

Upward Bound Chemistry at Los Angeles City College: The first year

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The Upward Bound Program

Low income American students from families where neither parent has attended college are at high risk of dropping after high school. To help these students begin college, graduate and move on to participate more fully in the economic and social life of the United States, Congress established the TRIO (three) program in 1965. Currently, over 2000 projects are hosted at over 1200 post-secondary institutions and more than 100 community agencies. TRIO programs consist of subprograms that address specific needs of students: "Educational Opportunity Centers" provide information on academic and financial aid opportunities; "Students Support Services" provide tutoring and support service to students once they reach college campus; "Talent search" and "Upward Bound" are early intervention programs. Upward Bound (UB) is designed to generate the skills and motivations necessary for college success.

The Upward Bound Program at LACC

Upward Bound is brought to LACC: The grant for Upward Bound at Los Angeles City College (LACC) was obtained by the Chair of the Theater Academy in the Fall of 1995. The UB program at LACC serves fifty students registered in grades 9-12 from six high schools in the Los Angeles City area. The selection of participating high schools comes to the different programs directly from the TRIO administration in Washington.

Recruitment of the students: The students are recruited by UB in conjunction with the counselors from each of the participating high schools. An UB counselor makes weekly visits to the high schools and holds recruitment sessions where application forms are distributed. Interested students complete an application form and submit it together with 3 recommendation letters from current high school teachers along with proof of low family income and a biographical. After the complete application is received, the student and the parents are interviewed by the Director and the counselor of the UB program. Parents are invited to the interview to assure their cooperation so that the students take advantage of the UB program to the fullest extent possible. The students

registered in the program are US citizens or permanent residents from various ethnic backgrounds. They must keep a grade point average (G.P.A.) of at least 2.0 in their high school classes.

Services Provided By The UB Program At LACC: The program promotes college preparation by providing academic training on Mathematics, English, Computers, Chemistry and Theater Conservatory. Students are encouraged to register in college by making them aware of the advantages of having a degree. This is accomplished through meetings with college graduates, in lectures and conferences, and by visiting various colleges and Universities. The program also offers seminars on cultural awareness and SAT preparation. The SAT, or scholastic aptitude test, is a standardized admission test for admission to colleges and Universities throughout the USA. Students also receive group and individualized counseling to help them choose a post-secondary school major and future occupation. In addition, several workshops are given during the year on personal development and interviewing techniques. Students are encouraged to present essays, stories and plays in foreign languages.

Schedule Of Activities: The UB runs 32 Saturdays during the Fall and Spring and during an intensive 6-week, 5-day-a-week Summer Program. During the academic year the students meet every Saturday at the Los Angeles City College campus from 8:00 AM to 3:30 PM. The six week Summer



Figure 1. The Los Angeles City College - Upward Bound Logo.

* Los Angeles City College, 855 N. Vermont Ave, Los Angeles, CA 90029. USA



Figure 2. UB Students on Field Trip to Catalina Island, California.

Program runs Monday to Friday from 8:00 AM. to 4:00 PM. Students receive academic instruction Monday through Thursday and each Friday there is a field trip to promote cultural awareness. During the Fall and Spring, when the students meet each Saturday, the field trip is once a month. The field trips include visits to universities, museums, theaters, cultural events, theme and recreation parks. The program also involves after school tutoring three days during the week.

Mathematics through pre-calculus, foreign language, chemistry courses with lab and composition/literature (play writing) are scheduled during the morning. The afternoon classes are comprised of a theater conservatory block of classes including acting, movement, speech, introduction to film, career orientation, computer literacy, interviewing techniques, scenic lighting, and costume technologies. Guest speakers, and workshops follow the regular session.



Figure 3. UB Students On Tour In The Administration Building At Los Angeles City College.

Closing Ceremony: At the end of the Summer, the program closes with a banquet and awards ceremony for the Upward Bound students and their families. The director of the program opens the ceremony summarizing the achievements of the year. Then, the students present a play that they have written and prepared during the year in the theater conservatory. The awards ceremony follows. Each teacher presents awards for the performance of the students in the class. The awards include; academic achievement, improvement, team player, perfect attendance and punctuality. The awards are given upon the recommendation of teaching assistants and professors. The banquet closes the ceremony and students have a break before the new Upward Bound cycle starts the following Fall.

College Credit: Students who participated in the 1996-1997 UB program received college credit in directed studies in chemistry, English math and/ or theater. Directed studies count as elective subjects when they register in college so that the load of subjects they have to complete for the college requirements is decreased.

UB Graduates: UB graduates are the students who finished 12th grade in their high school and attended the UB program. Five of the six senior students who finished the UB program in the Spring of 1997 are presently registered in different colleges of the United States. During the Summer that follows their graduation, these students are involved in their own program taking 6 units of college credit (paid by the UB program) during the morning and then participating in the afternoon conservatory.

The Chemistry Program

Goals: Chemistry was first included in the curriculum of the UB program in the Fall of 1996. As part of the Upward Bound program, the goals of the chemistry curriculum are



Figure 4. Students Registered In The UB Program At LACC During the Summer of 1997.

to motivate the students to register and succeed in college. Also to promote the sciences to those students embarking on a college career.

