



教師教學成果發表會

實驗e起來

化學系教師 李慧玲

化學系助教 陳怡如

1050408



Comparative toxicities of Cd, Cu, and Zn to freshwater planarians with comparisons to other invertebrates

Jui-Pin Wu¹, Mei-Hui Li¹, Hui-Ling Lee²

¹Environmental Toxicology Laboratory, Department of Geography, National Taiwan University, Taipei 106, Taiwan (Email: rb5_wu@yahoo.com.tw)
²Department of Chemistry, Fu Jen Catholic University, Xinzhuang Dist., New Taipei City 24205, Taiwan

SUMMARY
Due to its wide geographical distribution, low cost when being maintained in the laboratory, and responsiveness to xenobiotics, the freshwater planarian is considered a potential animal model for studying metal toxicity. In the present study, we determined the acute toxicities of cadmium, copper, and zinc to Chinese golden and patterned of metal bioaccumulation and metallothionein induction in treated planarians. According to the results, planarians showed different susceptibilities to different metals. To determine the possible causes for inter-metal differences in neurotoxicity, acute toxicities of metals to planarians and neural metal ion characteristics were correlated. We found that the acute toxicities of metals to planarians were related to their different effects. Additionally, after comparing acute toxicities of metals to freshwater invertebrates reported in the literature, an increasingly higher tolerance of planarians to metal exposure was revealed. By further conducting a comparative study, we found that different susceptibilities of freshwater invertebrates with different taxonomic statuses to metals might be related to interspecific differences in their bioaccumulation patterns. Although the mechanistic causes for inter-metal and inter-species differences in the susceptibilities of metals exposure to metals are likely quite complicated, our results provide some critical clues and directions for future work.

I. Background
Freshwater and marine planarians are found in clean aquatic environments, and also serve as valuable invertebrates in assessments of organic toxins. Toxins are observed in these small organisms because of their aquatic environment ability and their high reproductive rate to make studies.
In the laboratory, freshwater planarians can be easily and continuously cultured in high concentrations of water. Under these culture and best practice methods are required to maintain their appearance.
These advantages make freshwater planarians a potential model organism for the environmental toxicological research and bioassays to monitor environmental pollution.

II. Toxicities of different metals to *D. japonica*
Figure 1. Percentages of survival (%) of control (C), cadmium (Cd), copper (Cu), and zinc (Zn) exposed planarians for 96 h. The 50% lethal concentration (LC50) for Cd, Cu, and Zn were 0.01, 0.02, and 0.05 mg/L, respectively.

Table 1. Median lethal concentration (LC50) of Cd, Cu, and Zn to the freshwater planarians after exposure to the treatment water for 96 h.

Metal	LC50 (mg/L)
Cd	0.01
Cu	0.02
Zn	0.05

Table 2. Median lethal concentration (LC50) of Cd, Cu, and Zn to the freshwater planarians after exposure to the treatment water for 96 h.

Metal	LC50 (mg/L)
Cd	0.01
Cu	0.02
Zn	0.05

Conclusion
Based on the results of the present study, we found that the acute toxicities of metals to planarians were related to their different effects. Additionally, after comparing acute toxicities of metals to freshwater invertebrates reported in the literature, an increasingly higher tolerance of planarians to metal exposure was revealed. By further conducting a comparative study, we found that different susceptibilities of freshwater invertebrates with different taxonomic statuses to metals might be related to interspecific differences in their bioaccumulation patterns. Although the mechanistic causes for inter-metal and inter-species differences in the susceptibilities of metals exposure to metals are likely quite complicated, our results provide some critical clues and directions for future work.

