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開發探究為本和發現導向的日常生活化學實驗整合於普通化學實驗課程 (II)

Development of Inquiry-Based / Discovery-Oriented and Daily-Life-Related Chemistry Experiments Integrated into General Chemistry Laboratory

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中文摘要

普通化學實驗使用的藥品和器材絕大多數來自於制式的實驗室，鮮少利用消費者產品，其缺點是探究過程過於理想化而不切實際，常常不能運用到複雜的自然世界，也無法真正的融入生活化學之中，導致學生學習的興趣低落，因而解決化學的能力不足。本研究計畫的目的是開發適用於普通化學實驗課程的兩個主題以探究為本和發現導向的日常生活化學實驗，以提高學生學習化學實驗的興趣。第一個主題為『誰的呼吸效能最好？』包含二個實驗單元；第二個主題為『個人化.藝術化肥皂的製造』包含三個實驗單元。在評估本計畫的實驗設計之可行性方面，有實驗數據者以量的分析為主：(1)以 two sided F test 和 standard deviation 分析研究者和學生的實驗結果之偏差程度，以及他們兩者之間的實驗精確度是否達到顯著水準的差異；(2)以 two tailed t test 比較研究者與學生之間的實驗平均值之間是否達到顯著水準的差異。在探究實驗教材的開發上，以質的分析為主並且採用多元的評量方式。本研究成果將撰寫成為包含學生教材和教師指引的文章投稿於化學教育期刊，此教材可以立即地到國內外的大學普通化學實驗課程使用，以及編入普通學實驗教科書之中。

關鍵字：普通化學實驗; 實驗設計; 消費者化學; 家用產品; 酸鹼滴定; 定量分析; 化學動力學; 發現學習; 科學探究和探究教學

Abstract

Students rarely exercise chemical experiments using household products in general chemistry laboratory. The requirements including pure chemicals and device-specialized equipment for the laboratory are mostly obtained from chemical stock room. The shortcomings for this are too idealized to be realistic with the nature so that students』 exercises are not in connection with chemistry in life. Thus students』 interest becomes lower and the ability of their problem solving is insufficient. The purpose of this proposal is to develop two innovative topics including five chemical experiments focusing on inquiry-based / discovery-oriented and daily-life-related integrated into general chemistry laboratory. The five experiments will provide good opportunity for increasing students』 interest in learning chemical laboratory. The first of the two topics is entitled 「Who』s Respiration Has the Best Efficiency」 and the second one 「Making Soap toward Personal and Artistic Fashion.」 For the evaluation of the feasibility of these experiments for general chemistry laboratory, researchers and undergraduate students』 experimental results will be analyzed by two sided F test and two tailed t test. Besides, students』 students』 inquiry-based learning will be evaluated and their feedback will be qualitatively summarized. The performance of this proposal will be written as research articles including students』 handouts and instructor』s notes for general chemistry laboratory course. Expectantly, the articles can be outreached to domestic and overseas university after they are published in journals of chemical education. Furthermore, the two experiments can be compiled in textbooks of general chemistry laboratory.

Key words：General chemistry laboratory; Experimental design; Consumer chemistry; Household products; Acid-base titration; Quantitative analysis; Chemical kinetics scientific inquiry; Discovery-oriented learning; And inquiry-based approach