

A Biology and Chemistry Primer for Undergraduate Students

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Abstract

A Biology and Chemistry Primer for Undergraduate Students (ABACUS-1) is a project that has so far developed a General Chemistry Primer which introduces basic chemistry concepts and integrated relevant practical experiments to allow a refresher for Undergraduate students and enhance better performance in science related courses regardless of pre-university subjects studied. Data on applicants' education background, enrolment and performance was obtained from the Uganda Christian University Faculty of Science and Technology and Admissions Office. Chemistry experts developed ten chapters of the Primer that was made available to students as a reference text. Feedback was obtained in a structured Knowledge, Attitude and Practice survey. Continuous performance tracking was done on tests and exams of students with whom the Primer was piloted. Data was analysed using SPSS and Microsoft Excel 2010. In the 2013/14 Bachelor of Environmental Science (BES) cohort, 3 out of 15 students had sat for Advanced Level Chemistry, 53 % of the students in this program scored below 70% in General Chemistry course unit and all scored above 65% in Environmental Chemistry I before piloting the Primer. After piloting the Primer, 80% of the students in BES program that did not sit for Advanced Level Chemistry scored above 65% in Environmental Chemistry II. In the 2013/14 Bachelor of Science in Civil and Environmental Engineering (BSCEE) cohort, 26 out of 74 students had sat for Advanced Level Chemistry, 81% of these scored above 71% in Environmental Chemistry I and 4 students who scored below 65% did not sit for Advanced Level Chemistry. After piloting the Primer, 74 % of the students in the BSCEE program who did not sit for Advanced Level Chemistry scored above 65%. The Primer could have increased the confidence of the students who did not sit for Advanced Level Chemistry thus boosting students' education and training.

Keywords: *General Chemistry Primer, Education Background, Enrolment, Performance*

1. INTRODUCTION

A Biology and Chemistry Primer for Undergraduate Students (ABACUS-1) developed a General Chemistry Primer that introduced basic chemistry concepts and integrated relevant practical experiments to allow a foundation or refresher for Undergraduate students and enhance better performance in science related courses regardless of pre-university subject combination. Science programs at Uganda Christian University especially where chemistry knowledge is required indicate that some of the enrolled students lack an Advanced Level chemistry background which affects their academic performance. This is normally reflected in the data collected by the Department of Engineering and Environment through informal interviews with

first year students during a departmental orientation about the subjects offered at an Ordinary (O) and Advanced (A) Level. This is important to introduce basic chemistry concepts and integrated relevant practical experiments to allow a foundation and/or a refresher for Undergraduate Students. It was done through development of a General Chemistry Primer for Undergraduate students incorporating relevant basic theory and practicals, piloting the Primer in selected science related courses and tracking any changes in student enrolment, uptake and performance in the selected science related courses during the study period.

2. METHODS

First, baseline data was compiled on the selected science related undergraduate courses requiring chemistry knowledge at the Uganda Christian University, as several programs included core course units in Chemistry. This included data on: applicants (numbers, education background including Advanced Level subjects taken), gender, enrolment and performance. Data on students' education background was obtained from informal interviews from the Engineering and Environment departmental first year students' orientation and data on enrollment and performance was obtained from the Faculty of Science & Technology database. Only data on the Bachelor of Environmental Science and Bachelor of Science in Civil & Environmental Engineering programs was obtained. Chemistry experts developed ten chapters of the Chemistry Primer and it was made available to Undergraduate Students in the Bachelor of Science in Civil and Environmental Engineering and the Bachelor of Environmental Science programs as a reference text during the Environmental Chemistry II course unit. Feedback was obtained in a structured Knowledge, Attitude and Practice survey. Continuous performance tracking was done on tests and exams of students with whom the Primer was piloted. Data was analysed using SPSS and Microsoft Excel 2010.

3. RESULTS AND DISCUSSION

Using knowledge on relevant environmental samples such as soil extracts, wastewater, potable water, plant extracts among others, the students were able to conceptualize more advanced uses of the General Chemistry learned and show the relevance and contextualization of the General Chemistry to applications in Environmental Science, Civil and Environmental Engineering fields thereby ensuring student appreciation for the knowledge and skills within their chosen career.

Table 1: Grading System for Universities in Uganda

Grade	Marks (%)
A(U)	80-100
B+(U)	75-79
B(U)	70-74
B-(U)	65-69
C+(U)	60-64
C(U)	55-59
C-(U)	50-54
R(U)	Retake
UN(U)	Unknown
DO(U)	Dropped off

Source: National Council for Higher Education (2006)

Table 2: Uganda Advanced Certificate of Education grades

Grade	
A	
B	
C	
D	
E	
O	
F	
NA	Not Applicable

Source: Uganda National Examinations Board (2012)

The Advanced Level grades vary with students' performance in a given year.

