Investigation 7: Correlation between hand span and grip strength, or height and grip strength

To view the various elements of this example, please use the icons at the side of the screen.

**Note:** The comments in the annotated examples match the labelling on teacher forms.

Investigation 7: Moderator comments

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| --- | --- | --- | --- | --- | --- |
| **Personal engagement  x/2** | **Exploration  x/6** | **Analysis  x/6** | **Evaluation  x/6** | **Communication  x/4** | **Total  x/24** |
| 0 | 4 | 4 | 4 | 3 | 15 |

**Personal engagement**

|  |  |
| --- | --- |
| **Mark** | **Descriptor** |
| 0 | * The student’s report does not reach a standard described by the descriptors below. |
| **Moderator’s award**  0 | **Moderator’s comment**  There is no evidence of personal engagement. There is also no rationale for the choice of this research and indeed the conclusion contains reference to an identical investigation read by the student. The investigation is known to the student as not being original as it is out of the Vernier (Data Loggers) manual “Human Physiology with Vernier” lab book by Diana Gordon and Steven L. Gordon, M.D. Protocol is referenced; however, there is very little adaptation except to compare and look at the relationship between hand span and height and this is not enough to attain 1 mark. |

**Exploration**

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| **Mark** | **Descriptor** |
| 1–2 | * The background information provided for the investigation is **superficial** or of limited relevance and does not aid the understanding of the context of the investigation. |
| 5–6 | * The topic of the investigation is identified and a relevant and fully focused research question is clearly described. * The methodology of the investigation is highly appropriate to address the research question because it takes into consideration all, or nearly all, of the significant factors that may influence the relevance, reliability and sufficiency of the collected data. * The report shows evidence of full awareness of the significant **safety**, ethical or environmental issues that are **relevant to the methodology of the investigation**\*. |
| **Moderator’s award**  4 | **Moderator’s comment**  The research question is fully focused but there is no context or background information given at the start of the report. There is some context expressed towards the end of the report but this does not provide the scientific justification for the study. The methodology is effective in collecting sufficient relevant data for the research question and there is evidence of safety and ethical issues being taken into account. Both PAR-Q and consent forms are handed out and students are informed that they may withdraw from the experiment at any time. The mark is restricted to 4 because the scope of the study is not commensurate with the Diploma Programme: it is too simple. |

\* This indicator should only be applied when appropriate to the investigation.

**Analysis**

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| --- | --- |
| **Mark** | **Descriptor** |
| 3–4 | * The report shows evidence of some consideration of the impact of measurement uncertainty on the analysis. * The processed data is interpreted so that a broadly valid but incomplete or limited conclusion to the research question can be deduced. |
| 5–6 | * The report includes sufficient relevant quantitative and qualitative raw data that could support a detailed and valid conclusion to the research question. * Appropriate and sufficient data processing is carried out with the accuracy required to enable a conclusion to the research question to be drawn that is fully consistent with the experimental data. |
| **Moderator’s award**  4 | **Moderator’s comment**  The raw data collected is sufficient to address the research question and the processing of this data is correct, albeit simplistic. There is an explanation of regression lines and how the relationship between the two variables is statistically calculated and expressed through the coefficient of determination (R2) that ranges from 0 to 1.  The candidate uses the coefficient of determination to explain the correlation observed in the regression line. This correlation can be implied by looking at this coefficient (since being a positive correlation, it corresponds to the square root of the coefficient of determination). However, it would be better to use the value of the coefficient of correlation and then the coefficient of determination to explain to what extent the points in the scatter graph fit the regression line. The candidate talks also of a “positive coefficient of determination” to explain the correlation, but this coefficient is always positive, as it is the square of the coefficient of correlation, it gives the impression that he is mixing the two of them up.  While the uncertainty data is present, no attempt is made to assess the impact of this on the conclusion or explain whether this is human or mechanical uncertainty. The candidate does not attempt to assess the significance of the difference between the two correlation coefficients for the best-fit lines.  Given that this simple processing reveals no strong correlation, the student does not attempt to use the qualitative data to try and improve the analysis (for example, separating males from females, and those who do sports that involve hand grip and those who do not, or using only the first reading rather than the mean). |

**Evaluation**

|  |  |
| --- | --- |
| **Mark** | **Descriptor** |
| 3–4 | * A conclusion is **described** which is relevant to the research question and supported by the data presented. * A conclusion is described which makes some relevant comparison to the accepted scientific context. * Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **described** and provide evidence of some awareness of the **methodological issues**\* involved in establishing the conclusion. * The student has **described** some realistic and relevant suggestions for the improvement and extension of the investigation. |
| **Moderator’s award**  4 | **Moderator’s comment**  The validity of the conclusion is discussed in the previous criterion. The conclusion is described and justified using data accurately. There is a comparison with other studies that investigated the same correlations, but no analysis of differences due to, for example, sample size or characteristics, is presented.  Some strengths and weaknesses of the methodology are identified with simple and relevant modifications for the identified weaknesses. Suggestions linking to further extensions to the investigation are not provided. |

\*For example, incorrect/missing labelling of graphs, tables, images; use of units, decimal places. For issues of referencing and citations refer to the “Academic honesty” section in the guide.

**Communication**

|  |  |
| --- | --- |
| **Mark** | **Descriptor** |
| 1–2 | * The report is not well structured and is unclear: the necessary information on focus, process and outcomes is missing or is presented in an incoherent or disorganized way. * The understanding of the focus, process and outcomes of the investigation is obscured by the presence of inappropriate or irrelevant information. |
| 3–4 | * **The presentation of the investigation is clear. Any errors do not hamper understanding of the focus, process and outcomes.** * The use of subject-specific terminology and conventions is appropriate and correct. Any errors do not hamper understanding. |
| **Moderator’s award**  3 | **Moderator’s comment**  The presentation of the report is clear, and despite a few errors, the report is well structured and can be followed with relative ease. The report is organized into sections but in some aspects this is confusing. For example, the rationale for measuring hand grip strength, which should have been at the start of the report, appears in the conclusion. Due to the need to include consent forms and PAR-Q questionnaires when using human subjects, it is acceptable to include these documents as an appendix and not be counted in the 12-page limit. However, samples of PAR-Q and consent form are also not included in the report. |

\* For example, incorrect/missing labelling of graphs, tables, images; use of units, decimal places. For issues of referencing and citations refer to the “Academic honesty” section in the guide.