引導式仿生教學對大學生自然觀察智能與仿生設計能力之影響

周鴻騰 [1*]、王順美 [2]

[1.] 國立臺灣師範大學環境教育研究所博士
[2.] 國立臺灣師範大學環境教育研究所副教授

摘要

本研究於台灣北區某一科技大學環境工程系的課程中導入仿生學，探討接受「引導式仿生教學」的大學生在「自然觀察智能」、「仿生設計能力」之提升成效。本研究採用「不等組前測-後測設計」，結合問卷和實作歷程檔案評量進行研究資料收集。實驗組 1 接受全套仿生教學(N=43)、實驗組 2 接受半套仿生教學組(N=30)、控制組接受原有教科書講述教學(N=35)，三組分別進行前測、後測與延宕測，結果發現：(1)實驗介入後，二組實驗組之自然觀察智能較無法於短時間內顯著提升，長時間戶外觀察、累積飼養經驗或覺察生活細節將有助於提升自然觀察智能。(2)接受全套與半套仿生教學皆比傳統教科書講述教學，能有效提升仿生設計能力，更且，接受全套教學比半套教學在一個月後能維持較佳的延宕效果。(3)從實作歷程中發現一般學生產生的困難點在於對應相似性、分析科學原理與仿生設計等；而個案學生能主動建立學域特定知識與擁有較高的後設認知能力，故能展現較佳的類推聯想能力，進而提升了仿生設計能力。(4)課程結束後，學生表示擁有更多創新解決問題的點子、興趣與好奇心並且願意繼續主動探索。

關鍵字： 引導式仿生教學、自然觀察智能、仿生設計能力

Investigating the Effectiveness of Guided Biomimicry Teaching on Naturalist Intelligence and Biomimicry Design for Environmental Engineering Students

Chow, Hong-Teng[1*], Wang, Shun-Mei[2]

[1.] *PhD, Graduate Institute of Environmental Education, National Taiwan Normal University*

[2.] *Associate Professor, Graduate Institute of Environmental Education, National Taiwan Normal University*

Abstract

This study assessed the effects of guided biomimicry teaching in the program of environmental engineering on improving undergraduate students' ability of naturalist intelligence and biomimicry design. The research design adopted the quasi-experimental and nonequivalent pretest-posttest design, and data collection was completed by using questionnaire and portfolio assessment. Experimental Group 1 received complete biomimicry teaching (N=43). Experimental Group 2 received one-half of this biomimicry teaching (N=30). The control group received didactic instruction without any biomimicry teaching (N=35). The outcomes of the intervention were measured by questionnaires before the course (pre-test), after the course (post-test), and four weeks after the intervention (follow-up test). The main research results are as follows: (1) Post-test and follow-up test results showed that the naturalist intelligence of the two experimental groups did not improve significantly. However, outdoor observation, breeding animals, and carefully observing details of life were helpful in increasing naturalist intelligence. (2) The two experimental groups achieved higher biomimicry design scores than the control group. Furthermore, after four weeks, the biomimicry design scores of Experimental Group 1 were significantly better than those of Experimental Group 2. (3) Portfolio assessment revealed that students had difficulties with comparing and finding similarities, analysis of scientific

principles, and biomimicry design. Analogical thinking skill and biomimicry design ability could be improved with better domain-specific knowledge and meta-cognitive skills. (4) After the course, students have new ideas of environmental problem solving, and also show more interest, curiosity, and active exploration to biomimicry.

Key words: guided biomimicry teaching, naturalist intelligence, biomimicry design