

Principal Moderator Feedback

Summer 2013

GCSE Statistics (5ST02)
Paper 01

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GCSE Statistics 5ST02 Principal Moderator Feedback

Introduction

Students responded well to the three themes on offer this year. Angles and Lines was the most popular followed by Films.

Generally the work from centres was well presented, neatly packaged and arrived on time, but many centres continue to have difficulties in dealing with the associated paper work. A check list is provided at the end of this report to assist centres in preparing samples for future sessions.

It was not always clear from the paperwork, or from the assessment of the tasks, that centre moderation had taken place. This is expected for centres with more than one assessor and may cause problems for the external moderation process if the centre assessment is not in the correct order.

Moderators reported that a number of centres had submitted tasks in which errors in the application of techniques, eg inaccuracies in calculations and omissions in diagrams, had not been identified or penalised in the assessment.

This year has shown a marked improvement in the way centres are dealing with the Planning stage of the Controlled Assessment task. There continues, however, to be a wide variation in the way centres are using the Student Record Form to record the feedback given to students after the Planning stage. In the best instances centres are recording detailed feedback to students, enabling many to reconsider their initial approach and arrive at more suitable lines of enquiry. In most of these cases students were able to give a clear explanation for their changes, often in the body of the work, before starting on the Data Collection stage.

Example 1: Clear explanation of change to initial plan.

Ammendments to plan

The data that I collected ~~did not fit~~ was not able to do some of the calculations I included in my plan. My data was not symmetrical so I wasn't able to calculate its standard deviation. Also because there was no obvious correlation between the date of release and the box office takings of a movie, there was no point in calculating the moving averages as it would not help me answer my hypothesis.

Centres are reminded that all changes to the initial plan must be agreed by the teacher and recorded on the Student Record Form.

Specific comments

Strand 1: Planning

Moderators reported that a significant number of students produced tasks that attempted to demonstrate all the techniques they had been taught, and that many of these lacked a coherent strategy with a clear aim.

Students should be advised **not** to produce investigations involving the use of a number of hypotheses that are only loosely related by the general theme. In most cases only the best of these 'mini investigations' contributed to the overall assessment of the task, and many students expended a great deal of time and energy on work that did not contribute to the final mark.

As in previous years, the best investigations involved the use of:

- (a) a single hypothesis, often broken down into a number of sub hypotheses, considering the interrelationships between three or more variables.

Example 2: Related variables potentially leading to a mid to high demand activity (Interrelated variables require the pair-wise analysis of at least three variables, ie for the variables A , B and C the relationships between AB , BC and CA need to be considered).

To investigate the ~~ability~~ effect of gender and age on estimating the length of a straight line and an angle

Hypotheses:

- ① → Elder year groups are better in estimating the lengths of lines and the sizes of angles than younger year groups.
- ② → Girls are better in estimating the lengths of lines and sizes of angles than boys.
- ③ → ~~Boys~~ The longer the length of a line, Boys' estimations are more variable than girls'.

- (b) a carefully specified chain of activities over several stages leading to a clear objective.

Example 3: First stage of a sequence using a mid-demand technique to justify the application of a higher demand technique.

If these box plots show that the data is
symmetrical ^m I will calculate the standard deviation

Students need to give detailed reasons for their particular choice of techniques and explain why these are appropriate in the context of the data and the aims of their investigation. Simply stating that, for example, a scatter diagram will be used to compare the correlation of data is a low demand justification for the use of that technique.

Example 4: Typical low to mid-demand justification for the choice of box plots to compare data sets.

Diagrams:

To process my data, I will represent them on different statistical diagrams to compare the ability of estimation by different year groups and different genders. This will therefore allow me to test my hypotheses.

For the ~~st~~^{first} hypothesis, I will use a ~~st-back-bone~~^{box plot} ~~stem and leaf~~^{compare} diagram to be able to ~~calculate~~^{compare} measures of spread such as the upper and lower quartiles, the range, the interquartile range and outliers. Also to be able to measure the skewness of the data collected and compare the medians.

