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前科學啟蒙期兒童素樸實驗觀的萌芽—— 關於獨立變項與依變項的思考雛形之觀察

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摘 要

根據Piaget的理論，能設計實驗以釐清因果關係的思考能力，可以不待教導而自然發展出來。此一觀點蘊含，某些關於實驗的思考雛形，應該在發展的較早階段已然出現。基於此一看法，本研究探討前科學啟蒙期（國小低年級）的學童，是否擁有關於獨立變項與依變項的科學思考雛形。實驗一操弄假想情境中可能的依變項是否會因獨立變項而變異，並要國小二年級的參與者根據假想情境做因果判斷。實驗結果顯示，國小二年級的許多參與者已能傾向於去觀察有變異的依變項，藉以進行因果推論。實驗二同樣要參與者就假想情境做因果推論。實驗操弄可能的「因」是否為變項，結果顯示，參與者未能了解「獨立變項在觀察上必須是個變項」，才能顯示它與依變項的因果關係。實驗三進一步釐清實驗二數據所透露的疑點，並藉此改變實驗中因果判斷問題的問題型態，結果顯示，有相當多的國小二年級參與者，已有適當的「獨立變項」觀念。這些研究結果顯示，就關於獨立變項與依變項的思考而言，前科學啟蒙期的學童已有適當的思考雛形，然而，至少對於獨立變項的思考而言，這種思考雛形很容易受其他因素的干擾。

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The Emergence of Primitive Experimental Thinking: Children's Ability to Understand the Nature of Independent and Dependent Variables

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Abstract

According to Piaget, maturity itself allows children to develop the capacity to design experiments to clarify the cause and effect around age 11. If this is the case, the emergence of experimental thinking should appear in early age of school children. The purpose of this research is to explore children's ability to understand the nature of independent and dependent variable on the eve of formal scientific education. In Experiment 1, contingent relationship between independent variable and dependent variable was manipulated. Children were asked individually to infer the cause of an effect. Results indicated that most children have the ability to differentiate variable from non-variable as the cause. Experiment 2 aimed at investigating children's understanding of the nature of a particular independent variable. Results indicated that young children seemed not to understand that the cause of an observed dependent variable must be a

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variable. Nevertheless, when researchers changed the instruction of Experiment 2 to spell out the influence of experimenter suggestibility in Experiment 3, young children demonstrated proper understanding of independent variable. All three experiments were oriented in the same direction that children's ability to understand the nature of independent and dependent variable emerge as young as second-grade, however, this ability is vulnerable to other factors.

Keywords: primitive experimental thinking, independent variable, dependent variable, scientific thinking, scientific education

