國立臺灣師範大學114學年度碩士班招生考試試題

科目：**科學學習心理學基礎(Psychological Foundation of Science Learning)**　　適用系所：**科學教育研究所**

注意：1.本試題共3頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

一、何謂類比推理？應用於教學時需注意哪些事項？（8分）
What is analogical reasoning? What are the concerns when using analogical reasoning during instruction? (8 points)

二、請解釋以下名詞（12分）Please explain the following terms (12 points)
(一) 鷹架（scaffolding）
(二) 工作記憶（working memory）
(三) 長期記憶（long-term memory）
(四) 論證（argumentation）

三、哪些認知負荷（內在、外在、增生）可因教學方式而改變？請針對每一種認知負荷解釋原因並提出可促進改變的教學設計。（18分）
Which types of cognitive load (intrinsic, extrinsic, germane) vary with instructional methods? Please explain the reasons why (or why not) and describe instructional methods that can change each of the cognitive loads. (18 points)

四、請舉一實例說明在進行科學探究時，如何運用「計畫、監控、評估」等三項後設認知技能？(12分)
Please give an example about how to implement the three metacognitive skills, "planning, monitoring, and evaluation" during scientific inquiry? (12 points)

五、在科學教學與學習的過程中，學生的「另有概念」(alternative conception)經常造成教學與學習的困難。請針對以下問題分別說明：
Students' "alternative conceptions" often cause science teaching and learning difficulties. Please explain the following sub-items:

(一)請說明什麼是「另有概念」？(5分)
Please explain what "alternative conception" is. (5 points)

(二)請列舉三個並說明造成「另有概念」的可能原因。(10分)
Please list and explain Three possible reasons that could cause "alternative conception". (10 points)

(三)依照你的學科背景，以**兩個**科學概念舉例說明學生在學習該科學概念時，可能持有的另有概念。(10 分)
According to your disciplinary background, list and explain students' alternative conceptions for TWO scientific concepts. (10 points)

(四)**承上題**，針對上題列舉的另有概念，說明你會採取哪些教學策略幫助學生概念改變？(10 分)
Following the sub-item (三), explain what teaching strategies you may use to promote conceptual change regarding the alternative conceptions you responded to the previous question. (10 points)

六、請閱讀以下短文並回答問題：
Please read the following short essay and answer the question.
學生在學習新的科學概念時並非會全然接受。根據 Posner et al. (1982)，唯有在下列情況發生時，學生比較容易產生概念改變：
When learning new scientific concepts, students will not accept all of them. Based on Posner et al. (1982), conceptual changes are more likely to occur only when the following conditions are met:
1.***There must be dissatisfaction with existing conceptions.*** Scientists and students are unlikely to make major changes in their concepts until they believe that less radical changes will not work. Thus, before an accommodation will occur, it is reasonable to suppose that an individual must have collected a store of unsolved puzzles or anomalies and lost faith in the capacity of his current concepts to solve these problems.
2.***A new conception must be intelligible.*** The individual must be able to grasp how experience can be structured by a new concept sufficiently to explore the possibilities inherent in it. Writers often stress the importance of analogies and metaphors in lending initial meaning and intelligibility to new concepts.
3.***A new conception must appear initially plausible.*** Any new concept adopted must at least appear to have the capacity to solve the problems generated by its predecessors. Otherwise it will not appear a plausible choice. Plausibility is also a result of consistency of the concepts with other knowledge. A new idea in, say, astronomy is less likely to be accepted if it is inconsistent with current physical knowledge or if it simply has no clear physical account. Physical scientists prior to the 20th century, for example, were reluctant to accept what geologists were claiming

about the age of the world since they had no theory which would allow the sum to provide energy for that period of time.

4. ***A new concept should suggest the possibility of a fruitful research program.*** It should have the potential to be extended, to open up new areas of inquiry.

根據你對以上短文的理解(非重述或直接翻譯)，列出要讓概念改變發生時需要滿足的四種情況並解釋原因。(15 分)

Based on your understanding of the short essay (do not copy or simply translate), list the four conditions that must be met for conceptual change to occur and explain the reasons. (15 points)