輔仁大學 104 學年度第一學期校務會議





大綱

1. 課程方案設計之理念與思維
2. 課程方案設計之輔助工具
3. Edmodo平台之建構
4. 具體教學成果



課程方案設計之理念與思維

設計初衷-學生端

未知儀器操作之恐懼



初次儀器分析之驗證

實驗不熟悉之迷茫



儀器損壞之顧慮

課程內容--化學系特色(親自動手做/一人一組或兩人一組)

編號	實驗內容
	課程簡介
1	利用可見光/紫外線分光光譜儀測定混合物中 非 那 西 汀 和 咖 啡 因 的 含 量 (UV-Vis-MCA)
2	The ionization constant of an indicator (UV-Vis-Indicator)
3	利用高效液相層析儀測量可樂中之咖啡因含量(HPLC)
4	毛細管電泳儀分離測定飲料中之防腐劑(山梨酸鉀)及咖啡因(CE)
5	利用火焰式原子吸收光譜術檢測土壤中的銅 (AA)
6	利用氣相色層析儀分析混合物之組成(GC)
7	利用循環電位儀偵測氧化還原電位及電流(CV)
8	利用示差掃描熱量儀測定聚合物之 T _g (DSC)
9	利用符立葉紅外線光譜儀測定有機化合物之官能基 (FT-IR)
期 末 考	電腦線上 Edmodo 考試
	儀器上機考試





課程方案設計之理念與思維

歷史沿革

● 操作手冊

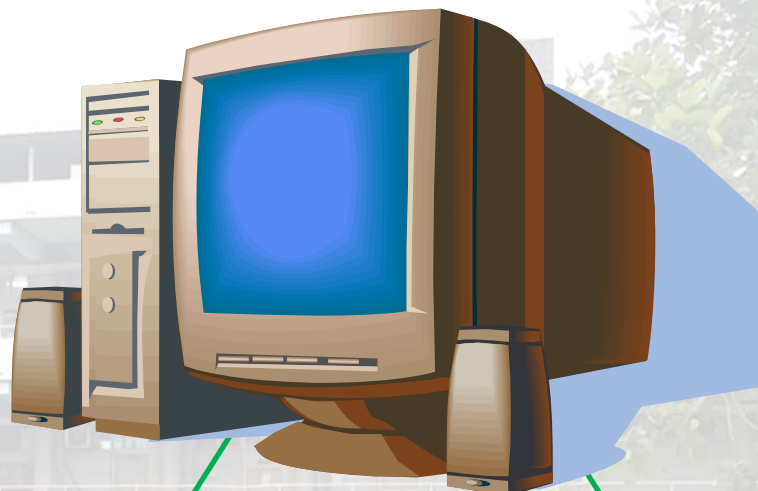
● 操作手冊
原理簡報

● 操作手冊
原理簡報
流程影片
數位學習平台



課程方案設計之理念與思維

設計目標：數位化



線上學習

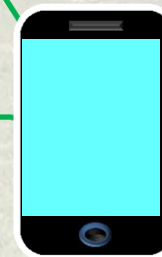
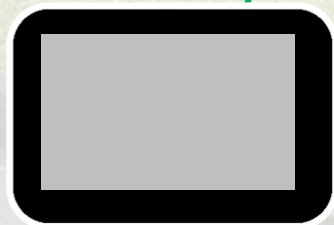
線上互動