Figures 1 - 5 show performance of the Bachelor of Environmental Science and the Bachelor Science in Civil and Environmental Engineering students in Chemistry related subjects including General Chemistry, Environmental Chemistry I and Environmental Chemistry II which were gauged using university grades. The performance of the students in General Chemistry, Environmental Chemistry I and Environmental Chemistry II was tracked basing on Advanced Level Chemistry grades and Gender. General Chemistry and Environmental Chemistry I was done before piloting the Chemistry Primer while Environmental Chemistry II was done after piloting the Primer. The Bachelor of Science in Civil and Environmental Engineering students did not sit for General Chemistry course unit.

Bachelor of Environmental Science (2013/14)

Out of 15 students who enrolled for this program, only 3 students sat for Advanced Level Chemistry subject.

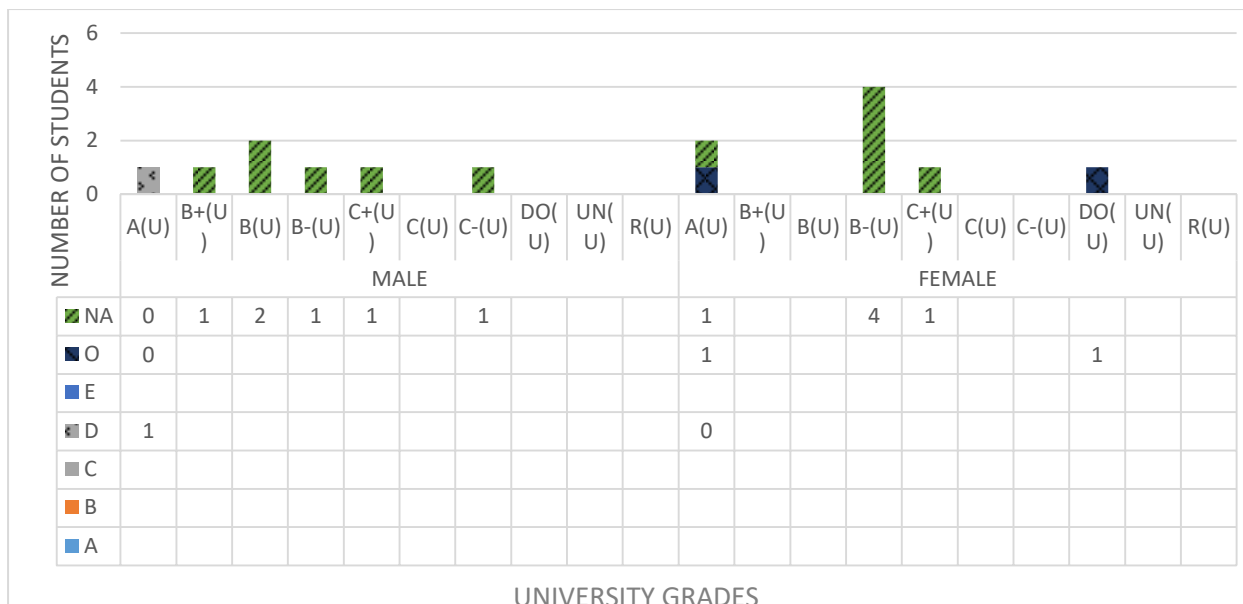


Figure 1: Advanced Level grades for students who enrolled for the Bachelor of Environmental Science and their performance at University in General Chemistry Course unit.

Following Figure 1, the general performance of students in General Chemistry was poor as 53% of the students scored below B- (65%). This poor performance could be because the majority (12 students) did not have a chemistry back ground. 100% of the students who sat for Advanced Level Chemistry scored grade A.

