國立彰化師範大學 101 學年度碩士班招生考試試題

系所：生物學系　　組別：丙組　　科目：生物教育

☆☆請在答案卷上作答☆☆　　

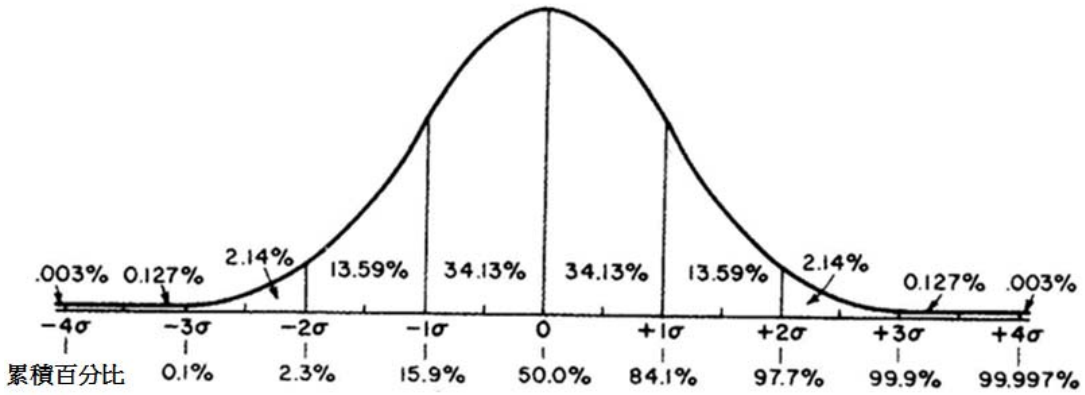
一、名詞解釋 (39%)

1. American Psychological Association citation style (APA)
2. analysis of variance, ANOVA
3. Bloom's taxonomy of learning domains
4. Cronbach's α coefficient (coefficient alpha)
5. formative evaluation
6. Science/Technology/Society Teaching Approach
7. Likert scale
8. Concept map
9. Serious Games
10. Situated learning
11. Quasi-experimental design
12. 5E learning cycle
13. Triangulation

二、請說明標準差 (standard deviation, SD) 與標準誤 (standard error, SE) 之差別。(4%)

三、魏氏智力測驗的平均數為 100，標準差為 15，假設智力分數為常態分配，請問：

1. 智力測驗分數為 85 者，其 Z 分數 (Z-score) 為多少？(2%)
2. 約有多少百分比的人之智力測驗分數落於 85 和 115 之間？(2%)



圖一、常態曲線下面積百分比及累積百分比圖

四、請簡述 Kuhn 的派典 (paradigm) 、Popper 的否證論 (falsificationism)，以及 Lakatos 科學研究綱領 (scientific research programmes)，以及如何以這些觀點來說明科學理論的形成與變遷 (theories of scientific growth) 呢？(12%)

五、請寫出常見的信度 (reliability) 估計方法及其誤差來源？(12%)

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六、請閱讀下列研究文獻的摘要後回答文下的問題：(19%)

Dynamic visualizations have the potential to make abstract scientific phenomena more accessible and visible to students, but they can also be confusing and difficult to comprehend. This research investigates how dynamic visualizations, compared to static illustrations, can support middle school students in developing an integrated understanding of energy in photosynthesis. Two hundred 7th-grade students were randomly assigned to either a dynamic or a static condition and completed a web-based inquiry unit that encourages students to make connections among energy concepts in photosynthesis. While working on the inquiry unit, students in the dynamic condition interacted with a dynamic visualization of energy transformation, whereas students in the static condition interacted with a series of static illustrations of the same concept. The results showed that students in both conditions added new, scientific ideas about energy transformation and developed a more coherent understanding of energy in photosynthesis. However, when comparing the two conditions, we found a significant advantage of dynamic visualization over static illustrations. Students in the dynamic condition were significantly more successful in articulating the process of energy transformation in the context of chemical reactions during photosynthesis. Students in the dynamic condition also demonstrated a more integrated understanding of energy in photosynthesis by linking their ideas about energy transformation to other energy ideas and observable phenomena of photosynthesis than those students in the static condition. This study, consistent with other research, shows that dynamic visualizations can more effectively improve students' understanding of abstract concepts of molecular processes than static illustrations. The results of this study also suggest that with appropriate instructional support, such as making predictions and distinguishing among ideas, both dynamic visualizations and static illustrations can benefit students. This study underscores the importance of curriculum design in ensuring that dynamic visualizations add value to science instructional materials.

--文章摘要擷取自 Ryoo, K. & Linn, M. C. (2012). Can dynamic visualizations improve middle school students' understanding of energy in photosynthesis? *Journal of Research in Science Teaching, 49*(2), 218-243.

(1) 本文研究目的為何？(2%)

(2) 本文的研究設計為何？(5%)

(3) 本文的研究對象為何？(2%)

(4) 本文的重要發現為何？(10%)

七、承上題，若請您設計一份 photosynthesis 的多媒體教材，請問您會如何設計？試以認知負荷的理論觀點來探討您的教材呈現方式。(10%)