實驗流程影片

實驗數據上傳

線上測驗

期末回饋





EverCam

課程方案設計之輔助工具

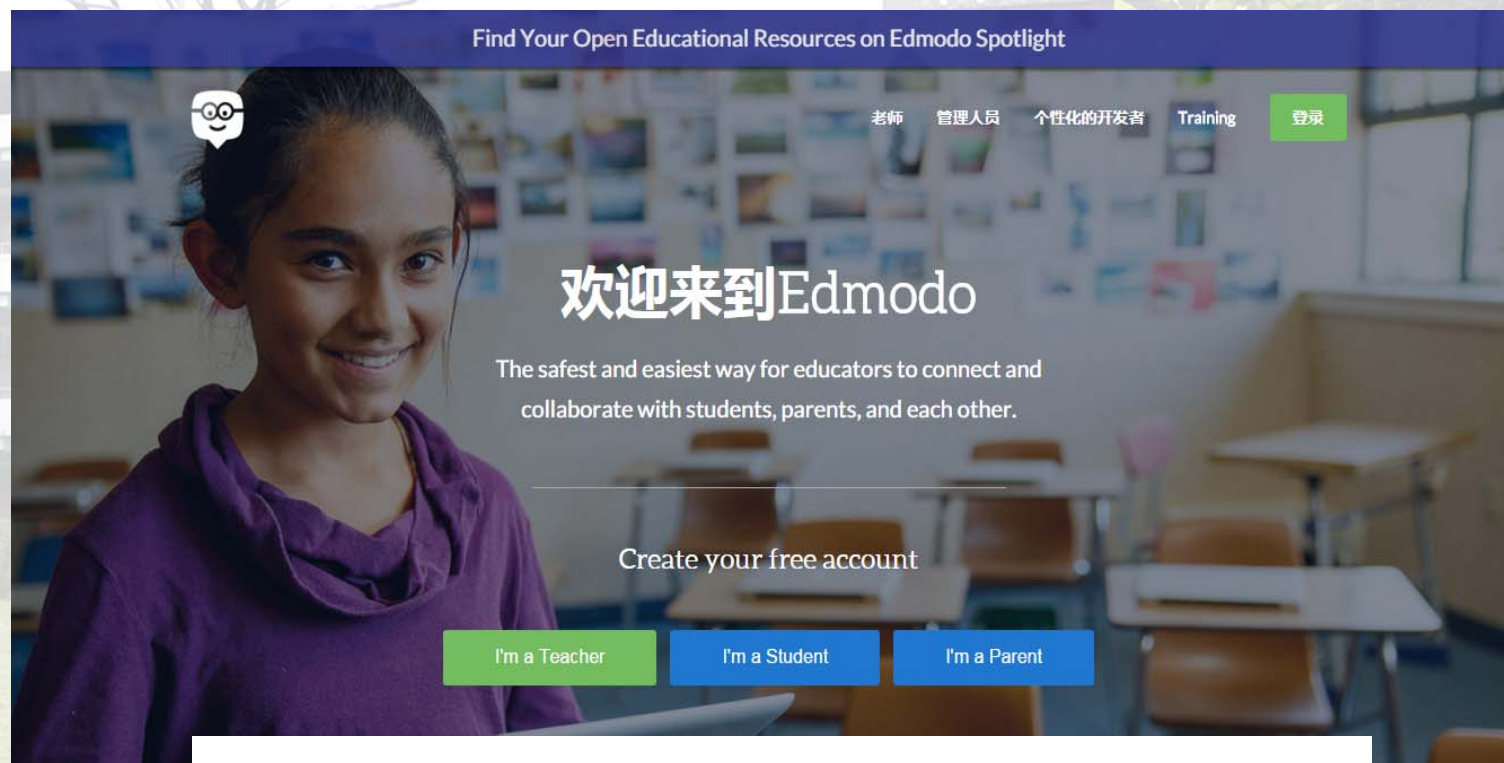


- 錄製儀器軟體影音教材
- 原理簡報錄製影音教材



課程方案設計之輔助工具

Edmodo-數位學習平台



- 建置各式說明與教學文件
- 社群網站
- 線上學習、測驗
- 數據上傳繳交
- 期末回饋



Edmodo平台之建構

依課程分組(學年、學期)

The screenshot displays the Edmodo platform interface. The left sidebar, highlighted with a red box, contains the following elements:

- 小组列表 (Groups List)
- 2016-Spring-A組
- 2016-Spring-B組
- 2015-B組
- 2015-A組
- 2015-Spring-B 組
- 2015-Spring-A 組
- U Lab
- Manage Groups
- 新建小组 (New Group)
- Join a Group

The main content area features a banner for 'edmodocon · 2016' with the text 'Call for speakers is now officially open!' and a button 'I Want to Apply'. Below the banner, there are tabs for '帖子' (Posts), '作业' (Assignments), '测验' (Quizzes), and '投票' (Polls). A search bar is present with the placeholder text '在此添加您的帖子...' and '输入小组, 学生, 或者教师的名字'. Below the search bar, there are icons for document, link, and book, along with a 'Send Later' button. A '取消' (Cancel) button and a '发送' (Send) button are also visible.