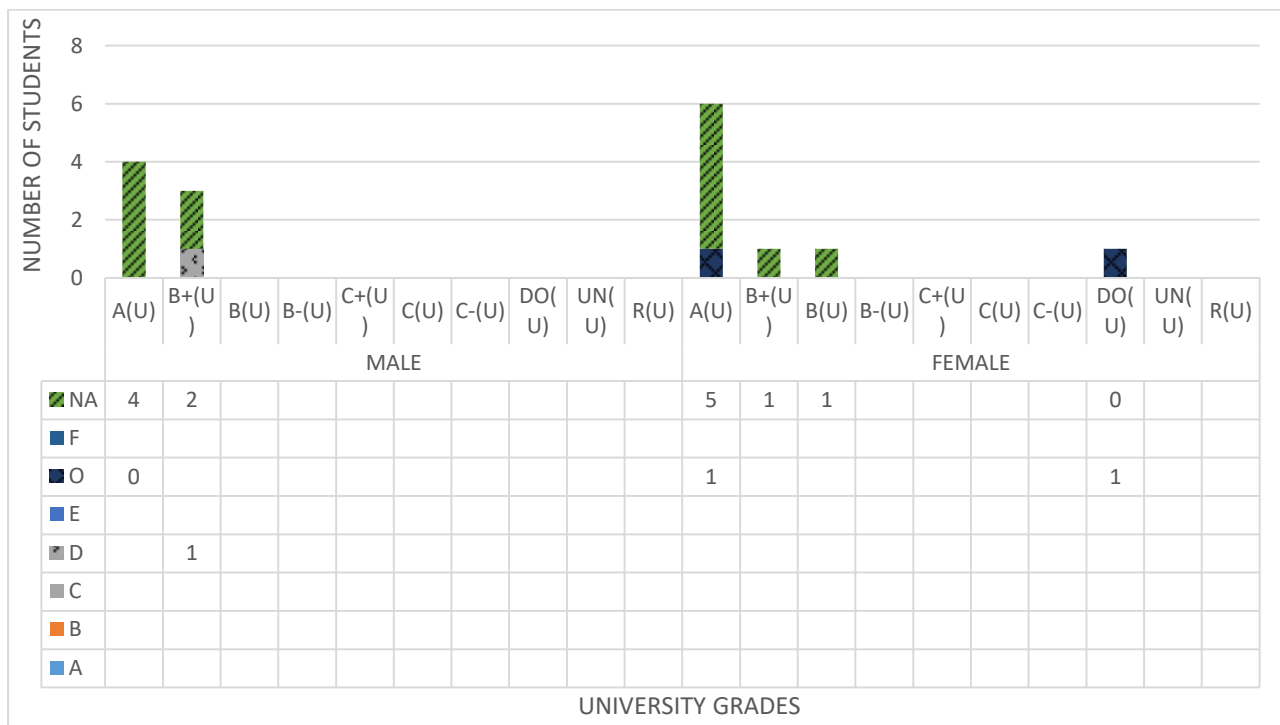


Figure 2: Advanced Level grades for students who enrolled for Bachelor of Environmental Science and their performance at University in Environmental Chemistry 1 Course unit.

As shown in Figure 2, the general performance of the students was good as the average score was A (80%) and all students scored above 70 % (B) in Environmental Chemistry I. The female students performed better than their male counterparts. All the students that sat for Advanced Level chemistry scored grade A.

