Unit 7 Critical thinking

Task 1 The scientific method

a) The scientific method is a process in which experimental observations are used to answer questions. Complete the collocations for describing the stages in the scientific method using the words and phrases in the list below.

a hypothesis an experiment (x2) conclusions data (x3) the question

analyse_____
collect _____
conduct / run_____
define _____
design_____
draw _____
interpret _____
formulate / propose / put forward _____

b) Number the stages above in the order you would normally do them.

c) Read this extract from a student website and check your answers to ex. 2.

The scientific method is a process in which experimental observations are used to answer questions. Scientists use the scientific method to search for relationships between items. That is, experiments are designed so that one variable is changed, and the effects of the change observed. While the exact methodologies used vary from field to field, the overall process is the same. First, the scientist must define the question – what exactly they are trying to find out. Next comes the formation of a hypothesis, which is an idea or explanation for a situation based on what is currently known. The next stage of the method is the design of an experiment which will allow this hypothesis to be tested. Usually a primary run of the experiment is conducted, and any changes to the experimental set-up made. In each experimental run, data collection takes place, followed by data analysis. Finally, the data is interpreted and from this, the scientist is able to draw conclusions.

d) Read the extract again to find the nouns forms of the verbs below. Which word/s use/s the same form for the verb and the noun?

analyse – collect – design – explain – form – observe – relate – run

(Hellemans, A., & Tomei, L. *Cambridge English for Scientists.* CUP, 2011.)

Task 2 Video - 5 tips to improve your critical thinking

(https://www.youtube.com/watch?v=dItUGF8GdTw)

A) Watch the video and write down the tips.

B) Explain the meaning of the phrases below.

reveal bias

subject an idea to scrutiny

weigh the options

unintended consequences

to sift through a sea of information

Task 3 Factfullness – The Quiz

Choose the answer you believe is correct.

1. **What is the global adult literacy rate?**

A) 80% B) 60% C) 40%

2. **In the past 20 years, the proportion of the global population living in extreme poverty has changed. But how?**

A) It has almost doubled. B) It has stayed the same. C) It has almost halved.

3. **What is the average life expectancy of the world´s population?**

A) 50 years B) 60 years C) 70 years

4. **In all low-income countries across the world today, how many girls finish primary school?**

A) 20% B) 40% C) 60%

5. **Where does the majority of the world population live?**

A) Low-income countries B) Middle-income countries C) High-income countries

(https://factfulnessquiz.com/, Hans Rosling)

Task 4 Conditionals

A) Study the examples and derive the rules from them:

Conditional I: E.g.: She will finish the data analysis in a few days if she gets that user-friendly software.

I: …….

Conditional II: E.g. She would finish the data analysis in a few days if she used that software.

II: …….

Conditional III: E.g. She would have finished the analysis ages ago if she had used that software.

III: ……...

B) Complete the sentences:

I will complete my diploma thesis soon if …

Writing my thesis would be much easier if…

I wouldn´t have completed … if I …

C) Transform the following sentences:

1. He hopes the statistician will process his data. Then he can interpret them.
   He will interpret the data if the statistician ……..

2. I have very little time. I can´t complete my thesis this semester.
   I could complete my thesis this semester if I ……..

3. He studied really hard. He passed the state exams with flying colours.
   He wouldn´t have passed the state exams with flying colours if he ……

4. The physician´s hypothesis was rejected. They did not determine the cause of the illness.
   If the physician´s hypothesis had been confirmed, they ……. .

Task 5 Thinking critically on critical thinking: why scientists´ skills need to spread

A) with its basis in logic, rationality, and synthesis
B) examine the logic of arguments
C) in order to gain it
D) the lecture theatre or classroom
E) the work scientists do
F) remain in the domain of scientists
G) but in the thinking
H) needs to be taught and cultivated
I) into the realms of scientific inference and reasoning

When we think of science and maths, stereotypical visions of lab coats, test-tubes, and formulae often spring to mind. But more important than these stereotypes are the methods that underpin (1) … – namely generating and systematically testing hypotheses. A key part of this is critical thinking. It's a skill that often feels in short supply these days, but you don't necessarily need to study science or maths (2) … . It's time to take critical thinking out of the realm of maths and science and broaden it into students' general education.

What is critical thinking?
Critical thinking is a reflective and analytical style of thinking, (3) ….. It means delving deeper and asking questions like: why is that so? Where is the evidence? How good is that evidence? Is this a good argument? Is it biased? Is it verifiable? What are the alternative explanations?
Critical thinking moves us beyond mere description and (4) … . This is what enables discoveries to be made and innovations to be fostered. For many scientists, critical thinking becomes (seemingly) intuitive, but like any skill set, critical thinking (5)… . Unfortunately, educators are unable to deposit this information directly into their students' heads. While the theory of critical thinking can be taught, critical thinking itself needs to be experienced first-hand.

Can you teach it?
It's well established that statistical training is associated with improved decision-making. But the idea of "teaching" critical thinking is itself an oxymoron: critical thinking can really only be learned through practice. Thus, it is not surprising that student engagement with the critical thinking process itself is what pays the dividends for students. As such, educators try to connect students with the subject matter outside (6) … . For example, problem-based learning is now widely used in the health sciences, whereby students must figure out the key issues related to a case and direct their own learning to solve that problem. Problem based learning has clear parallels with real life practice for health professionals. Critical thinking goes beyond what might be on the final exam and life-long learning becomes the key. This is a good thing, as practice helps to improve our ability to think critically over time.

Just for scientists?
For those engaging with science, learning the skills needed to be a critical consumer of information is invaluable. But should these skills (7) …? Clearly not: for those engaging with life, being a critical consumer of information is also invaluable, allowing informed judgement.
Being able to actively consider and evaluate information, identify biases, (8) …, and tolerate ambiguity until the evidence is in would allow many people from all backgrounds to make better decisions. While these decisions can be trivial (does that miracle anti-wrinkle cream really do what it claims?), in many cases, reasoning and decision-making can have a substantial impact.
Pushing critical thinking from the realms of science and maths into the broader curriculum may lead to far-reaching outcomes. With increasing access to information on the internet, giving individuals the skills to critically think about that information may have widespread benefit, both personally and socially. The value of science education might not always be in the facts, (9) … .
(http://theconversation.com/thinking-critically-on-critical-thinking-why-scientists-skills-need-to-spread-15005)