The right sidebar contains the following elements:

- Complete Profile
- What grade and subject do you teach?
- Select Grade/Subject
- 帮助中心 (Help Center)
- Invite Your Colleagues
- Introduce fellow educators to Edmodo, the world's largest education community.
- 邀请 (Invite)

The main content area also shows a post from a user named 'A6 (2016-Spring-A組)' dated 2016-03-08. The post includes a PDF file named 'all.pdf' and a button 'PDF 文件'.



Edmodo平台之建構

依實驗組別分組

課程代碼

The screenshot displays the Edmodo platform interface. On the left, a sidebar titled "小组列表" (Group List) shows a list of groups. The "2016-Spring-A組" group is highlighted with a red box, and its sub-groups (A1 through A8) are listed below it. The main content area shows the "2016-Spring-A組" group page, which includes a header with the group name and a description, a search bar, and a post creation area. On the right, there is a sidebar with a password field (highlighted with a pink box), an "Invite Group Members" button, and an "Assignment Center" section.

小组列表

2016-Spring-A組

- A1
- A2
- A3
- A4
- A5
- A6
- A7
- A8

创建小组

2016-Spring-B組

2015-B組

2015-A組

2016-Spring-A組

Ms. chen · 高等教育 · 科学

发帖 文件夹 成员 25 小组设置

贴子 作业 测验 投票

在此添加您的贴子...

2016-Spring-A組

取消 或 发送

Group Posts

筛选消息

至 2016-Spring-A組, 2016-Spring-B組

**DSC儀器使用注意事項:

1. 實驗完畢務必將樣品旋取出後再進行空燒, 日後若發現未取出樣品旋就直接空燒, 除扣實驗成績外, 若有樣品流出污染樣品槽, 則需另外負擔部分維修費用(可能高達數萬元).

密码: e [redacted]

Invite Group Members

Assignment Center

Track your classroom's progress on assignments and quizzes with ease.

Add Assignments



Edmodo平台之建構

公告、線上測驗、數據上傳、線上互動與期末回饋

The screenshot displays the Edmodo platform interface. On the left, a sidebar titled '小组列表' (Group List) shows a list of groups, with '2016-Spring-A組' selected. The main content area shows the group page for '2016-Spring-A組', managed by 'Ms. chen' in the '高等教育·科学' (Higher Education·Science) category. The page has a green header bar with the group name and a search bar. Below the header, there are tabs for '发帖' (Post), '文件夹' (Folder), and '成员' (Members), with '发帖' currently active. A red box highlights the '发帖' tab and the sub-tabs '帖子' (Posts), '作业' (Assignments), '测验' (Quizzes), and '投票' (Polls). Below these tabs is a text input field with the placeholder '在此添加您的帖子...' (Add your post here...). A search bar with '2016-Spring-A組' is also visible. At the bottom of the input area are icons for text, link, image, and a 'Send Later' option, along with '取消' (Cancel) and '发送' (Send) buttons. The 'Group Posts' section shows a post from a user with a profile picture, titled '**DSC儀器使用注意事項:' (DSC Instrument Usage Precautions:). The post content includes a numbered list: '1. 實驗完畢務必將樣品旋取出後再進行空燒，日後若發現未取出樣品旋就直接空燒，除扣實驗成績外，若有樣品流出污染樣品槽，則需另外負擔部分維修費用(可能高達數萬元).' (After the experiment is over, be sure to remove the sample and then perform an empty burn. If it is found later that the sample was not removed and an empty burn was performed directly, in addition to deducting the experimental score, if the sample flows out and pollutes the sample slot, you will need to bear part of the repair cost (which may reach tens of thousands of dollars).). On the right side of the interface, there is a password field, an 'Invite Group Members' button, and an 'Assignment Center' section with the text 'Track your classroom's progress on assignments and quizzes with ease.' and an 'Add Assignments' link.