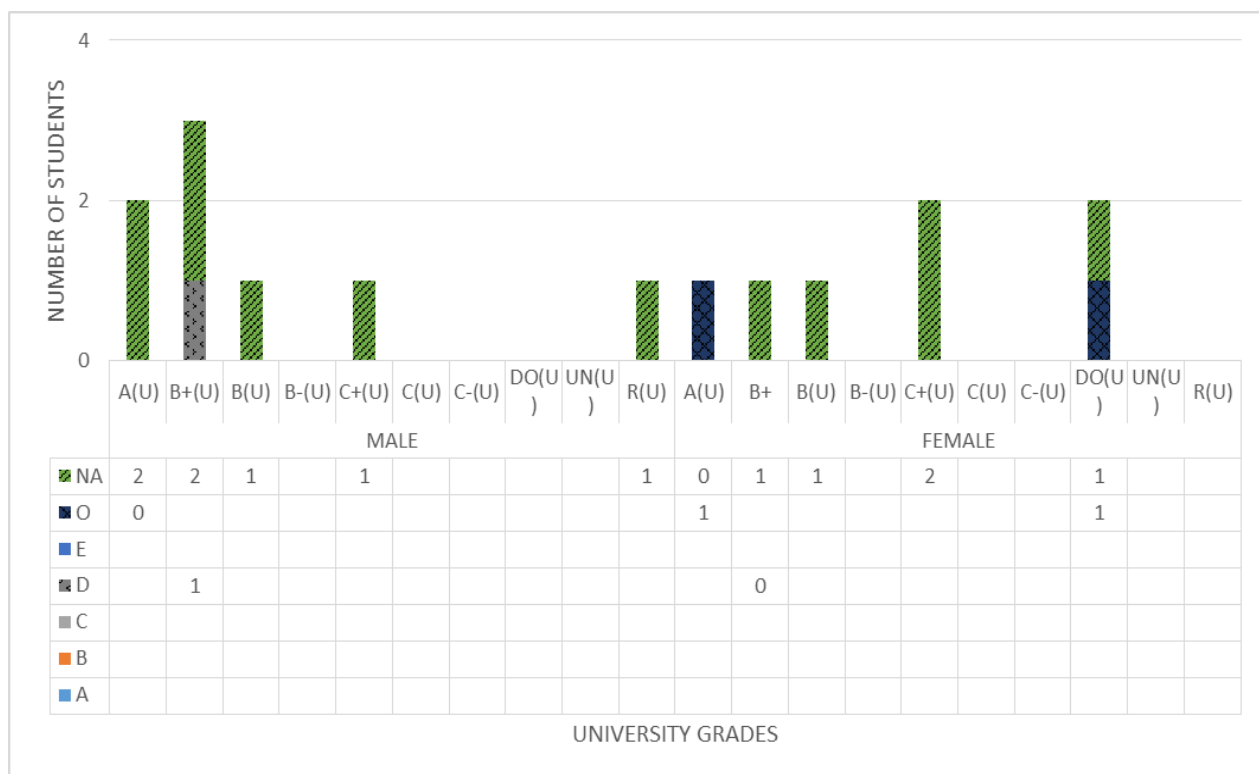


Figure 3: Advanced Level grades for students who enrolled for Bachelor of Environmental Science and their performance at University in Environmental Chemistry II Course unit.

All the students scored above 65% (C+) with best students scoring grade A in Environmental chemistry II as shown in Figure 3. The average score of the class was B (65%) and 80% of the students who did not sit for Advanced Level chemistry scored above B (65 %). This implies that students could have been referring to the Chemistry Primer.

Bachelor of Science in Civil & Environmental Engineering (2013/14)

74 students registered and enrolled for this program. Out of these, only 26 students sat for Advanced Level Chemistry subject.

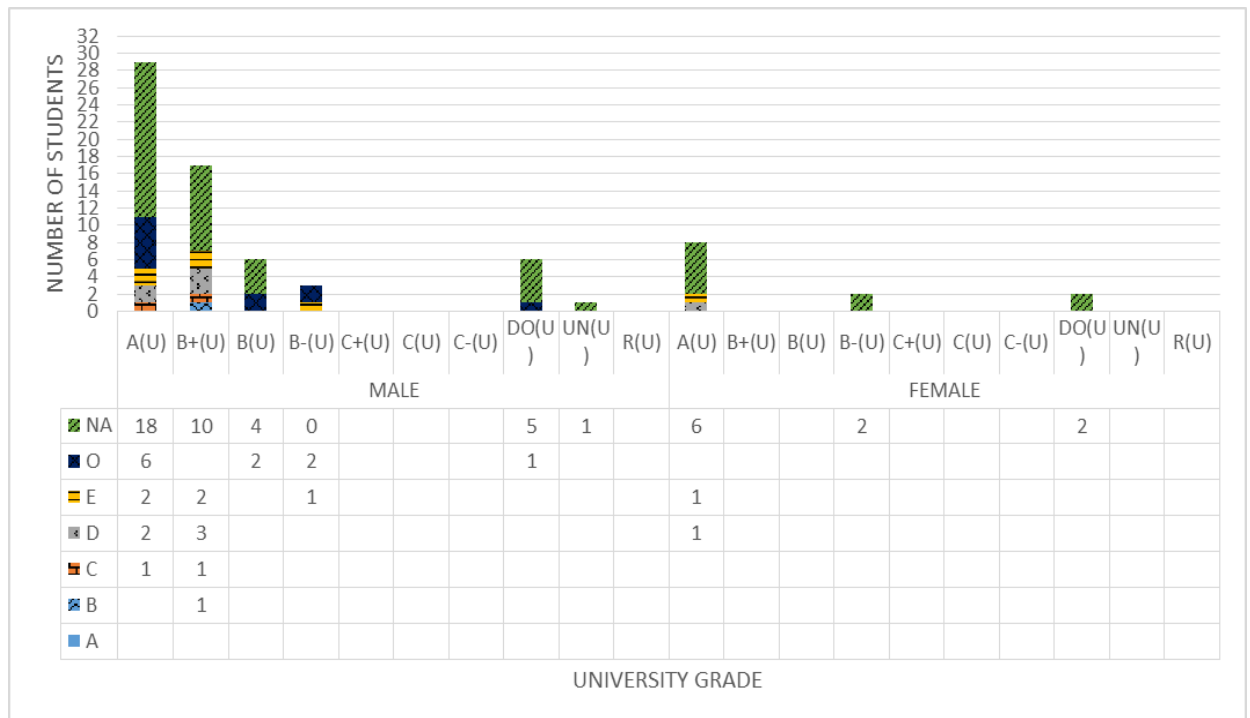


Figure 4: Advanced Level grades for students who enrolled for Bachelor of Science in Civil & Environmental Engineering and their performance at University in Environmental Chemistry I Course unit.

