美国大学生数学国际合作研究

Research Experiences for U.S. Undergraduate Students in Hong Kong

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编者按：本文作者应编者的邀请，把他们组织的美国大学生海外研究体验形成文字，供中国两岸三地的大学生和基金委参考。我们非常感谢，这两位美国学者如此认真地提供了一份内容丰富图文并茂的报告。本文不仅对培养大学生研究兴趣的教师或学术基金单位有启发，也为我们写相关的结题汇报提供了一个高质量的范文。

1. 引言

2006年，位于美国科罗拉多州的科罗拉多矿业学院（Colorado School of Mines）数学与计算机系在美国国家科学基金委的资助下启动了一个为期三年的大学生研究体验（Research Experiences for Undergraduates，以下简称REU）项目。美国国家科学基金委是美国政府支持下的一个重要的基金机构，用于资助自然科学和工程方面的研究；而其支持的 REU项目旨在支持在校大学生参与有实际应用的研究活动。数学与计算机系受资助的REU项目被称为 “美国-香港数值分析与科学计算”，此项目分别于2006年至2008年的夏季以香港浸会大学为中心在香港举行。在香港设立REU项目的目的是为学数学的大学生提供一个参与具有国际水平数值分析和科学计算研究的机会，并拓宽他们的全球视野。在每届活动中，十名学生以分组的形式用八周的时间研究一些开创性的课题，每个小组由二至三名大学生组成，他们均是从美国各地的大学申请人中经过严格评审后选拔出来的。每个小组配备一名指导教师，这些教师来自包括香港浸会大学、香港城市大学、香港中文大学和香港理工大学在内的四所大学。

本文主要介绍美国基金委的REU项目，重点是香港站REU项目的独特之处。需要声明的是，本文的工作得到国家科学基金委的部分资助。另外，本文的观点和思想仅代表作者本人，并不一定代表基金委的观点。

1. Introduction

In 2006, the Department of Mathematical and Computer Sciences (MCS) at the Colorado School of Mines (CSM), located in Golden, Colorado, U.S.A., established a three-year Research Experiences for Undergraduates (REU) program funded by the National Science Foundation (NSF). The NSF is a major funding agency in science and engineering supported by the U.S. government. NSF REU programs are designed to support the active involvement of college students in meaningful research activities during their undergraduate education. The MCS REU program, entitled "United States-Hong Kong REU in Numerical Analysis and Scientific Computing", was held during the summers of 2006, 2007 and 2008, and was centered at Hong Kong Baptist University (HKBU). The purpose of establishing an REU program in Hong Kong was to provide undergraduate mathematics students with the opportunity to contribute to the exciting research being conducted in numerical analysis and scientific computing at an international level while also affording these students the chance to increase their global awareness. During each summer of the program, ten U.S. undergraduates spent eight weeks working on original research projects in teams comprising two or three student members supervised by a faculty member from one of four Hong Kong universities: HKBU, City University of Hong Kong, The Chinese University of Hong Kong and Hong Kong Polytechnic University. The student participants were selected from a broad spectrum of colleges and universities across the U.S. through a rigorous application and review process.

This article describes the NSF and its REU programs, the participating U.S. institution (CSM) and its prior REU efforts, and the unique Hong Kong REU program. It expands significantly upon [4] and [5] which focused only on the first year of this program; two additional years have since been completed. This work was partially funded by the NSF (grant DMS-0453600). The opinions and ideas expressed in this article are those of the authors and do not necessarily reflect those of the NSF.