Edmodo平台之建構

實驗流程影片、實驗手冊、課程資料、實驗原理簡報

搜索贴子、群组、用户以及更多

1

密码: e [redacted]

Invite Group Members

Assignment Center

Track your classroom's progress on assignments and quizzes with ease.

[Add Assignments](#)

小组列表

2016-Spring-A組

A1

A2

A3

A4

A5

A6

A7

A8

创建小组

2016-Spring-B組

2015-B組

2015-A組

2016-Spring-A組

Ms. chen · 高等教育 · 科学

发帖

文件夹

成员 25

小组设置

文件夹

Manage Folders

姓名 ^	Modified Date
分析實驗(二)實驗流程影片-2016 所有者: yiru chen	2016年1月5日
分析實驗(二)實驗手冊-2016-Spring 所有者: yiru chen	2016年1月5日
分析實驗(二)之課程資料-2016-Spring 所有者: yiru chen	2016年1月11日
分析實驗(二)之ppt-2016 所有者: yiru chen	2016年1月5日



Edmodo平台之建構

學生清單、觀看學生進度與近況

搜索贴子、群组、用户以及更多

小组列表

2016-Spring-A組

A1

A2

A3

A4

A5

A61

A7

A8

创建小组

2016-Spring-B組

2015-B組

2015-A組

2016-Spring-A組

Ms. chen · 高等教育 · 科学

发帖 文件夹 成员 25 小组设置

成员

Member Options 查找成员

教师 (所有者)

学生
chenjerrysmart
小组: A6

进度 管理

学生
eric275481
小组: A5

进度 管理

密码: e

Invite Group Members

Assignment Center

Track your classroom's progress on assignments and quizzes with ease.

Add Assignments



Edmodo平台之建構

準備發送試題擇題設定截止日期成功發佈

The screenshot displays the Edmodo platform interface. On the left, a sidebar titled '小组列表' (Group List) shows a list of groups, including '2016-Spring-A組' and 'test'. The main content area shows the 'test' group page, which includes a header with the group name and a description 'Small group for 2016-Spring-A組'. Below the header, there are tabs for '发帖' (Post), '文件夹' (Folder), '成员' (Members), and '小组设置' (Group Settings). A '创建测验' (Create Quiz) button is visible, along with a link to 'Load From Collection'. The 'Group Posts' section shows a post titled '2016-CV' with a red box highlighting the text '提交了的 (0) 截止至 2016年 3月 10日' (Submitted (0) Deadline: March 10, 2016). The right sidebar contains an 'Assignment Center' section with a link to 'Add Assignments' and a calendar icon showing the date '30'.



Edmodo平台之建構

查看成績及統計

我的学生徽章

2016-CV
截止日期：2016年 3月 10日

Showing: 全部

test

问题分解
21个问题 | 10:00

问题	状态	类型
问题1 1. CV是利用...	正确	选择题
问题2 进行CV实验...	正确	选择题
问题3 物质传送方...	正确	选择题
问题4 本次实验所...	正确	选择题
问题5 辅助电解质...	正确	选择题
问题6 常用的电位...	正确	选择题
问题7 从CV图谱中...	正确	选择题
问题8 选用工作电...	正确	选择题
问题9 本次实验的...	正确	选择题
问题10 实验中参考...	正确	选择题
问题11 实验中辅助...	错误	选择题
问题12 实验中所使...	正确	选择题
问题13 反应物的形...	正确	选择题
问题14 CV实验中物...	正确	选择题
问题15 实验中电位...	正确	选择题

綠色：正確
紅色：錯誤
學生答題正確率



學生使用方式

可先檢視公告

Find Your Open Educational Resources on Edmodo Spotlight

搜索帖子、群组、用户以及更多

Pssst...unlock an **exclusive badge** when your message is selected as the Edmodo for Projects and...

