Activity 3: Data collection and drawing conclusions
The International Swimming League

Accessories:
• Act 3 presentation
• Act 3 worksheet
• Measurement sheet
• Measuring tapes

Learning goal:
In this activity, students learn that conclusions are only valid in the measured range. A more informative conclusion thus requires a large range and as much relevant information concerning these data. The further the minimum and maximum are separated and the smaller the interval, the clearer a possible correlation becomes.
Students learn that the limitation to the conclusion (or the extent to which the conclusions are still valid) have to be explicitly stated. Students learn that a proper conclusion answers the research question, is reliable, useful and as informative as possible.
Students learn that sharing dataset helps in collecting as much data as possible but that this additional data may only be used when the same procedure has been followed.

Procedure activity 3:
1. The teacher introduces the activity by telling it concerns the collection of data and drawing conclusions out of these.
2. The teacher tells about the different categories in sports as a way to keep the sport as fair as possible. For instance, in boxing and martial arts, there are different weight classes.
3. But how about swimming? Is it not remarkable that the winners are mostly tall people. Is the swimming competition still fair?
4. The fictitious news article is read out loud. Focus in the investigation will be on the first phase of the investigation: Is there a norm, a ratio between body length and span width that is valid to most people?
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6. But how about swimming? Is it not remarkable that the winners are mostly tall people. Is the swimming competition still fair?
7. The focus in this investigation is on the first phase of the inquiry of the ISL, is there a norm, a ratio between body length and span width that is valid to most people?
8. The teacher tells the students to measure the body length and span width of one of the other students and share the data in the spread sheet.
9. Once each student has measured and shared the data, the following questions are asked and discussed:
   a. Looking at the data, what do we see? Is there a norm?
   b. Does a single measurement allow to determine the norm? And two? Why? How many is enough?
c. Has everyone measured in the same way? Are our data reliable?
d. To what extent are our findings valid and useful for the ISL?
   i. The teacher now introduces an extra dataset (sheet 1 of the excel form, copy paste the measured values)
e. Does this extra data changes one or more of the answers given?
f. Are we allowed to use this additional data? Why (not)? What do we need to know about these data? (men/women, country, age, ...)
g. What has to be done to provide better data and advise to the ISL?

10 The teacher refers back to the research question stated by the ISL. This question needs to be answered. The data allows for many different conclusions, but what makes a proper conclusion? The teacher asks: Write down what conditions a conclusion must satisfy to be a proper conclusion.

11 The teacher introduces different conclusions and asks students whether these conclusions are useful to the ISL:
a. Long people have long arms.
b. There is a relationship between the body length and span width.
c. There is a proportional relationship between the body length and span width.
d. There is a proportional relationship between the body length and span width which is valid for people with a length between 1,50 m and 1,90 m.
e. There is a relationship between the body length $L$ and the span width $S$ described by the formula $S = 0,89 \cdot L + 16$. Within a marge of 5%, this relationship is valid for 93% of the people with a length between 1,50 and 1,90 m.

12 The teacher summarizes that, according to science: A proper conclusion:
   - Answers the research question
   - Is reliable
   - Is as informative as possible
   - Is useful (in the given context)

13 Using this information, students are asked to write an even better conclusion for the ISL and give recommendations for follow-up studies. Students are asked to use their knowledge gained to write down how they would write a different, better conclusion in the pirate investigation.

14 Students fill in the general reflection form.