Getting Started with a Laboratory Class

從實驗課程開始

1.Goals of the Course
2.The Role of the GSI　GSI 所扮演的角色

Portions of this section adapted from Gale and Andrews (1989)
as described in Black, Gach, and Kotzian (1996)

1.Goals of the Course

Every laboratory class has goals that may be particular to that course and it is important to find out those goals before classes begin. For example, in the introductory physics laboratory students learn "how to apply the concepts learned in lectures to physical systems" while in the introductory chemistry laboratory students engage in "developing principles from data." A general goal that pertains to most labs is to "make a connection between the theoretical elements of a discipline and the practical aspects of the technical performance." Most laboratory instruction addresses these three common objectives:


Translation

每堂實驗室課程都有那堂課的特定目標，在課程開始前去找出那些目標會格外重要。例如在"物理導論 introductory physics"的實驗課程，學生學習"如何應用課堂上的觀念到各個物理系統中"，或是在"化學導論"的實驗課程中，學生投入於"發展實驗數據中所呈現的原理"，但一個通用屬於多數實驗課程的目標會是"連結理論元素的規則與實際層面的技術方法"，多數的實驗指導會提到以下三個特點

- The practice and mastery of specific technical skills (such as using the microscope, setting up an apparatus for measuring mass changes in a chemical reaction, determining voltage changes across a circuit, or generating code to run a device.)

練習及熟練特定的技巧(例如使用顯微鏡、架設量測化學反應改變的儀器、得知電路中的電壓改變，或是會編寫程式去驅動裝置)

- The mastery of the skills of the scientific process (such as observation, classification, inference, hypothesizing, and designing methods of investigation.)

熟練於依循特定科學方法的技巧(例如觀察、分類、推論、假設，以及設計調查的方法)

- Experiencing abstract concepts in a concrete manner (such as measuring and understanding free energy or angular momentum.)

以實際的態度去體驗抽象的概念(例如量測及了解"自由能"或"角動量")

On another level, the lab experience is valuable for its ability to give students a more intimate knowledge of the discipline and a more intense involvement in the process of scientific inquiry. A basic framework for bringing scientific inquiry into the laboratory involves having students asking questions and then using data to answer these questions. Laboratory classes encourage cooperation and teamwork among students, thus reinforcing the social aspect of learning that is implicit in the practice of scientific inquiry. Together all of these elements – experiencing abstract ideas in a concrete manner, practicing scientific inquiry, and

GSI Tip: Lab time is best spent having students do the experiments. Generally, laboratory objectives involve the students in active learning through participation in laboratory experiences and not in passive learning by

participating in cooperative teamwork – are goals that help promote a positive and exciting learning environment.

listening to someone talking about scientific concepts.

Translation

在另一方面，實驗室的經驗有助於給予學生詳盡了解紀律的知識以及尋求科學的過程，一個基本的尋求科學框架包含了使學生發問並且運用資料去回答這些問題，實驗課程也鼓勵了學生間的團隊合作，因此增強社交學習是蘊含在尋求科學的內容中的，綜合以上的元素---以實際的態度去體驗抽象的觀念、練習尋求科學、以及參予合作性的團隊行為，在長遠的目標上會是有益於展示一個正向且令人興奮的學習環境。

GSI 小秘訣：實驗室的時間的最佳利用是著手進行實驗，通常的實驗室主體會包含使學生在參予經歷實驗下活躍的學習，不是在聆聽某些人講解科學觀念下被動的學習

2.The Role of the GSI　GSI 所扮演的角色

The graduate student instructor (GSI) has a very important role in helping students feel good about their lab experience. As a GSI you may have many responsibilities: discussion leader, laboratory instructor, safety monitor, grader, exam proctor, and other roles. You also have an especially important role in helping to make the undergraduate students' education a quality experience. In fact, in most lab settings, the GSI has the biggest influence on to the success or failure of the lab experience for the student.

Because you work with students in small groups and on a one-to-one basis in your office hours, you have the opportunity to provide the personal touch, individual feedback, and encouragement that students need in order to succeed in a science laboratory class. You have the opportunity to get to know the students as individuals, to know their strengths and weaknesses, to understand how they think, and to challenge them to improve. In their early

years, many undergraduate students need encouragement and understanding and you have the opportunity to provide them with the personal help that can motivate them to do their best work.

Another important aspect of your work will be to help students develop higher-level thinking skills and problem-solving skills through active involvement, guidance and feedback. Your role will be to ask the kinds of questions that will help students think through the problems and learn how to go about solving them. In order to do this, you must create the climate needed for students to feel safe enough to ask and answer questions and to participate in discussions. Often students don't participate because they are afraid they will be wrong and look stupid in front of the GSI and their peers. It is important to help students realize that everyone learns from mistakes, and that it is working through the mistakes as a group that often leads to a much deeper level of understanding and thought for everyone.

Finally, you will be working as part of a team with other GSIs and the faculty member in charge of the course to help make the course better. It helps everyone if GSIs collaborate with each other, sharing and discussing successes and any problems that might arise. Several ways of communicating with others teaching the course include weekly meetings, e-mail, and lab-section wikis. It is also important that you provide a communication channel between the students and the supervisor and/or faculty instructor in charge of the course. Instructors are not always in a position to know what students are finding difficult or how the lectures could be more helpful to students.

Translation

研究生指導單位(GSI)有個非常重要的角色是幫助學生感覺實驗經歷是好的，身為一個 GSI 你會有可能負責於討論的領導者、實驗室的指導者、環安的監理者、評分者、監考者、以及其他可能的角色。你也會有個特別重要的角色是維護大學生教育的品質，實際上，在多數實驗室的設定上，GSI 有絕大的影響力於給予學生成功或失敗的實驗經驗。

因為你與學生是一小個團體的合作，並且在 office hour 時是一對一的，你有機會去提供個人接觸、個人回饋、以及有幫助的鼓勵學生使得他們在科學實驗的課程上能夠成功。你有機會去個別的了解學生，去了解他們的長處跟缺點、去理解他們的想法，並且挑戰他們去改進。在他們剛入學的時候，許多大學生需要鼓勵以及理解，你有機會去提供他們個人的協助並且激勵他們去做到最好

另一方面你的重要工作會是幫助學生發展高層次的思考技巧以及問題解決技巧，使用的方會是互動式的參予、指導、回饋。你的角色會是詢問會幫助學生循著課題思考以及如何解決課題的問題。去達到這樣的目的，你需要製造一個具安全感的氛圍讓學生發問、回答問題、以及參予討論，通常學生不會參予因為他們會害怕他們是錯的以及在 GSI 以及同學面前出糗。很重要的是幫助學生瞭解每個人都要從錯誤中學習，並且在團體上著手於錯誤會有助於個人更深層的理解及思考。

最後，你會與其他 GSI 以及教職員同組的工作去討論課程讓課程進步，對整體也有幫助的是 GSI 互相合作、分享以及討論成功以及任何可能發生的問題，許多與他人交流教學的方法包括了每周的開會、email、以及 lab 部分的查找，也很重要的是提供學生與教職員或指導者的一個課程上的溝通管道，指導者並不總是知道學生的難處或是課程怎樣才會對學生較有幫助的。