2. 美国国家科学基金委和REU项目

1950年，美国国家科学基金委作为一个独立的美国联邦机构由美国国会批准建立，其目的是“推动科学的进步，推进国家的健康、繁荣和富裕，加强国防等等”。这一使命是通过提供科研资金给前沿课题研究人员来实现的，而选择资助的项目要通过严格的竞争筛选过程。它包括7个分部门：生物科学，计算机信息科学与工程，工程，地球科学，数学和物理科学，社会、行为和经济学，教育与人类资源，每一个部门又被细分为几个部分。其2009年的预算大致是65亿美元，其中约20%的基础研究是通过美国国家科学基金委的资助在大学和学院里完成的（参看：http://www.nsf.gov/about）。

美国国家科学基金委使命的一个重要组成部分就是对所有层次的科学和工程教育给予支持——从幼儿园到大学教育。REU项目就是其中一个大学生层次的例子。基金委推出REU项目是基于这样的理论：让学生较早地参与研究可以使他们更倾向于追求科学和工程领域（包括教学和相关的教育研究）的相关事业。

基金委资助两类REU体验：REU补加资助和REU站。 REU补加资助是拨款给受基金委资助的个人和团体，用来支持他们吸纳本科学生参加到基金委资助的项目中。如果其内容与其研究课题有关联，项目负责人可以直接向基金委申请REU补加基金，项目负责人也可以把REU作为新的研究计划的一部分向基金委申请。另一方面，REU站则不要求申请人有在研的基金项目，但需要呈交独立的计划去说明如何启动和发展让大学生参加研究项目。通常情况下，补加基金在学年和暑期都可以使用，而REU站基金则只支持暑期的项目。

3. 早年科罗拉多矿业学院的REU站基金

矿业学院于1874年在美国科罗拉多州金色市创立，为的是服务于科罗拉多的采矿社区。当1876年科罗拉多成为一个州的时候，矿业学院就成为一个州立学院。今天它是一个专门致力于自然资源、环境和相关领域的公立研究型大学。它是美国工程和应用科学方面最大的专业大学之一，大约有4000名学生，其中有800名研究

2. NSF and REU Programs

In 1950, the NSF was established by the U.S. Congress as an independent federal agency, “to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" [8]. This mission is fulfilled through the funding of limited term grants which are selected var a highly competitive merit review process. NSF comprises seven directorates: Biological Sciences, Computer and Information Science and Engineering, Engineering, Geosciences, Mathematics and Physical Sciences, Social, Behavioral and Economic Sciences, and Education and Human Resources, each of which is subdivided into divisions. NSF’s 2009 budget was approximately US$6.5 billion (see: www.nsf.gov/about/congress/111/highlights/cu09_0310.jsp). Around 20% of the basic research completed in U.S. colleges and universities is funded through the NSF (see: www.nsf.gov/about/).

A major component of NSF’s mission is the support of science and engineering education at all levels, pre-kindergarten through graduate education [8]; the REU program is one example at the university undergraduate level. The

美国国家科学基金委大楼

National Science Foundation Building

theory that supports the NSF/REU program is that early exposure to research will entice more students to complete advanced degrees, and pursue careers in science and engineering including teaching and related educational research. NSF funds two types of REU experiences [9]: REU supplements and REU sites. REU supplements are awarded to individual investigators or investigative teams to support the inclusion of undergraduate students in research being conducted as part of NSF funded programs. Investigators can request an REU supplement through a proposal which is directly linked to an existing NSF research grant or included as a component in a proposal for a new NSF research grant. NSF/REU site grants do not require that the applicant have a currently funded NSF project but are based on independent proposals to initiate and conduct projects that engage undergraduate students in research. Supplements typically provide financial support to students during either the academic year or the summer, whereas site grants only fund summer programs.

生。矿业学院在科罗拉多州中有着最高的招生标准，并且也是全美公立大学中招生标准最高的学校之一。

除了充满生机的研究生项目外，矿业学院的数学与计算机系还通过REU补加基金拨给在研项目和现有的国家科学基金站，为大学生提供提前研究的机会。这一基金站在前系主任Graeme Fairweather博士的指导下在矿业学院的校园内举办了2000年至2002年的暑期项目。这三届活动中，共有28名学生参加，其中2000年有9名，2001年有10名，2002年有9名，一共有13名女生，15名男生，他们是从175名申请者中选拔出来的。在历届项目的六周时间里，这些参与的学生2-3名结为一组，与数学与计算机系的一名教师或博士后一起做很有开创性的研究工作。

