Year 12 Essential Mathematics Unit 3

Statistical Investigation Validation

Using Bivariate Data

**Total Marks: /25 Weighting: 10%**

A group of 24 year 12 students was surveyed to see how much time they spent studying for a test as well as how much sleep they had the night before the test. Their results are recorded in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time spent studying  (minutes) | Time slept the night before  (hours) | Test score (%) | Time spent studying  (minutes) | Time slept the night before  (hours) | Test score (%) |
| 120 | 6 | 80 | 90 | 7 | 75 |
| 60 | 8 | 60 | 0 | 6 | 30 |
| 90 | 8 | 65 | 10 | 6 | 40 |
| 15 | 8 | 90 | 45 | 8 | 60 |
| 30 | 5 | 45 | 40 | 8 | 60 |
| 45 | 8 | 50 | 30 | 7 | 55 |
| 100 | 7.5 | 75 | 80 | 8 | 80 |
| 60 | 7.5 | 65 | 90 | 7 | 85 |
| 150 | 6.5 | 80 | 120 | 8 | 95 |
| 25 | 7 | 55 | 100 | 8 | 100 |
| 30 | 7 | 60 | 60 | 6 | 70 |
| 75 | 8 | 70 | 60 | 6 | 55 |

Use the data provided to answer the question:

**”Which has the greater effect on test performance, the time spent studying before the test or the number of hours slept before the test?”**

**1. Introduction – provide an overview of your investigation (3)**

|  |  |
| --- | --- |
| This investigation will use the data provided to determine which has the greater effect on test performance, the time spent studying before the test, or the number of hours slept before the test. In order to make an informed decision, I will compare the strength of the association between the pairs of variables (and draw a scatterplot to analyse the data); that is, the association between time spent studying and test performance and the association between number of hours slept and test performance. | |
| Provides a simple introduction of the question | 1 |
| Restates question in his/her own words | 1 |
| Mentions comparison of association between variables | 1 |

**2. Graphical analysis**

|  |  |
| --- | --- |
| Constructs a single scatterplot | 1 |
| Shows comparative scatterplots | 1 |
| Presents correct graphs, including: (1/2 each graph)  Descriptive Titles  Labelling of axes  Correct Units (Correctly breaks scale if necessary)  Correct Scale on each axis | 1  1  1  1 |

* ***consider the most appropriate graphs which represent the data provided (6)***
* ***choose various statistical measures you’ve studied to analyse the data (6)***

|  |  |
| --- | --- |
| Of the data there was only one outlier. The outlier was for the effect of Study Time on Test Score; 15 mins scoring 90%. This outlier could be explained by the fact that there was an error in recording the data, or this student was very intelligent and scored a high test score regardless of the amount of study he/she did. This outlier has not been included in determining the trend line, as including it would have skewed the association making it appear less positive. If I was to extrapolate the graphs, it appears that most students would need to study for at least 160 mins to achieve 100% on the test. Students would need to sleep for more than 8 hours to achieve more than 80% on the test. | |
| Identifies an outlier | 1 |
| Provides a valid reason for the outlier | 1 |
| Provides reason for removing the outlier/explains effect it would have had on association if included. | 1 |
| Accurate trend line between half of the data points (outlier not used to determine trend line) | 1 |
| Student makes a valid comment for EACH graph, using specific data. They interpolate/extrapolate data to support their analysis. | 2 |

**3. Interpretation of the graph/data. (6)**

* ***describe any trends and patterns in your data***
* ***describe any associations with the data***

|  |  |
| --- | --- |
| There is a strong, positive, linear relationship between study time and test score. As the amount of time spent studying increases, so does test score. Based on this data, more study time causes the student to perform better in the test.  There is a moderate, positive, linear relationship between the number of hours slept and test score. As the number of hours slept the night before the test increases, so does test score. Based on this data, more sleep appears to make the student perform better in the test, however the effect isn’t as great as the time spent studying. | |
| States the linear relationship between EACH variable | 2 |
| Describes in their own words the effect of one variable on the other for EACH graph | 2 |
| States the causal relationship between the variables for EACH graph | 2 |

**4. Conclusion (4)**

* ***summarise your findings and conclusions in one paragraph.***

|  |  |
| --- | --- |
| After analysing the provided data obtained from the 24 Year 12 students, it can be concluded that the more time a student spends studying and getting enough hours sleep before a test, increases the chance of getting a better test result. Getting data from more students would make this a better investigation. Although there is an association between both variables on test performance, I would conclude that the amount of time spent studying for the test has a greater effect on test performance, as the data is closer to the trend line compared to the data for number of hours slept. | |
| Makes a valid comment about the data, perhaps suggesting a way to improve the investigation | 1 |
| Summarises the results of the effects of BOTH variables on test performance | 2 |
| Relates problem back to original question and writes a conclusive statement in answer to that question. | 1 |