

國立臺灣師範大學 109 學年度碩士班招生考試試題

科目：科學學習心理學基礎

適用系所：科學教育研究所

注意：1.本試題共 2 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、請從科學教育的觀點針對以下四點分別加以闡述：(共 30 分)

(一) 迷思概念的定義 (2 分)

(二) 迷思概念的特性 (5 分)

(三) 造成迷思概念的可能來源 (8 分)

(四) 迷思概念可以用哪些教學策略來克服(請舉三例說明)? 所選擇教學法的理由為何?(15 分)

二、學生在科學學習時所持有的迷思概念和科學史的發展有何異同?(10 分)

三、科學學習科學時，迷思概念與心智模式(mental models)有何異同?在學習進展(learning progression)過程中各自可能扮演的角色為何?(10 分)

四、名詞解釋：(共 20 分)

(一)知識表徵 (Knowledge representations) (5 分)

(二)認知結構 (Cognitive structure) (5 分)

(三)知識建構 (Knowledge construction) (5 分)

(四)Power Law of Learning (5 分)

五、認知與教學研究指出，學生學習科學概念過程中，其先備知識佔有影響學習的重要角色。(共 10 分)

(一)請論述學習者之先備知識如何影響科學概念學習 (5 分)。

(二)教師如何考量先備知識的作用，設計利於概念改變的教學策略?也就是說，什麼樣的教學策略有利於概念改變? (5 分)。

六、請閱讀以下短文並回答問題：(共 20 分)

When we approach a problem, our natural default is to tap the least tiring cognitive process. Typically this is what psychologists call type 1 thinking, famously described by Nobel Prize-winning psychologist Daniel Kahneman as automatic, intuitive processes. This is in contrast to type 2 thinking, which is slower and involves processing more cues in the environment. Defaulting to type 1 makes evolutionary sense: if we can solve a problem more simply, we can bank extra mental capacity for completing other tasks. A problem arises, however, when the simple cues available are either insufficient or vastly inferior to the more complex cues at hand. Exactly

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this kind of conflict can occur when someone chooses to believe a personal opinion over scientific evidence or statistics. When we evaluate a personal opinion, we automatically engage the evolutionarily old regions of the brain, which encourage social interaction and peer bonding. But understanding scientific evidence, a more recent achievement, involves more complex, logical and difficult type 2 processing.

From this dual-processing perspective, we can see several ways in which personal opinion might trump scientific thinking. First, some people may not have learned the rules of scientific thinking. In such cases, type 1 processing will be their default setting. And even if we can evaluate concrete evidence, our tendency to revert to type 1 processing may still lead us astray, ignoring logical reasoning in the face of an emotionally persuasive personal opinion. In other words, even when scientific thinking is compelling, our propensity to be a cognitive miser and conserve mental energy often prevents us from engaging type 2 processes.

The good news is that it is possible to override our tendency toward type 1 processing. To do so, we must practice scientific and statistical thinking to the point of automaticity, eventually making it our go-to option. (Abstracted from Scientific American, 2015)

根據上頁短文所敘述，

(一)請個別解釋 Type 1 與 type 2 思考的形式？(6 分)

(二)根據短文的說法，請詮釋為何遇到複雜問題時，人類很難執行「科學思考」？(9 分)

(三)短文最後一段提到要贏過或制服 type 1 thinking 的方法是什麼？你認為為何需要這樣做？(5 分)