作为评估环节的一部分，REU学生在结束暑期项目之前，需要完成一个书面调查报告和面谈，调查报告包括17个莱克特量级问题，这些问题是关于刚刚参加的REU经历会怎样影响他们对数学研究的兴趣。学生们需要给17个问题打分（0-10级），分数越高就表明对这个问题越肯定。评估还包括一些自由回答的问题，比如“在科罗拉多矿业学院参加REU项目如何影响你的受教育和职业目标？”大多数的学生表示这个项目增加了他们对研究生学习的兴趣，而且更确信从事数学科学的职业适合他们。收集来的数据再度表明REU的学生一般会计划通过进入研究生院来继续他们的学习。事实上，10名女生和7名男生在参加完项目后就立即开始攻读研究生学位了。

4. 促成REU香港设站

2000年，基金委国际项目部开始鼓励美国的研究者建立国际REU站。一段摘自基金委的项目通告写道：“美国科学和工程研究队伍需要迎接全新的和不同技能的竞争。……最好的技术训练一定要懂得怎样将专业技术知识与社会大环境、本国国情、以及其它国家的目标相结合。”与这些目标相呼应，美国大学协会在《在全球化经济中取得成功，大学如何为学生做好准备》（见[6]）一文中将下面几条作为不可缺少的要素，它们对当今的大学毕业生来说也是至关重要的：i)需有不同小组之间分工合作的团队技能，ii)全局观念和发展观，

3. Prior NSF/REU Site Grant at CSM

CSM was established in Golden, Colorado, U.S., in 1874 to serve the mining community of Colorado. When Colorado became a state in 1876, CSM became a state institution. Today, it is a public research university with a special focus on natural resources, the environment, and related fields. It is one of the largest colleges of engineering and applied sciences in the U.S., serving a student population of approximately 4000 students including 800 graduate students. CSM has the highest admission standards of any university in the state of Colorado and has among the highest admission standards of public universities throughout the U.S. [2].

科罗拉多矿业学院校园

The Campus of Colorado School of Mines.

In addition to a vibrant program in graduate research, MCS had offered several prior opportunities for research experiences for undergraduates through REU supplements to existing NSF grants as well as an NSF site grant (DMS-9912293) in the mathematical sciences which was implemented on the CSM campus during the summers of 2000, 2001 and 2002, under the direction of Dr. Graeme Fairweather, former department head of MCS. Over the course of this three year program, there were a total of 28 student participants, nine in 2000, ten in 2001, nine in 2002, with 13 females and 15 males, selected from approximately 175 applicants. For six weeks during each summer of the program, the participating students worked in teams of two or three with an MCS faculty member on an original research project. The following refereed journal articles were produced as a result of this research; an asterisk (*) denotes an REU student author.

•B. Bialecki, G. Fairweather, D. B. Knudson, D. A. Lipman*, Q. N. Nguyen, W. Sun and G. M. Weinberg*, “Matrix decomposition algorithms for the finite element Galerkin method with piecewise Hermite cubics”, Numer. Alg., 52 (2009), pp. 1-23.

以及他们对未来将产生的影响。这些论点反映了美国一个日益增长的忧虑，那就是没有足够的学生特别是研究生层次的学生准备参与自然科学和工程的研发工作，也没有充足的学生准备参与全球经济竞争。在基金委的项目通告中重申“东亚呈现出培养科学和工程人员的鲜明挑战。东亚是对美国具有重要战略意义的地区，该地区拥有具有科学天赋的精英骨干、迅速发展的技术源泉以及为美国技术产品提供崭新市场的潜力”。在回复基金委的项目通告中，当时数学与计算机系的两位教师Fairweather博士和王军平博士提交了申请并且获得了REU补加形式的基金，这是对原来REU站基金的一个补充，用以支持他们去香港一周调查设立REU国际站的可行性。在香港期间，这两位学者会见了来自香港四所大学的代表。会谈的一个结果就是设立本文所说的新的REU项目的构想。随后由这两位博士和本文的第一作者起草的申请成功地获得了国家基金委的资助。