It should be noted that to award the higher marks in this strand, students need to do more than simply give a simple reason for why a particular techniques will be used, particularly if that technique is nominally a high demand technique.

Simply stating that outliers will be removed is a low demand treatment of outliers. A more advanced treatment would be to give details of the criteria used to identify them and include a discussion, in context, of the probable effect of their inclusion, or exclusion, on the reliability of the results.

Strand 2a: Data collection

Most students were able to collect suitable data for their investigations.

Moderators reported that some centres had provided data sets for their students, and that these were generally accepted by the students as good quality data without any appreciation of how the data had been collected. Furthermore, students often used these data sets to generate sub samples when it would have been far better to have used the entire data set given to them.

Centres are discouraged from providing sets of data for their students as this denies students one of the chief features of any statistical investigation - the choice of how the data will be collected. An understanding of how the data is collected affects all aspects of a statistical investigation and ultimately leads to an appreciation of the quality of the results that are produced.

Students should be advised to think carefully about the amount of data they are collecting. For example, the collection of 25 items of data for each of two data sets may not be an appropriate amount of data for the techniques to be used. The amount of data collected should be linked to the choice of technique. A 'Goldilocks' justification for the choice of sample size, ie 'not too big and not too small', is considered to be a low demand justification.

Example 5: Typical low demand justification for the choice of sample size.

I feel that 30 pieces of data per vegetable is an appropriate sample size since the whole population (all of the ^{mangetout} carrots grown for Aldi) is far too large a sampling frame for me to be able to collect data for each individual ^{item of the} population (a census), which would be expensive and time-consuming; nonetheless, it is enough data to be able to spot patterns and draw reliable conclusions.

The amount of data to be collected should be related to the choice of technique and, at the higher end, this should be appropriate for the technique. For example, a plan to collect 30 items of data to draw a histogram is generally an inappropriate amount of data for that technique.

Students should be advised to give more details of the data source, eg the web address - not just 'the internet', or, if the sample is taken from their school, they should give details of the population by describing the composition of the school and, if appropriate, the catchment area of the school. They should describe in detail how they will select each item of the sample, the choice of sampling frame, the selection of the random numbers, etc.

Strand 2b: Processing and analysing

Moderators reported that the centre assessment of this strand was often generous. It should be noted that it is not the complexity of the technique that is being assessed in this strand, but how the technique is being used and the depth of analysis generated, eg the use of the standard deviation to compare the spreads of two data sets is a low demand application of the standard deviation, particularly if it had not been shown that the use of standard deviation is an appropriate measure of spread for each of the data sets.

