國立屏東教育大學102學年度研究所碩士班入學考試

文獻閱讀（科學教育類） 試題

（數理教育研究所碩士班　科學教育組）

※請注意：1.本試題共四頁。
2.答案題號須標示清楚，並寫在答案卷上，否則不予計分。
3.本科考試提供電子字典查閱英文詞彙。

申論題（共100分）

一、以下這一篇隕石撞地球文章大意為何？如何融入自然與生活科技課程？(50%)

2013-02-17 01:35 中國時報 【楊永年】

根據媒體報導，日昨俄國境內遭逾十噸隕石襲擊，威力相當於二十枚原子彈。所幸大部分能量遭大氣層吸收，不過仍造成一千多人受傷。由於這樣的案例過去從未發生，而且目前又沒有具體的證據或線索，因此引發諸多聯想與揣測。這些揣測（或謠言）包括末日來臨、美中暗中發動攻擊，或真的是外太空隕石作祟。無論是什麼原因，若真要下定論總必須有「科學證據」，才能證明隕石或恐怖攻擊的來源或原因為何。問題又在於，以目前俄國或世界的科學能力，能否讓這次的意外水落石出，很多人沒有把握。主要原因有三：

一、科學並非萬能：這裡所指的科學，是指傳統的自然科學（含天文學與目前相當發達的太空、電子、工程科技）。不過，若此次意外災害真係外太空隕石造成，在天文史上造成這麼大的傷害，似乎還是頭一次。或者，天文學的範圍可能真的太廣，人類（或天文學者）對天文的瞭解可能還是有限。而科學非萬能的現象不只存在於天文學，例如地震也很難或無法預測；以及堪稱安全係數相當高的核能電廠，也發生了車諾比、三哩島與福島核災。科學固然並非萬能，但沒有科學也可能萬萬不能，這可以從美國或西方國家先進的科技發達，引領世界發展得到印證；或者，這次事件我們仍得依靠科學給我們答案。而這又和下個因素有關。

二、人類的信仰：不論是自然科學、社會科學、人文學或神學，都和人類的信仰或認同的價值有關。例如，即便在西方世界，最早的天文學有時和星象學或神學有某種程度的聯想，所以有星座與命運（與個性）的說法。這樣的說法把我們帶到心理學（社會科學）或神學的層次。在過去，即便哥白尼最早提出「地球是圓的」說法，卻仍遭宗教極力否認並視地圓說為禁忌。也就是說，科學再發達，仍舊是人類的信仰主宰著世界的發展。以這次事件為例，俄國政府（與民眾）究竟信仰（或相信）的是隕石意外或「恐怖攻擊」，將影響俄國的未來（命運）。依目前媒體報導分析，俄國政府可能比較相信為隕石事件。而這又和下個因素有關。

三、國際關係：近幾年來，因為蘇聯解體，從具社會主義色彩的共產國家，走向自由或民主色彩濃厚的資本主義國家，然因為制度遽變，讓俄國國力元氣大傷，也影響了俄國的國際關係。或許這起事件可吸引全世界天文或太空研究專家的興趣、投入瞭解真相。如果各國頂尖科學家能針對這起個案，通力合作，或許可在短時間瞭解「隕石」撞地球的始末。不過，是否世界各國頂尖科學家有合作的誘因，背後還牽涉複雜的國際關係，包括各國對未來的預期是戰爭還是和平？若各種危險因子（包括朝核）帶來的下一步是戰爭，隕石事件是怎麼一回事，也就變得不重要了。

二、請閱讀表1關於我國中小學科學課程發展的不同階段特色及影響科學教育改革的大環境之大略檢視後，說明我國中小學科學課程改革在課程目標、課程理念、課程發展、課程內容與結構、教學活動及策略面向有何**趨勢**？(25%)

