sensible purpose in the context of the investigation. Credit is given for both the use and purpose of a technique rather than for the technique itself in any absolute sense.

Candidates should be reminded that diagrams should be fully labelled. One mark may be deducted in this strand for poor or inappropriately labelled diagrams.



Here the candidate loses credit for not labelling the axis.

Many centres were generous in the assessment of this strand, often giving credit for the apparent complexity of a technique rather than the use and purpose of the technique. A mark given to the application of a technique, eg the drawing of box plots to compare, is affected by the depth of the candidate's analysis using the technique, eg those comparing only the median or only the interquartile range would, in principle, do less well than those comparing both the median and the interquartile.



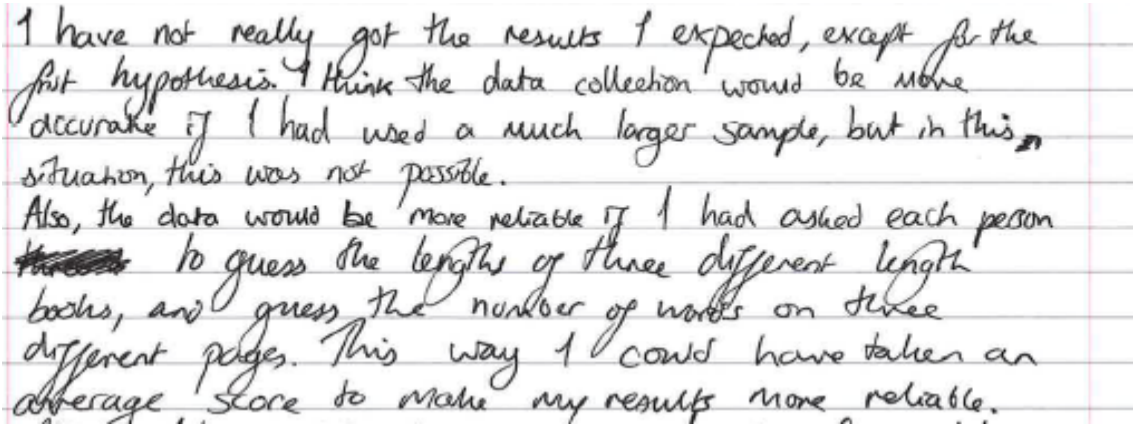
Here the candidate chooses to compare only the ranges of the boxplots. A comparison of the medians, and/or the skews of the distributions would, in principle, be considered to be a more sophisticated use of the diagrams and could potentially score higher marks.

Strand 3: Interpretation

Many candidates were able to draw the various parts of their investigation together in this strand and relate their findings to their initial hypotheses.

The most successful candidates in this strand were those that were able to assess the reliability of their findings in the context of their method, e.g. the quality of the data and the choice of techniques for the analysis, and discuss the range of applicability of the findings beyond the immediate sample or population.

Many candidates were able to state that they would have been able to improve their results if they had taken a larger sample, but surprisingly few of these made any reference to their choice of sample size in their plan. Candidates should be advised to give more detail as to how a larger sample would increase the reliability of their findings in the context of the particular techniques they had used, e.g. explain how a larger sample would increase the accuracy in the calculation of particular statistics, or if it would have no appreciable effect.


I have not really got the results I expected, except for the first hypothesis. I think the data collection would be more accurate if I had used a much larger sample, but in this situation, this was not possible.
Also, the data would be more reliable if I had asked each person to guess the lengths of three different length books, and guess the number of words on three different pages. This way I could have taken an average score to make my results more reliable.

Here the candidate suggests a simple improvement to make the results more reliable.

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