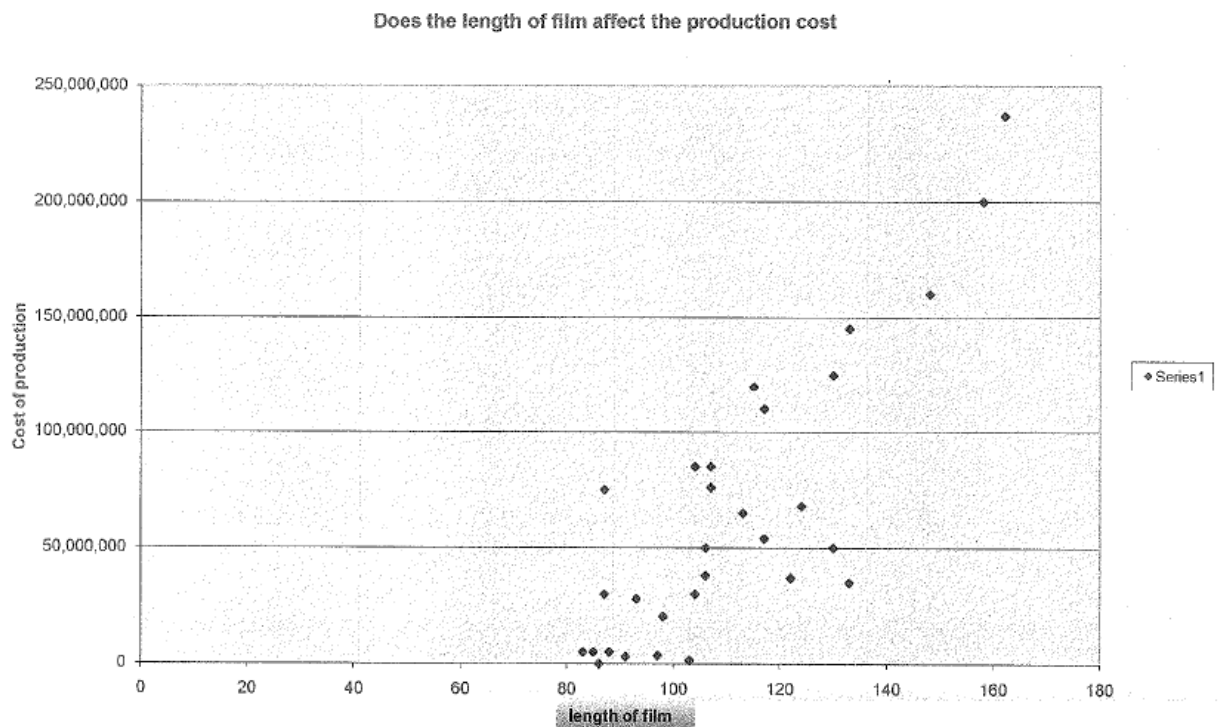
Example 6: Low demand application of the standard deviation.

However, the standard deviation values for estimating the length of a line shows that females' estimation of the length of the line is much more variable than the males' as their value of standard deviation is much higher

Similarly, the calculation of Spearman's Rank Correlation Coefficient for data that has already been shown to have no association on scatter graph is a low demand application of the technique, compared to (say) the comparison of two Spearman's Rank Correlation Coefficients.

The use of ICT to do the more arduous calculations and representations is to be commended, but students should be encouraged to be more critical of what is produced. Calculations should be given to an appropriate degree of accuracy, and the inappropriate choice of axes, or the poor labelling of graphs, eg the omission of units, must be penalised.

Example 7: Typical low demand scatter graph produced by IT. Note that the graph should be penalised for the choice of horizontal scale and the absence of units in the data labels.



Strand 3: Interpreting and evaluating

The centre assessment of this strand was generally accurate.

Many of those students who adopted a strategy of interpreting their results as they went along did better in this strand than those who saved all the interpretation for the end as they were able to concentrate more of their efforts on the evaluation of their results.

It was reported that a significant number of students were unable to evaluate their findings in terms other than simply stating that 'increasing the sample size increases the accuracy', which is considered to be a low demand evaluation.

Only the best students were able to discuss the reliability of their results by discussing the sampling regime, the quality of the data, the amount of data used in the techniques and the particular choice and application of techniques, e.g. the effect of the choice of class intervals on histograms.

Centres are reminded that techniques that have not been used should **not** be given credit in the assessment of the work, ie if a technique has not been interpreted or analysed it cannot be awarded credit in strand 2b.

Administration check list

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 the work of an absent candidate been replaced by an equivalent controlled assessment task?
- 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).
- 6) Has the centre retained a copy of the OPTEMS for its records?

Key points

- Internal moderation is expected for centres with more than one assessor.

- It is expected that errors in students' work are identified by the centre assessor.
- Students should be advised **not** to produce investigations involving the use of a number of hypotheses that are only loosely related by the general theme.
- Centres are encouraged **not** to provide sets of data for their students.
- It is **not** the complexity of the technique that is being assessed in strand 2b but how it is being used and the depth of analysis that is generated.
- Students should be encouraged to be more critical of the calculations and diagrams produced by ICT.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

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