Codebook II

Researching explanations of physics concepts that have a difficulty level indicator

1. What is the number of the article?

2. What search term, also called difficulty level indicator, was used to obtain the section? The search terms are here translated to English with the origin Dutch terms given in brackets.

1 = Difficult (*moeilijk*)

2 = Complicated (*ingewikkeld*)

3 = Complex (*complex*)

4 = Easy (*makkelijk*)

5 = Straightforward (*eenvoudig*)

6 = Simple (*simpel*)

7 = Tricky (*lastig*)

8 = Confusing (*verwarr*, *verward*)

3. Quote the piece of text were the difficulty level indicator refers to (also called the target).

For example:

It is difficult to understand quantum physics → **understanding quantum physics**

Applying nano cylinders is very easy → **applying nano cylinders**

4. Does the difficulty level indicator refer to a physics concept?

1 = Yes

2 = No

3 = Unknown

4 = Does not apply, the search term is not a difficulty level indicator.

For example:

1. Dark matter is very complex.
   In this example “complex” is used to indicate the difficulty level of dark matter which is a physics concept. In this example the answer is “1 = Yes”.
2. The new book written by Jane Do about dark matter is written in simple words.
   In this example “simple” is used to indicate the difficulty level of the writing of Jane Do, but it does not refer to dark matter itself. In this example the answer is “2 = No”.
3. Many researchers from different topics in research are waiting for more powerful computers for their simulations. The quantum computers of the future can do all kinds of complicated calculations.
   In this example it could be that the “complicated calculations” are calculations about physics, but from this piece of text it is not deducible if this is the case. In this example the answer is “3 = Unknown”.
4. John Do had an Oedipus complex
   In this example “complex” is a noun and not an adjective. In this example the answer is “4 = Does not apply”

<u>If the answer to question 4 is “2, 3, or 4”, the coding finishes here. If the answer to question 4 is “1 = Yes”, please proceed with question 5.</u>

5. What physics concept is in the target?

For example:

It is difficult to understand quantum physics → understanding quantum physics → **quantum physics**

Applying nano cylinders is very easy → applying nano cylinders → **nano cylinders**

6. What type of difficulty level indicator is used?

1 = Difficult (difficult, complicated, complex, tricky, confusing)

2 = Not difficult (negative use of difficult, complicated, complex, tricky, confusing)

3 = Easy (easy, straightforward, simple)

4 = Not easy (negative use of easy, straightforward, simple)

7. Examining the target described at question 3, in what context is the difficulty level indicator used?

1. The physics concept is easy/difficult to measure, find, prove, determine, observe, or solve.

2. The physics concept is easy/difficult to explain.

3. The physics concept is easy/difficult to understand, or to imagine.

4. The physics concept is easy/difficult to do, or to get done.

5. The physics concept is easy/difficult on its own.

6. Unknown

7. Other (use the extra column in the coding sheet to give an answer to this question)

8. Is there any explanation provided about the physics concept described in question 5?

1 = Yes

2 = No

<u>If the answer to question 8 is “2 = No”, the coding finishes here. If the answer to question 8 is “1 = Yes”, please proceed with question 9.</u>

9. What type of explanation is provided about the physics concept described in question 5 (Faye, 2014)?

<u>Every type of explanation has its own column. Put down a “1” in the colomn if the type of explanation is present, otherwise put down a “0”.</u>

1 = An analogy is used. The physics concept is compared to something else which is well known for the reader.

2 = A causal correlation is used as explanatory tool.

3 = A functional explanation is provided. There is an explanation in terms of what the use of the physics concept is, or how it can be applied.

4 = There is a general description given of the physics concept. The physics concept is defined or elaborated on.

5 = Other (fill the other form of explanation in this column)

Examples of the types of explanation:

1. The electrons move around each other like in a complicated dance.
2. Lightning is caused by a charge difference between the earth and the atmosphere.
3. You can make very detailed pictures of bacteria with an electron microscope.
4. An electron is a negative charged particle.

References

Faye, J. (2014). *The Nature of Scientific Thinking On interpretation, Explanation, and Understanding.* Palgrave Macmillan.