香港被选作可行的REU站有以下几点原因。第一，它集中了一些数值分析和科学计算方向有实力的大学；第二，Fairweather和王博士最近与香港地区进行数值分析与科学计算研究的大学进行了交流，感觉和这些教师们的合作很放松很愉快；第三，英语是香港的官方语言，这极大程度上降低了潜在的语言障碍；第四，香港被认为是有极小健康风险的地区。根据美国疾病控制和预防中心的说法，去香港的访客也要“遵循类似的健康预备措施，就象在美国旅行一样”；第五，香港被很多人视为中西方文化的融合体；最后一点，香港是亚洲最安全的城市之一。

5. 香港REU体检

这一国际REU项目的目标是：提高大学生追求数学科学方面高等学位的兴趣；以及为参加的学生们提供在数学科学方面体验高质量国际研究的机会。

这一节我们将讲述REU参加者和活动，以及相关目标是如何实现的。

参加者

每年，我们会从大约50名申请者中选出10名，根据他们在数学学科上的学习表现、职业兴趣和目标，还

•K. Bold*, C. Chen* and N. Dutzman*, “An introduction to the computation of American options”, University of Texas Undergraduate Research Journal, 1 (2002), pp. 38-43.

•W. Navidi and E. Weinhandl*, “Risk set sampling for case-crossover designs”, Epidemiology 13 (2002), pp. 100-105.

As part of the evaluation process, the students completed a written survey and an exit interview at the conclusion of the REU experience. The survey included seventeen Likert scale type questions in which the students rated the extent to which project participation had impacted their interest in research in the mathematical sciences. The evaluation also included free response questions, such as "How has participating in the REU program at the Colorado School of Mines influenced your educational and career goals?" The majority of students indicated that the program had increased their interest in graduate studies and reassured them that a career in the mathematical sciences was appropriate for them. The collected data additionally indicated that the REU students generally planned to further their education by continuing into graduate school. In fact, ten females and seven males pursued a graduate degree immediately after participating in the program.

4. Impetus for Hong Kong REU Site

In 2000, NSF’s Division of International Programs began an effort to encourage U.S. researchers to establish international REU sites. A key excerpt from the NSF program announcement states: "The U.S. science and engineering (S&E) workforce is competing in a context that demands new and different skills and competencies…The best technical training must be combined with an understanding of how that expertise fits into the larger societal environment, into our overriding national goals, and into the goals of other nations.” Consistent with these goals, the Association of American Colleges And Universities [6] identified the following learning outcomes as critical areas of need for recent college graduates: i) teamwork skills and the ability to collaborate with others in diverse group settings, and ii) global issues and developments and their implications for the future. These arguments reflect a growing concern in the U.S. that there are not enough students prepared in science and mathematics and there are not enough students prepared to participate in a global economy, especially at the graduate level [3, 7]. In the NSF program announcement, it was further argued, “East Asia presents clear challenges and opportunities for developing an S&E workforce. It is a region of strategic importance to the United States, with a strong cadre of scientific talent, a rapidly developing technological base, and the potential to provide significant new markets for U.S. technological products…” In response to NSF’s program announcement, Dr. Fairweather and Dr. Junping Wang, both MCS faculty members at that time, submitted a proposal and received funds in the form of a supplement to the original REU site grant to support a visit to Hong Kong and investigate the feasibility of establishing an REU site (DMS-0206884). This visit led to the creation of the REU program described in this article (DMS-0453600).