The Chemistry Curriculum: To design the chemistry curriculum we considered that students may be able to succeed in many careers if they acquire and develop effective study habits. Active participation, initiative, curiosity, good reading habits, consistency, focus and a systematic approach to problem solving are good study habits that will help them to succeed in many careers. To succeed in chemistry; knowledge of chemistry principles, reading of scientific literature, appropriate performance in chemistry laboratories, awareness of safety guidelines, mastering common laboratory techniques and use of equipment were considered. The successful chemistry student should also be aware of the environment and of ways to maintain it and to improve it. The chemistry program was designed considering that UB entertains open enrollment year around. In addition, since the chemistry background of the students ranged from none to advanced placement; the most challenging task in designing the curriculum was to make a program that was interesting, challenging and motivating for both the newcomers and the advanced students.

The Chemistry Course: To fulfill our goals we based our course on laboratory experiments and reading assignments. In our laboratory-based course a topic for the laboratory was selected and all the theory pertinent to that topic was taught. The topics were taught in modules and each module run for several sessions. The students were shown the vast array of applications of chemistry in lectures, in seminars by chemistry professionals, in field trips to Universities and through reading assignments.

The Teaching Assistants: In this program, many of the chemistry principles were taught or reinforced while performing the experiment. Teaching assistants (TAs), who are themselves college students, were in charge of this task. A teaching assistant was assigned to every group of eight UB student. Each TA worked with the same group of students for the entire semester. Their duties included guiding the students to perform the experiments, checking attendance, tutoring homework, evaluating students, and preparing the materials and equipment for the lab and lectures.

Schedule Of Classes: During the Summer, the chemistry class met four days a week. During the Fall and Spring, the meetings were once a week, three Saturdays each month. Each chemistry session lasted 90 minutes. The sessions started with a 30 minute pre-lab lecture followed by 60 minute laboratory period. When an experiment was concluded, a post-lab discussion closed the sessions.

Pre-lab session: The students received reading material regarding the topic to be covered in advance along with a

questionnaire on the same topic. During the pre-lab session the TAs checked that the students answered those questions before introducing the topic. During the Fall and Spring, the topic was introduced by a video or by the instructor. During the Summer, this was done by a TA or a student volunteer. If a video was used to introduce the topic, it was accompanied by a questionnaire. When a student volunteer gave the pre-lab lecture, it was followed by peer evaluations. Before proceeding to the laboratory, the TAs explained specific safety precautions and details about the experiment to be performed.

The laboratory: While performing experiments the students worked initially in teams and, as the course progressed, they started working individually. During the laboratory periods the TAs guided the students, answered questions, and explained chemistry principles. The most advanced students completed the experiment early and assisted the TAs in helping their fellow students.

Post-lab session: After finishing the experiment, the students, TAs and Instructor met in a post-lab session. In this session the students shared their results. Students were given post-lab questionnaires and their answers were checked during this session. The students, TAs and instructor engaged in a discussion of the results

Other Activities: The students were taken to field trips to local Universities to visit chemistry departments, to attend lectures and to talk to chemistry professionals. The last week of the course the students were given a topic to research and to present to the class during a poster session.

Topics Covered: The course was based on six different topics. These included laboratory equipment, mixtures and acids and bases, which were taught during the Fall and Spring (Saturday classes), and solid state, periodic table and polymers, which were taught during the Summer. Each one of those topics was covered by using several chemical principles and experiments. For instance, in the module on laboratory equipment one introduces measurements, units, significant figures, precision, accuracy, exponential notation and nomenclature. While studying mixtures, we covered nomenclature, matter, physical states, chemical composition and separations. With acids and bases we covered chemical reactivity, pH, indicators and titration. With the solid state, students learned various recrystallization techniques and how to build unit cells. Melting points and boiling points were introduced in the module on the periodic table and in the polymers module the students were introduced to organic structures while preparing nylon and polystyrene. They also learned about material and chemical waste and the importance of recycling plastics.

Experiments were selected from several sources and were adapted to our facilities, laboratory equipment, and



Figure 5. UB Students Prepare Nylon As Part Of The Experiments In The Polymers Module.



Figure 6. An Upward Bound Student Giving The Pre-Lab Lecture.

philosophy of teaching. The main sources were the *Journal of Chemical Education*, and the book on *Chemical Demonstrations* by Summerlin and Ealy published by the American Chemical Society.

The theoretical background required for each module was introduced on an "as needed" basis, and at the depth of coverage was dictated by the nature of the experiment. To stress the fact that chemistry is part of our daily life, some experiments were designed for the students to bring samples from home.

Results

A Laboratory-Based Course: In our laboratory-based course, once a topic for the laboratory was selected it dictated the theoretical background required to make the most out of the learning experience. This approach is in sharp contrast to the more traditional courses where theory is lectured and the principles are reinforced with experiments. Since chemistry is an experimental science, it allowed us to present the course with hands-on activities. Furthermore, this approach was embraced enthusiastically by the students. Performing experiments, always with the proper safety considerations, is fun. We dispelled one of the main misconceptions that many students encounter when they are first introduced to chemistry, i.e. that chemistry is difficult or boring.