表 1 我國中小學科學課程改革的趨勢

年代階段	課程改革重點	備註
1.終戰～1968	• 教育目標在培養健全國民及升學準備和職業訓練。 • 課程設計強調學科概念知識結構的嚴謹性。 • 學生的學習以概念知識為核心。	• 注重民族精神教育。 • 科學教育是為政治和特定意識型態服務。
2.1968～1974	• 教育目標在培養健全的國民及升學準備和職業訓練。 • 課程設計與教學注重學習的心理學基礎。 • 課程內容強調科學過程和探討能力的培養。	• 注重民族精神教育。 • 此一時期的科學課程發展深受1960s先進各國”Alphabet soup”科學課程的影響。 • 科學教育是為政治和特定意識型態服務。
3.1974～1990	• 國中改為國民教育，科學教育目標在培養基本科學素養。 • 科學課程隨部頒課程標準之修訂進行週期性的漸進改革。 • 以系統化的團隊實驗研究模式發展課程。 • 課程設計重視科學概念知識結構的完整性和嚴謹性。 • 課程內容與教學逐漸注入統整科學的理念。	• 在國科會科學教育發展處的介入之下，學習評量的理念和實務產生顯著的革新。 • 科學教育為政治和特定意識型態服務的情形逐漸淡化。
4.1990～2000	• 科學課程之設計以培養基本科學素養為目標。 • 知識結構的學習與科學過程的培養並重，並注重「能力」的培養。 • 統整科學的理念逐漸受到重視，並逐漸融入學校的科學課程與教學活動設計之中。 • 課程與教學趨向比較生活化、本土化、 STS取向。	• 由於教育改革運動的風起雲湧，社會各界及教育界呼籲課程改革的呼聲甚響。 • 科學教育不再為政治和特定意識型態服務。（地方與中央政府執政輪替的好處之一。）
5.2000以後	• 科學教育目標在培養全民的基本科技素養。 • 科學課程設計以培養基本「能力」為目標，重視學習領域的統整。 • 課程設計注重科學的本質及科學美學和科技倫理。 • 課程內容設計強調本土化、鄉土性，重視「學校本位課程」，強調多元和彈性。 • 教室內組合課程、模組課程（ modular curriculum）、以 STS理念為核心的課程等逐漸受到重視。	• 課程與教學內涵之主導權回歸到學校及教師。 • 教育民主化運動興起，社會運動團體、專業團體（如教師會、各類學會、協會、各種權益促進會等）對教育決策的介入既深且廣，深深影響了國家的課程設計決策。

註：摘自鄭湧涇(2005)。我國科學教育改革的回顧與展望。科學教育月刊，284，2-22。

三、請閱讀下文，說明文章中所指之科學探究的意涵為何？老師教學時可以如何做？這樣的教學可以協助學生瞭解什麼？(25%).

NSTA Position Statement: Scientific Inquiry

Introduction

The *National Science Education Standards* (*NSES* p. 23) defines scientific inquiry as "the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Scientific inquiry also refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world." The Science as Inquiry Standard in *NSES* includes the abilities necessary to do scientific inquiry and understanding about scientific inquiry.

Scientific inquiry reflects how scientists come to understand the natural world, and it is at the heart of how students learn. From a very early age, children interact with their environment, ask questions, and seek ways to answer those questions. Understanding science content is significantly enhanced when ideas are anchored to inquiry experiences.

Scientific inquiry is a powerful way of understanding science content. Students learn how to ask questions and use evidence to answer them. In the process of learning the strategies of scientific inquiry, students learn to conduct an investigation and collect evidence from a variety of sources, develop an explanation from the data, and communicate and defend their conclusions.

The National Science Teachers Association (NSTA) recommends that all K–16 teachers embrace scientific inquiry and is committed to helping educators make it the centerpiece of the science classroom. The use of scientific inquiry will help ensure that students develop a deep understanding of science and scientific inquiry.

Declarations

Regarding the use of scientific inquiry as a teaching approach, NSTA recommends that science teachers

- Plan an inquiry-based science program for their students by developing both short- and long-term goals that incorporate appropriate content knowledge.
- Implement approaches to teaching science that cause students to question and explore and to use those experiences to raise and answer questions about the natural world. The learning cycle approach is one of many effective strategies for bringing explorations and questioning into the classroom.
- Guide and facilitate learning using inquiry by selecting teaching strategies that nurture and assess student's developing understandings and abilities.
- Design and manage learning environments that provide students with the time, space, and resources needed for learning science through inquiry.
- Receive adequate administrative support for the pursuit of science as inquiry in the classroom. Support can take the form of professional development on how to teach scientific inquiry, content, and the nature of science; the allocation of time to do scientific inquiry effectively; and the availability of necessary materials and equipment.
- Experience science as inquiry as a part of their teacher preparation program. Preparation should include learning how to develop questioning strategies, writing lesson plans that promote abilities and understanding of scientific inquiry, and analyzing instructional materials to determine whether they promote scientific inquiry.

Regarding students’ abilities to do scientific inquiry, NSTA recommends that teachers help students

- Learn how to identify and ask appropriate questions that can be answered through scientific investigations.
- Design and conduct investigations to collect the evidence needed to answer a variety of questions.
- Use appropriate equipment and tools to interpret and analyze data.
- Learn how to draw conclusions and think critically and logically to create explanations based on their evidence.
- Communicate and defend their results to their peers and others.

Regarding students' understanding about scientific inquiry, NSTA recommends that teachers help students understand

- That science involves asking questions about the world and then developing scientific investigations to answer their questions.
- That there is no fixed sequence of steps that all scientific investigations follow. Different kinds of questions suggest different kinds of scientific investigations.
- That scientific inquiry is central to the learning of science and reflects how science is done.
- The importance of gathering empirical data using appropriate tools and instruments.
- That the evidence they collect can change their perceptions about the world and increase their scientific knowledge.
- The importance of being skeptical when they assess their own work and the work of others.
- That the scientific community, in the end, seeks explanations that are empirically based and logically consistent.

—Adopted by the NSTA Board of Directors
October 2004

References

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