搜索帖子、群组、用户以及更多

至 2016-Spring-A組

****CV注意事項：**

1. 連接線前端的鱈魚夾在夾CV電極之前，務必將電極連接端擦乾淨，不可有樣品水字漬殘留，否則會導致樣品產生反應變黃。
2. 實驗時，連接線前端的鱈魚夾也不可掉落樣品溶液中，否則鱈魚夾也會參與反應進行。

Like • 回复 • 分享 • 浏览 2 小时前

输入回复

至 2016-Spring-A組

****DSC儀器使用注意事項：**

1. 實驗完畢務必將樣品鉗取出後再進行空燒，日後若發現未取出樣品鉗就直接空燒，除扣實驗成績外，若有樣品流出污染樣品槽，則需另外負擔部分維修費用(可能高達數萬元)。
2. 實驗中壓好的樣品鉗須拿給我(非小助教)確認OK後，才可用於實驗中。
3. 蓋上樣品槽外蓋時，不可用力敲打，否則若外蓋變形而無法使用，或導致樣品槽位置偏離中心時，除扣實驗成績外，另需負擔更換一組外蓋(8210元)或部分維修費用(可能高達數萬元)。

[显示较少](#)

Like (1) • 回复 • 分享 • 浏览 2016年 3月 7日



學生使用方式

學生被教師組進行並經選取各自組別

搜索贴子、群组、用户以及更多

1

你好，陳志昇 4.
学生

Looks like you don't have an avatar. Get one here!

Pssst...unlock an **exclusive badge** when your mom or dad use the Edmodo for Parents app!

Send them a download link:

在此添加您的贴子...

发送给

取消 或 发送

小组列表

2016-Spring-A組

Show All Groups

Join a Group

社区

Catholic Fu Jen University

家长密码

家长可靠此密匙创建Edmodo账户:

最近的帖子

筛选消息

Edmodo 至 [redacted]

你已被添加到: test (2016-Spring-A組)

39 分钟前

Show us what you know in math and earn



學生使用方式

收到測驗訊息開始測驗

The screenshot displays the Outlook.com web interface. On the left, the '資料夾' (Folders) pane is visible, showing '收件匣 4' (Inbox 4), '封存' (Archived), '垃圾郵件 2' (Spam 2), '草稿 6' (Drafts 6), '寄件備份' (Sent Items), '刪除的郵件' (Deleted Items), and '新資料夾' (New Folder). The main content area shows a quiz titled '2016-CV' with a timer at '08:27' and a '提交測驗' (Submit Quiz) button. Below the title, there are tabs for '有问题' (Has Problem) and '问题 10' (Question 10). The quiz content features a graph of a function $f(x)$ on the interval $[-0.50, 0.20]$. The y-axis is labeled 'Density' and ranges from -3.00×10^{-5} to 2.00×10^{-5} . The x-axis is labeled 'x' and ranges from -0.50 to 0.20 . The graph shows a red curve with several points labeled: F, H, I, G, B, K, and A. A red rectangle highlights the area under the curve from $x = -0.50$ to $x = 0.20$.



學生使用方式

提交測驗 查看結果

The screenshot displays a web-based quiz interface. At the top, a dark blue navigation bar contains icons for home, a list, and a search bar with the text '搜索帖子、群组、用户以及更多'. To the right of the search bar are icons for a document, a bell with a red '1' notification, and a user profile icon. Below the navigation bar, the main content area is divided into several sections. On the left, a sidebar lists 15 questions, with question 6 highlighted in blue. The main area shows the details for '问题 6' (Question 6). The question text is '實驗中輔助電極的作用是' (The function of the auxiliary electrode in the experiment is). Below the question, there are five multiple-choice options: A. 參與氧化還原反應 (Participate in redox reaction), B. 偵測待測物質 (Detect the substance to be tested), C. 提供穩定電位 (Provide a stable potential), D. 以上皆是 (All of the above), and E. 以上皆非 (None of the above). Option A is highlighted with a green border and a green 'A' in a box, and a green label '正确答案' (Correct Answer) is next to it. Option C is highlighted with a red border and a red 'C' in a box, and a red label '已回答' (Answered) is next to it. To the right of the question, there is a '提交測驗' (Submit Quiz) button and a '10:00 限制' (10:00 Limit) timer. Below the timer, it says '21/21 問題已完成' (21/21 Questions Completed). On the far right, a summary box shows '20/21 Total Points:'. Below this, there is a section for '发布者:' (Publisher) with a profile picture and a '提示' (Hint) section that says '恭喜！你已经完成测验。请在左侧了解你的测验结果。' (Congratulations! You have completed the quiz. Please check your quiz results on the left side.).

