空間能力與空間認知對三維空間搜尋系統的影響

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中文摘要

本研究透過文獻探討與三維空間搜尋影響因素的分析，探討面對新科技的Google earth三維空間搜尋系統，國中學童的空間能力與空間認知在搜尋時會有那些影響。空間認知分析可提供研究者瞭解人類的對空間資訊處理行為能力。而認知圖即是瞭解人類空間認知能力的有力工具，因為認知圖是人類腦中的空間環境模型，透過認知圖可以推測人類腦中的空間認知環境。

本研究嘗試從分析國中學童空間認知與空間能力，並討論是否影響學童操作三維空間搜尋系統進行搜尋任務時結果。實驗使用的操作軟體是由Google公司所發佈的免費軟體Google earth系統，此系統可以真實呈現各地的空照圖，以三維空間向度的方式呈現，並且在建築物與地形部分有3D模擬功能，藉由操作此系統完成搜尋任務。

研究的對象為台中縣某國中一年級學童，為獲得學童空間能力與空間認知資料，於第一階段先採用測驗方式。空間能力測驗採用多因素性向測驗中的空間關係與抽象推理測驗；空間認知採用繪製認知地圖（Cognitive Maps）方式。然後，進行第二階段的教學實驗。教學實驗步驟，首先由研究者公佈搜尋任務，然後配合搜尋目標學習單，請受測者完成搜尋任務目標，然後將任務目標資料傳送至網路作業區。再由研究者檢視將每一位學生的搜尋任務計算得分轉化數字資料，以利量化分析。

本研究的結果發現空間能力高的學童在三維空間搜尋任務表現比空間能力低的優異，其中空間關係得分高的學生最顯著；而空間認知等級高的學童在三維空間搜尋任務表現也比空間認知等級低的優異。從實驗中也發現學童的空間認知參考架構大都未達到統合參考階段，反而有不少學童仍在自我參考階段，顯示研究對象的地圖能力確有不足。從實驗研究中得知的結果，除了提供開發三維空間搜尋系統的參考，也希冀對於國中學生的

地圖教育研究有所幫助。

關鍵詞：Google earth系統、電子地圖、地圖搜尋、空間認知、空間能力、三維空間搜尋系統。

The Effects of Spatial Ability and Spatial cognition to the 3-Dimentional Search System

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Abstract

Through the literature investigation and the analysis of influence factors of three-dimensional space search, this research investigates how the spatial ability and spatial cognition of junior high school students would affect the performance on three-dimensional space search by using the new technology product, Google earth search system. The analysis of spatial cognition provides the researchers with the understanding of human behavior ability on processing of spatial information.

The cognitive map is used as a powerful tool to understand human spatial cognitive ability because the cognitive map is a spatial environment model in human brain. Through the cognitive map, one can extrapolate the spatial cognitive environment in human brain. This research attempts to analyze if junior high school students' spatial cognition and spatial ability would affect the result of these students' performance on the three-dimensional space search task. The free software, Google earth, provided by Google Corporation is used in this experiment. This system may truly present the three-dimensional satellite image of every place. It also has the tree-dimensional simulation function in the buildings and terrains. Students may complete the search task by operating this system.

The research objects are the ninth grade students of a junior high school in Taichung County. In order to get the information on the students' spatial ability and spatial cognition, some tests were used for the first stage. Spatial ability is determined by using spatial relationship and abstract reasoning tests in multifactor aptitude test. Spatial cognition is examined by drawing cognitive maps. After that, the teaching experiment is the next stage. The first step in this stage is that the search task is announced by the researcher. The research objects were asked to complete the goal search task assisted by the learning sheet.

The goal search of the task was transferred to the internet work area. Then the researcher inspected every student's search result and quantified the data into numerous scales which is ready for the quantification analysis.

This research shows the students who have greater spatial ability did better on the three-dimensional space search task than those who have lower spatial ability. The result is shown most significantly on the students who score high in spatial relationship test. Students of high rank in spatial cognition also have superior performance in three-dimensional space search to those of lower rank in spatial cognition. It is found, through the experiment, that students' reference construction abilities have not yet reached the level of integrating reference. Instead, quite a few students are still in the self-reference stage. This reveals that the map ability of the research objects is insufficient.

The outcome from the research on this experiment not only provides the reference for developing three-dimensional search system, but also hopefully, does help the research of junior high school students' map education.

Keywords: Google earth system, electronic map, map search, spatial cognition, spatial ability, three-dimensional space search system.

誌　謝

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