

國立屏東教育大學 101 學年度研究所碩士班入學考試

文獻閱讀（科學教育類） 試題

（數理教育研究所科學教育碩士班）

※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。

一、請閱讀以下英文摘要，說明此研究的內容與結論為何？這一篇文章對科學教育的研究與實務之啟示分別為何？。（50 分）

Ideas about earthquakes after experiencing a natural disaster in Taiwan: An analysis of students' worldviews

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On September 21st, 1999, the central part of Taiwan suffered an earthquake which was 7.3 on the Richter scale. This disaster provided a unique and rare opportunity to study students' worldviews. Science educators have proposed that students' worldviews influence their ways of interpreting natural phenomena and then impose an effect on conceptual development in science. The objective of this study was to explore students' worldviews as revealed by their ideas about the causality of earthquakes after experiencing the natural disaster. In Taiwan's socio-cultural milieu, there are some indigenous worldviews about earthquakes including the perspectives of supernatural forces and myths. Through tracking the ideas of 60 fifth graders and sixth graders for eight months, this study showed that students tended to employ the following three major approaches to resolve the incongruence between indigenous worldviews and scientific worldviews. First, they may try to accept the scientific ideas and to abandon their original worldviews. Second, they may try to grasp the scientific views and at the same time try to keep the indigenous worldviews unchanged. Many students held a scientific/myths dual perspective about the causes of earthquakes. Finally, they may retain their original worldview and try to ignore the scientific worldview. This paper finally suggests that science educators need to integrate socio-cultural aspects of science and of learning science into science education research and practice.

文獻來源：INT. J. SCI. EDUC., 2001, VOL. 23, NO. 10, 1007- 1016

二、 文獻閱讀一(共 20 分)

1. 文獻閱讀一的教師的教學特色為何?(10 分)
2. 本文對於台灣自然科教學的啟示為何?(10 分)

文獻閱讀一

TEACHING EVOLUTION THROUGH INQUIRY

The following dialogue demonstrates a way of teaching about evolution using inquiry-based learning. High school students are often interested in fossils and in what fossils indicate about organisms and their habitats. In the investigation described here, the students conduct an inquiry to answer an apparently simple question: What influence has evolution had on two slightly different species of fossils? The investigation begins with a straightforward task—describing the characteristics of two species of brachiopods

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“Students, I want you to look at some fossils,” says Karen. She gives the students a set of calipers and two plastic sheets that each contain about 100 replicas of carefully selected fossil brachiopods.¹ “These two sheets contain fossils from two different species of a marine animal called a brachiopod. Let’s begin with some observations of what they look like.”

“They look like butterflies,” replies one student.

“They are kind of triangular with a big middle section and ribs,” says another student.

“Can you tell if there are any differences between the fossils in the two trays?”

The students quickly conclude that the fossils have different sizes but that they cannot really tell any other difference.

“In that case, how could you tell if the fossil populations are different?” Karen asks.

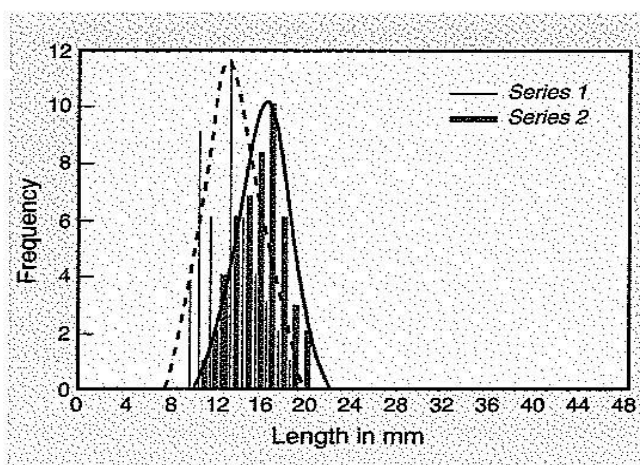
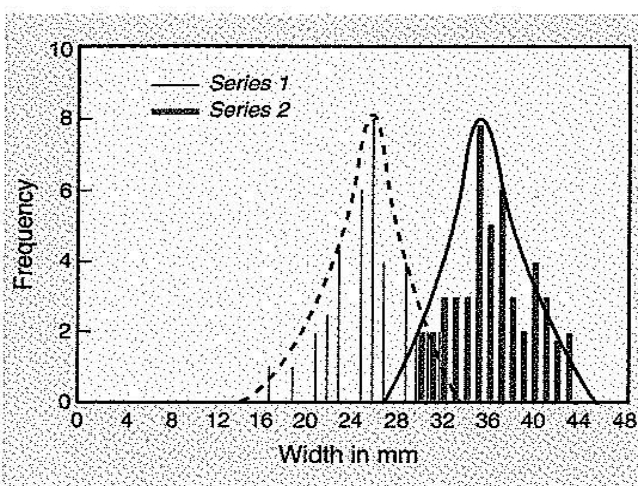
“We can count the ribs.”

“We can measure them.”

“Those are both good answers. Here’s what I want you to do. Break into groups

of four and decide among yourselves which of those two characteristics of the fossils you want to measure. Then graph your measurements for each of the two different populations.”

For the rest of the class period, the students investigate the fossils. They soon realize that the number of ribs is related to the size of the fossils, so the groups focus on measuring the lengths and widths of the fossils. They enter the data on the two different populations into a computer data



Graphs showing characteristics of brachiopod populations

base. Two of the graphs that they generate are shown on the facing page.