Hong Kong was selected as a potential REU site for several reasons. First, its concentration of universities with excellence in numerical analysis and scientific computing is exceptionally strong. Second, Drs. Fairweather and Wang had previously interacted with numerical analysis and scientific computing university

有他们是否乐意参与这一海外项目。大多数参加者是从基金委网站上了解到此项目的，还有一些则是通过系里的教师了解到相关信息。这些教师能定期收到美国数学协会的电子通知，并且大都在参与美国应用和计算数学方面的研究项目。在总共三次活动的三十名学生参加者中，除去其中5名外都在一年内完成本科学业并且都声明主修数学。

基金委鼓励参与者来自a)科学和数学界的弱势群体（类似于中国的少数民族）；b)研究机会受限制的学术单位；c)非主办单位。每年此项目招收5名女生5名男生；总共三次活动的三十名参加者中两名是西班牙人或葡萄牙人；他们来自于24间大学，其中只有5间为博士学位授予单位；30名学生中，只有5名来自于科罗拉多矿业学院。在美国的数学界，女性和西班牙或葡萄牙裔学生被分类为弱势群体。虽然大多数参加者都有过研究经历，但是这次却是他们第一次有海外旅行的机会。

国际旅行和研究的准备

在前往香港之前，学生们会被分配到研究小组中，小组是由香港的一间大学的教师和两至三名学生组成。随后很快他们之间就建立起电子邮件往来。此外，这些学生还会拿到一些有关课题和实际问题的资料，后者包括当地文化的知识、旅行安排、保险事务、食宿、健康和安全等方面。除此之外，他们还要完成一份评估问卷，这在第六节将会提到。

每次暑期活动中，在五月的最后一周，学生们会在香港旅游。国家基金委指定的首席调查员Fairweather博士陪同学生们一起，住在香港浸会大学的吴多泰国际中心宾馆。这个校内住宿安排为REU的学生们提供了一个愉悦的环境，购物、就餐和交通都很方便。主办单位还为学生小组提供了办公空间以及享用图书馆和计算设施的便利，最重要的当然是提供了做为研究顾问的优质教师。

研究计划

参加项目的香港老师们在活动期间担任14项研究课题；这些课题和研究团队以及他们所属的单位都列在附录中。原本希望所有的学员在常微分方程，线性代数，数值方法，编程语言例如C，Fortran或者Matlab方面有

faculty from this region, providing ease in communication and comfort among the faculty participants. Third, English is the official language in Hong Kong, minimizing the potential of language barriers. Fourth, Hong Kong is recognized as a country that provides minimal health risks. According to the U.S. Center for Disease Control and Prevention, visitors to Hong Kong should “observe health precautions similar to those that would apply while traveling in the United States”. Finally, Hong Kong is one of the safest cities in Asia.

5. Hong Kong REU Experience

The project goals for this international REU program were:

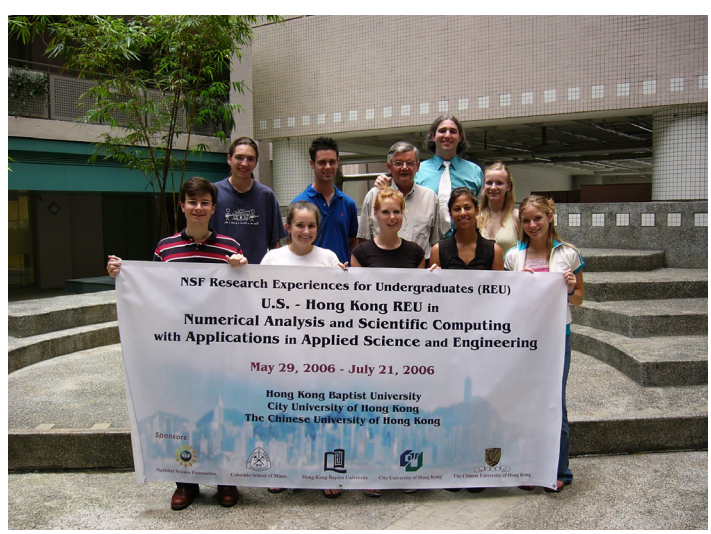
•to increase undergraduate students’ interests in pursuing advanced degrees in mathematical sciences; and

•to provide participating students with a high quality international research experience in the mathematical sciences.

This section describes the REU participants, and the activities that were designed to support the attainment of these goals.