2016-CV 03:29 离开 提交测验

有问题

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

问题 6

實驗中輔助電極的作用是

A 參與氧化還原反應 正确答案

B 偵測待測物質

C 提供穩定電位 已回答

D 以上皆是

E 以上皆非

10:00 限制
21/21 問題已完成

20/21
Total Points:

发布者:

提示
恭喜！你已经完成测验。请在左侧了解你的测验结果。



期末回饋

學生使用方式



104學年度分析化學實驗(二)之線上預習系統 使用成效調查

麻煩請本學期修"分析化學實驗(二)"的同學協助系上評估新製作之線上預習系統(數位教材及Edmodo線上測驗系統)的使用成效並讓系上了解該套教學系統需改善之處！

*必填

1. 學生班別*

2. 學生組別*

3. 線上預習系統(含數位教材及Edmodo線上測驗系統)的設計，是否有助於你在實驗前對"實驗儀器之基本原理"有概括性了解？*

1 2 3 4 5

無幫助 ● ● ● ● 有極大幫助

4. 線上預習系統(含數位教材及Edmodo線上測驗系統)的設計，是否有助於你在實驗前對"實驗儀器之操作"有概略性了解？*

1 2 3 4 5

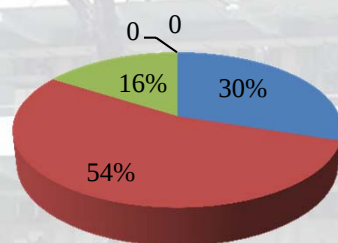
無幫助 ● ● ● ● 有極大幫助



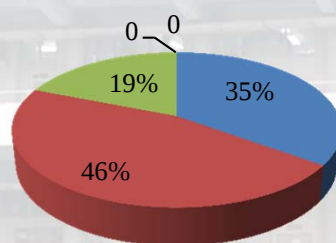
學生使用方式

期末回饋-103學年度下學期 (參加問卷總人數：54人)