"Now that we have these graphs of the fossils' lengths and widths," Karen says at the beginning of the next class period, "we can begin to talk about what these measurements mean. We see from one set of graphs that the fossils in the second group tend to be both wider and longer than those in the other group. What could that mean?"

"Maybe one group is older," volunteers one of the students.

"Maybe they're different kinds of fossils," says another.

"Let's think about that," says Karen. "How could their lengths and widths have made a difference to these organisms?"

"It could have something to do with the way they moved around."

"Or how they ate."

"That's good," says Karen. "Now, if you had dug up these fossils, you would have some additional information to work with, so let me give you some of that background. As I mentioned last week, these fossils are from marine animals known as brachiopods. When they die their shells are often buried in sediments and fossilized. What I know about the fossils you have is that they were taken from sediments that are about 400 million years old. But the two sets of fossils were separated in time by about 10 million years."

"Taking that information, I'd like you to do some research on brachiopods and develop some hypotheses about whether or not evolution has influenced their size. Here are some of the questions you can consider as you're writing up your arguments."

Karen hands out a sheet of paper containing the following questions:

- What differences in structure and function might be represented in the length and width of the brachiopods? Could efficiency in burrowing or protection against predators have influenced their shapes?
- Why might natural selection influence the lengths and widths of brachiopods?
- What could account for changes in their dimensions?

The following week, Karen holds small conferences at which the students' papers are presented and discussed. She focuses students on their ability to ask skeptical questions, evaluate the use of evidence, assess the understanding of geological and biological concepts, and review aspects of scientific inquiries. During the discussions, students are directed to address the following questions: What evidence would you look for that might indicate these brachiopods were the same or different species? How could changes in their shapes have affected their ability to reproduce successfully? What would be the likely effects of other changes in the environment on the species?

NOTE

1. The materials needed to carry out this investigation are available from Carolina Biological Supply Company, 2700 York Rd., Burlington, NC 27215. Phone: 1-800-334-5551. www.carolina.com

National Academy of Sciences (1998). *Teaching About Evolution and the Nature of Science*. Publisher: National Academies Press.

三、 文獻閱讀二(共 30 分)

1. 文獻閱讀二提到閱讀能力應包含哪幾個層面？(10 分)
2. 科學閱讀理解可以有哪些面向？(10 分)
3. 教師可以使用哪些問句，來提醒學生摘要出重點？(10 分)

文獻閱讀二

科學童話最能吸引學生閱讀。什麼是童話？童話的定義是「童話是專為兒童編寫的，以趣味為主的幻想故事」(李麗霞，1993)。所以童話一定是兒童的、故事的、幻想的、趣味的。科學童話內容難為虛構、想像的，但需有正確的內容，並且對讀者需有啟發性和引導性，兒童對此類讀物有極高的興趣閱讀。目前，國小自然與生活科技教科書內容的閱讀教材仍嫌不足，因此，教師應多提供機會，讓學生接觸科學讀物，並在閱讀後加以討論、寫心得、發表。

科學閱讀的教學目標是培養學生的閱讀能力。什麼是閱讀能力呢？若由聯合國經濟合作與發展(OCED)機構所做的國際學生評量計畫(Program for International Student Assessment, PISA)所訂的項目來看，閱讀能力應包含三個構面：

1. 擷取資料：能否從閱讀的文字資料中，擷取所需的資料，可能由分析或推論中找答案。
2. 解讀資料：閱讀後，能否正確解讀資訊的意義，建構文章的意義。
3. 思考與評價：能將所讀的內容與自己原有的知識、想法和經驗作聯結，綜合判斷後提出自己的觀點。學生要將文章與自己的經驗、知識與觀念聯結起來；也能評價文章的特徵，這些要用自己的口語表現出來。

科學閱讀理解，還可以從不同面向來看，包括：

1. 詞彙、專有名詞(vocabulary)：科學閱讀素材中有極多的專有名詞，讀者要能從字面，知道其內涵是什麼。如「通路」的內涵是由電源、導體、燈泡或其他用電作功的物件所形成，而不是只有讀到「通路」兩字。
2. 理解(comprehension)：用圖、表與數字幫助文字理解的能力，也能區隔事實真相與個人意見差異的地方，閱讀後，能摘要、因果推論、比較異同等。
3. 探討的能力(study skill)：能把全文內容用類似概念技巧繪圖、能應用所讀的內容推類到其他的情境中；若為實證過程的描述，則可以嘗試複製實驗過程。

教師指導兒童閱讀時，有些原則必須注意：要向學生指出閱讀目的、重點所在。如要學生找出結論、找答案、找其他的資料或其他的理由等，並要學生筆記他所唸的部分。再如，要由多方面的書面資料去閱讀，這點可以要求同一學生擁有（或去查閱）多種資料，或由每一人查閱同一主題不同的資料，大家分享閱讀結果，分享不同觀點的書面資料。當然，閱讀書面資料不限於文字敘述的部分，應包含圖片、表格、海報、期刊、報紙、雜誌，甚至於網路上的資料或其他數位資料。

兒童在閱讀讀物之後，要能作分析、比較、綜合、具體法、抽象法。教師可以用問句，提醒學生摘要出重點。

王美芬、熊召弟（2005）。國小階段自然與生活科技教材教法。台北：心理出版。