Participants

Each year, ten participants were selected from a pool of approximately fifty applicants, based on their academic performance in the mathematical sciences, career interests and objectives, and readiness to pursue an overseas project. Most of the participants learned of the program from the NSF webpage listing all such programs [11]. Others learned of it from faculty members who received electronic



REU 香港站的第一批学生.

REU 2006 students in Hong Kong

fliers sent through list servers of the Mathematical Association of America and other leading U.S. programs in applied and computational mathematics. All but five of the 30 student participants were within one year of completing an

很强的基础。但是这并不现实，因为在美国的大学教育环境下，一些重要的专业课程通常是在最后一个学年修完的。考虑到这一点，我们要非常谨慎地保证每个小组能聚集起来指定课题所需要的各种技能。这些学生很有天赋，并能很快激发起处理知识不足的积极性，这主要是通过他们之间的相互合作达到的。

在活动期间，学生小组会向Fairweather博士以及其它学生做几次口头的进展报告。这些中期报告包括讨论他们取得的成果的讨论，遇到的问题和解决方法，以及接下来的课题目标。在活动要结束的时候，每个小组要准备一个最终的书面报告并给出一个30分钟的演讲。听取最终报告的包括做研究顾问的教师和来自香港浸会大学的师生。

Fairweather博士在整个活动中自始至终作为一个直接的全权顾问和领导，当学生们遇到课题有关的困难时，会直接帮助他们。学生们还可以以小组或者个人的形式约见他并和他讨论不同的问题，诸如研究生学习以至职业选择。

研究之余的活动

每年，REU的学生都有机会参加一些既定安排之外的活动，为的是让他们置身于更广阔的国际数学研究的视野之下。例如，许多REU学生参加博士生的答辩和听取访问学者的报告。他们还有机会参与学术会议，包括在2006年六月由香港浸会大学主办的第二届结构矩阵国际研讨会；2008年六月由香港城市大学主办的应用数学的模型分析和计算方法国际会议，以及同年在香港举办的国际计算数学基础研究系列会议的香港站会议。有两名2007年的学生参加了在香港举办的亚太区教育的职业领袖论坛。

2006年的REU学生还有机会与来自斯坦福大学的享有盛誉的Gene Golub院士进行非正式的讨论。随后Golub院士出席了在香港中文大学专门为REU学生开设的研讨班。

在2007年和2008年的活动中，澳门大学数学系金小庆教授安排REU学生到澳门大学进行为期一日的访问。在那里，他们参加了讨论会并会见了那里的研究生。当地的研究生还引领他们参观了校园和澳门市。另外，一

undergraduate degree and all had a declared major in the mathematical sciences.

The NSF encourages the participation of underrepresented groups, students from academic institutions where research opportunities are limited and students from institutions other than the host institution. Each year, the program involved five female students and five male students; two of the 30 participants were Hispanic; of the 24 colleges and universities represented by the participants, only five are Ph.D. granting institutions; and, of the 30 participants, only four were from CSM. In the mathematical sciences, both women and Hispanic students are classified as underrepresented in the U.S.A. Most of the participants had prior research experience but for many this was their first opportunity for foreign travel.

Preparation for Travel and Research

Before departing for Hong Kong, the students were assigned to research teams comprising a faculty member from a participating Hong Kong university and two or three REU recipients; these individuals immediately began electronic interaction. The students were also provided background material regarding their project and addressing practical issues, such as cross-cultural understanding, travel arrangements and insurance matters, accommodation and food, and safety and health concerns. Moreover, they were asked to complete and submit preliminary assessment activities which are described in the Assessment and Evaluation section of this article.