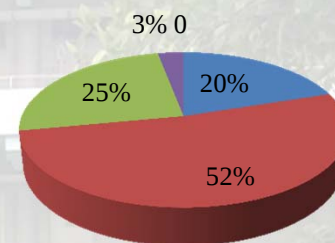
- 線上預習系統的設計，對你在實驗前在下列方面之了解的助益程度？



基本原理



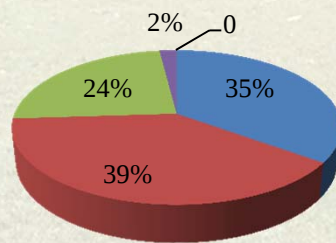
儀器操作



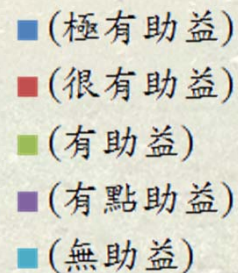
整體流程



- 實驗完畢後，你認為線上預習系統內對下列方面是否有助益？



儀器操作

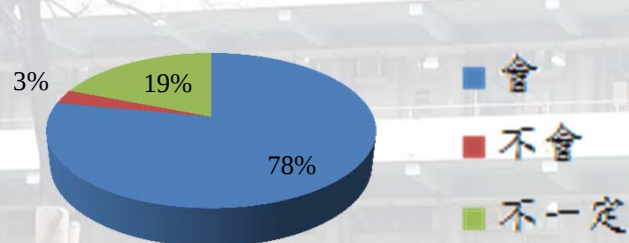




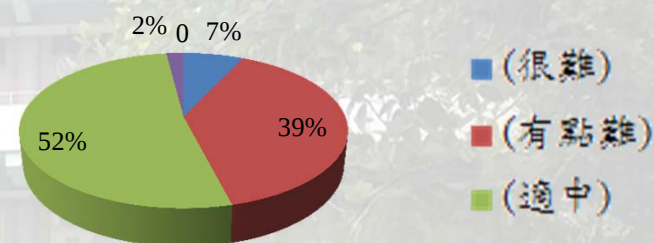
學生使用方式

期末回饋-103學年度下學期 (參加問卷總人數：54人)

- 關於Edmodo線上測驗系統



檢討正確答案



考題難易度

- 其他建議：
 - 儀器操作影片太長，不容易記住儀器操作細節。
 - 影片講話速度略顯偏慢。
 - 建議增加影片中各操作步驟的目的及Edmodo線上考試的時間，提供考題出處。



課程中所遭遇的困難

遭遇之困難

- 更換實驗內容須更新實驗操作影片和實驗原理的困擾。
- 示範同學操作時不免解說生硬、音量大小不一致等問題。
- 搭配平板電腦的使用，落實學生在實驗前即時進行Edmodo測驗，因學校Wi-Fi連線不穩定而不順利。



具體教學成果

儀器分析知識PK大賽

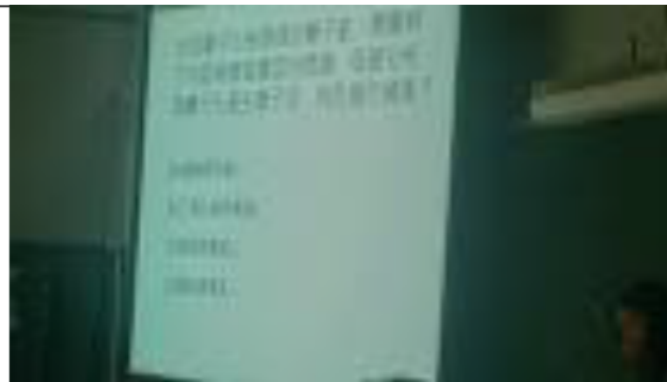
主要藉由競賽方式提高系上同學對儀器分析知識的了解及興趣，進而期望對其日後的研究實驗有幫助。

報名人數：		24				
實際參與人數：		教師： 1 職員： 1 學生： 37 校外人士				
問卷回饋	問卷填寫份數：	23				
	活動滿意度：	95%				
	項目(以人次填答)	非常同意	同意	沒意見	不同意	非常不同意
	1.提升「問題分析與解決」能力	8	10	4		
	2.提升「人際溝通行為」能力	6	8	9		
	3.提升「團隊合作行為」能力	9	11	3		
	4.提升「創新行為」能力	6	9	7	1	
	5.提升「應變行為」能力	7	10	4		
	6.提升「整合與善用資源行為」能力	9	9	4	1	
	7.提升「規劃行為」能力	9	7	5	2	
	8.提升「洞察環境變動(國際視野)行為」能力	6	7	8	2	
	9.提升「領導行為」能力	8	5	9	1	
	10.提升「學習行為」能力	9	9	5		
	11.提升「自我管理行為」能力	6	9	7		
12.提升「積極行動行為」能力	9	11	2	1		

儀器分析知識PK大賽



比賽規則海報張貼於比賽會場



比賽題目播放在螢幕上



比賽同學搶答情況



李慧玲老師頒獎給得獎同學並合影留念

實驗e起來最大優點

學生 - 自主學習

無紙化-落實環保與
綠色化學概念

老師 - 利用零碎時
間給學生個別回覆

資訊交換快速





THANKS FOR YOUR ATTENTION

感謝 
學校
理工學院
化學系