All the Bachelor of Science in Civil and Environmental Engineering students that enrolled in 2013/2014 scored above B- (65 %) in Environmental Chemistry I (Figure 4). 81% of the students who sat for Advanced Level Chemistry scored above B+ (75 %). The female students performed better than the male students.

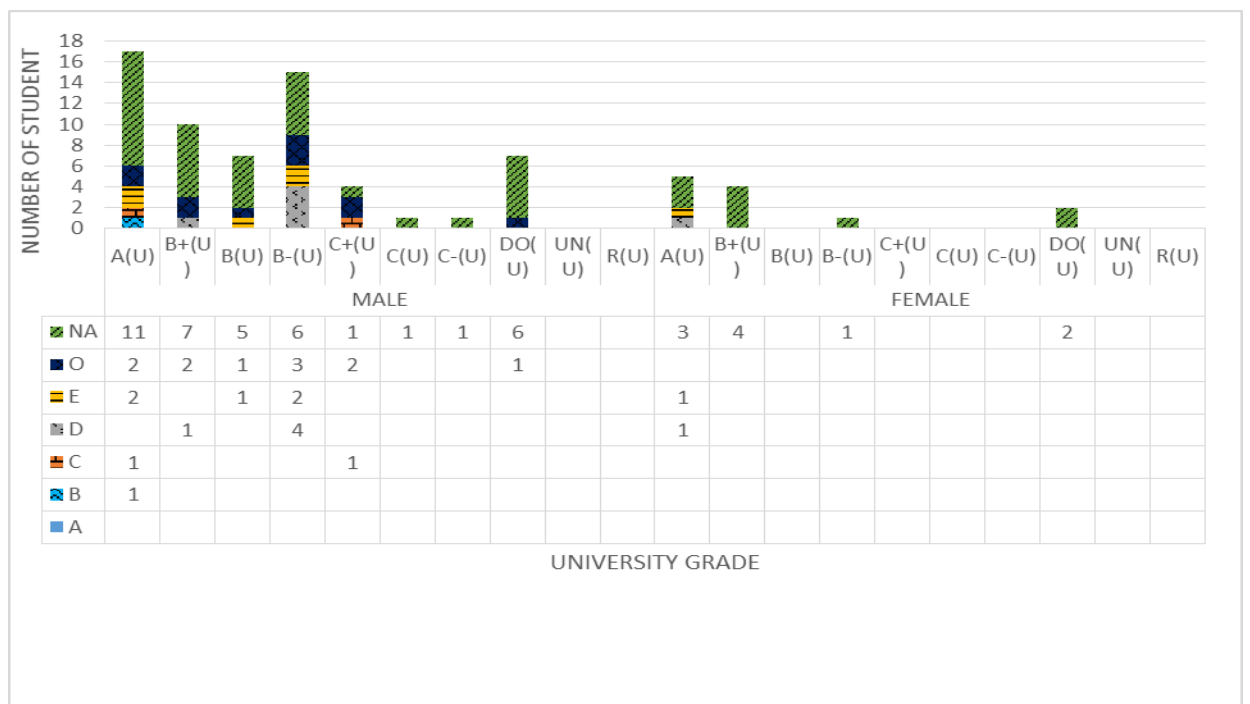


Figure 5: Advanced Level grades for students who enrolled for Bachelor of Science in Civil & Environmental Engineering and their performance at University in Environmental Chemistry II Course unit.

From Figure 5, 74 % of the students that had not sat for Advanced Level Chemistry scored above B (65%). These performed better than the students who sat for Advanced Level chemistry as they had 54% scoring above B (65%). One of the possible explanations of this performance could be that the use of the chemistry primer increased the confidence of the students who did not sit for Advanced Level chemistry.

4. CONCLUSIONS

After piloting the Chemistry Primer, findings show that the overall performance in Bachelor of Environmental Science, 80% of the students in this class who did not sit for Advanced Level Chemistry scored above grade B (65%) in Environmental Chemistry II course unit implying that students could have been referring to the Chemistry primer.

In the Bachelor of Science in Civil and Environmental Engineering, 74 % of the students who did not sit for Advanced Level chemistry also scored above grade B (65%) and performed better than the students who had sat for Advanced Level chemistry. The explanation of this improved performance could be that the use of the Chemistry primer increased the confidence of the students who did not sit for Advanced Level chemistry.

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