As mentioned above, all the topics were taught in modules and each module run for several sessions: We introduced every topic assuming no previous background in chemistry. By incorporating chemistry material into modules, we exposed the students to a wide variety of principles and techniques. Since each module is self contained, the students

entered the program at various times of the year, greatly diminishing the threat of being behind or falling behind.

The Pre-Lab Session: During the pre-lab lecture the students met with their respective TAs in small groups. This type of setting provided the students with a sense of camaraderie where they felt confident in a very friendly environment. During this session, the reading assignments were checked. Reading at least once about the topic before it was presented in class increased the understanding by the student of the lecture material. When the students watched a video, a questionnaire was also given to be completed and returned at the end of the video. By including a questionnaire along with the video students focused on the material being presented. The presentation of the pre-lab lecture by the UB students during the Summer was the most successful step in this program. Students volunteered to research, summarize and present a new topic. These activities foster an independent thinker, which is an ideal attribute for a successful student in any career.

During the presentation period, students were encouraged to ask questions and at the end of the session the entire class analyzed and criticized the presentation. With this approach we introduced constructive, objective evaluations which motivated the students to do their best. Students learned that there is always room for improvement, and that they were able to have friendly academic competitions. At the same time their accomplishments were recognized.

The Laboratory: The students worked in teams and then individually while performing experiments. We found out that two students per team function more efficiently than three or more. Working in pairs gave some confidence to students who were new to chemistry. The more advanced

students learned to work cooperatively. As the class advanced, the TAs identified, on an individual basis, the students that could work independently. The experiments run several sessions allowing the students to advance at their own pace. The advanced students, who usually finished faster, assisted the rest of the class. In this situation, everybody is a winner. The TAs had help, the advanced students learned how to teach. Since "the one who teaches learns", advanced students also furthered their learning. And finally, the rest of the class received personalized attention.

Occasionally, students were asked to bring samples from home for some experiments. For example, they used flowers and vegetables as natural indicators of pH, they determined the concentration of acetic acid in commercial vinegar and classified plastic containers according to their composition for recycling. With these examples students had an opportunity to see chemistry as a relevant part of our daily life.

Post- Lab Session. The post lab lectures were necessary for the newcomers in order to convey the main idea, or principle, involved in the experiment. When a student is first exposed to a topic, he/she focuses on the technical words or new methodologies. After performing the experiment, the post-lab discussion enabled the students to put the concepts together. In this session, the data was shared to encourage collaboration and socialization with peers. Independent thinkers are desirable in any career but they should also have good social skills.

Teaching Assistants (TAs). Top students from LA City College chemistry class were selected to be TAs. The TAs were only one class ahead of the high school students. They were selected because they were highly motivated and expressed an interest in tutoring high school students. Both TAs and high school students benefited from this program. The TA's interaction with the students increased their knowledge of chemistry and their teaching ability. The TAs are also role models to the students.

Motivation: UB students are motivated individuals who commit to attend the program on Saturdays and during the Summer. Their families do not always foster a college bound student. It is easier to give up than to maintain appropriate academic involvement, good attendance, positive attitude and competition. To help motivate the students, we "awarded" points for good answers to questions on the topics being discussed. Points were exchanged for periodic tables, minerals or school materials. This approach turned many shy students into active participants. The TA's kept progress reports of each individual student and the UB director recognized outstanding students at the end of the year with certificates, calculators and molecular model sets. The UB program also gives the students a weekly transportation stipend

and a monthly cash grant. The peer evaluation resulted in one of the greatest motivations for the students to perform well and come well prepared to present their lectures.

Summary

The program was designed to give the student the opportunity to be active participants in the learning process, to promote both individual activities and team work. It included reading assignments and problem solving exercises, consistency and focus on the subject taught were rewarded. Students were exposed to a wide variety of chemistry principles and techniques. This exposure will allow them to focus on the message to be transmitted in future chemistry courses, as opposed to getting lost in technical words or definitions. The program included searches in the library and the internet, environmental awareness and the students realized that chemistry is all around us. Students were also shown the vast array of applications of chemistry in lectures and seminars by chemistry professionals, field trips to Universities and in reading assignments.

UB Chemistry At LACC; What Is Next?

The chemistry program will be offered only during the Summer. During the Fall and Spring sessions, the curriculum will focus on personal development, language classes, computer lab, workshops and theater classes. We observed that chemistry is assimilated better with the continuity of the four week Summer program, as opposed to Saturdays only. This intensive Summer session promotes the reinforcement of the material since they have the opportunity to meet one day and to review the next.

The chemistry program will be adapted to fulfill the high school chemistry requirements employing the same philosophy in teaching. Participating high schools have agreed to give credit to the students if the program covers the high school material. The topics taught will be decided according to the high school curriculum and the groups will be homogeneous as it relates chemistry background of the students.

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