Over the three summers of the program, the participating students traveled to Hong Kong during the last week of May. The principal investigator of the NSF award, Dr. Fairweather, also traveled to Hong Kong, and stayed with the students in the Ng Tor Tai (NTT) International House at HKBU. This on-campus housing provided a pleasant environment for the REU participants, conveniently located for shopping, dining and transportation. The host institutions provided the student teams with office space and computing facilities

Research Projects

Fourteen research projects developed by participating Hong Kong faculty members were undertaken over the course of the program. These are listed in Appendix I together with the members of the research teams and their affiliations. It was originally expected that all of the student participants would have a strong grounding in ordinary differential equations, linear algebra, and numerical methods, together with knowledge of a programming language such as C, Fortran or Matlab. However, this proved to be rather unrealistic since a key prerequisite course, numerical methods, is often a final year course in a standard U.S. undergraduate curriculum. In view of this limitation, care was taken to ensure that each team collectively had the requisite skills for the project to which they were assigned. The students were sufficiently talented and well motivated that they quickly addressed any deficiencies in their knowledge, primarily through their interactions with other participants.

During the course of the program, the student teams presented several oral progress reports to their peers and Dr. Fairweather. These interim reports included a discussion of accomplishments, problems encountered and solutions, and the remaining project goals. At the end of the program, each team was required to prepare a final written report and give a 30 minute oral presentation.

REU 香港站的第二批07年学生
REU 2007 students in Hong Kong

年一度的乘船巡游香港是由香港中文大学计算机科学与工程系的蒙耀生教授组织的。蒙教授研究小组的学生们也参与了这些充满欢乐的游船活动。

6. 评估

评估是美国国家科学基金委对REU项目验收的重要部分。作为基金委资助项目的一部分，研究者们被要求收集和分析数据资料，目的是检查REU活动的效果。本文第一作者领导了评估的全部工作。

项目的前后文

在前往香港之前，REU的学生们被要求写一篇小短文（REU项目中称为“前文”），内容主要是他们将来对数学和数学界的贡献会是什么。结束项目回来后，他们要提交一篇小短文（REU项目中称为“后文”），主要是如何基于他们在香港的体验修改前文的。在他们的前文里，所有的学生都表明他们打算攻读数学或相关领域（也就是数学、计算机科学或物理）的研究生，并且大约半数学生对在这些科目之一取得博士学位感兴趣。绝大多数学生还表示他们有兴趣将来从事大学的数学教学和研究的工作。大多数学生的后文表明REU体验不仅没有改变他们的初衷，而且加强了这个愿望。REU的经历使得大多数学生坚信读研究生和从事数学工作更加适合他们。

每周反思

在项目的前七周，每周结束的时候，学生们要提交

Attendees at this presentation included faculty research mentors and faculty members and students from HKBU. Dr. Fairweather acted as a direct resource to the students throughout the program, assisting students when projected-related difficulties emerged. The students also met informally with him in small groups or individually to discuss various issues such as graduate studies and career options.

Activities Beyond Research

Each year, there were opportunities for the REU students to participate in activities designed to expose them to a broader scope of international mathematical research beyond what they were completing. For example, many of the REU students attended Ph.D. defenses and listened to talks given by visiting speakers. They also had the opportunity to attend and participate in research conferences, including the 2nd International Workshop on Structured Matrices at HKBU (2006), and, at City University in 2008, the International Conference on Applied Mathematics: Modeling, Analysis and Computation and the Foundations of Computational Mathematics Conference. Two of the 2007 participants attended the Asia-Pacific Professional Leaders in Education Conference held in Hong Kong in July 2007.

The 2006 REU students also had the opportunity to have tea and informal discussions with the now late Dr. Gene Golub, the renowned numerical analyst from Stanford University. As a result of this meeting, Dr. Golub later presented a seminar on the history of scientific computing at the Chinese University specifically for the REU students. During the 2007 and 2008 programs, the students made a day trip to the University of Macau arranged by Dr. X. Q. Jin of the University of Macau's Mathematics Department. There, they attended a seminar and met with graduate students, who provided a guided tour of the campus and city. An annual cruise was organized Dr. Yiu Sang Moon of the Department of Computer Science and Engineering at the Chinese University. This was attended by the REU students and graduate and undergraduate students in Dr. Moon’s research group.

6. Assessment and Evaluation

Assessment and evaluation are central components of the NSF/REU