The Predictive Validity of CXC General Proficiency Qualification for GCE Advanced Level Success in Biology

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This study investigated the effectiveness of the Caribbean Examinations Council certification as a predictor of Advanced Level performance. The sample consisted of 287 students who wrote the Advanced Level Biology examination between 1986 and 1989 inclusive, and was drawn from all the secondary school types in Trinidad and Tobago. Kendall's rank order correlation coefficients were computed between these variables for the total sample and for sub-groups divided by school type and sex. All correlations were relatively low.

Background and Problem Statement

The prevailing social and economic conditions in Trinidad and Tobago have had a variety of effects on the country's education system, some of which have, to a large extent, been unanticipated. For example, there has been a marked shift towards the already over-subscribed science and technical, and vocational streams at all levels of the system above the Junior Secondary level, since qualification in these areas seems to offer the greatest promise of entry into the job market. However, the same conditions which have produced the increased demand for places in these streams of the school system threaten to cause a decline in the quality of the instruction offered in these areas, since these are the areas of the curriculum with the highest recurrent expenditure, and have therefore suffered the most as a result of the shrinking of the budgets experienced by all schools.

Perhaps one of the least anticipated effects of the present economic climate on the education system has been the increased demand for sixth form admission in all areas of the curriculum. The unavailability of jobs in both the public and private sectors has made school leaving at age 16, after five years of secondary schooling, an unattractive proposition.
Many students and their parents prefer to opt for two more years of schooling in the hope of gaining university entrance qualifications or, at least, of postponing the evil day. The entry qualifications for the sixth form have been stipulated by Ministry of Education regulations as five CXC passes including English Language and Mathematics, and passes at Grades I or II in all the subjects to be pursued in the sixth form. In some schools, far more students meet these criteria than can be accommodated in the available sixth form places, with the result that some of the Government-assisted seven-year schools have begun to consider raising the level of entry qualifications to accept only students with Grade I CXC passes in the subjects to be pursued at the Advanced level.

The alarmingly high failure rate at the Advanced level examinations (only about 20% gaining two or more passes) and the generally low level of the passes obtained, coupled with the increased demand for sixth form places, suggest that closer attention needs to be paid to all aspects of the sixth form level of the system. These include, the quality of instruction offered in the sixth form, the suitability of the examination set by a foreign examining body for Caribbean students, the possible amalgamation of sixth forms of different schools into centralized units so as to avoid wastage of efforts and resources, support services for sixth form teachers, and improved selection procedures for admission to the sixth form. It is to the last of these factors that this study is addressed. The study is a preliminary investigation of the effectiveness of CXC certification as a predictor of A level success.

The Caribbean Examinations Council (CXC) was established in 1973 as the regional examining body and accepted as two of its mandates:

(i) to set and maintain standards which ensure regional and international acceptance of its certificates; and

(ii) to provide acceptable certification for a larger number of candidates than the traditional 20% certified by the overseas examining boards. (Caribbean Examinations Council, 1981, p.12)

In 1979, the first subjects came on stream and certification was offered at the General Proficiency Level. In an effort to fulfill the second of the two mandates stated above, CXC introduced its Basic Proficiency Level of
certification in 1982. However, by 1984, there was still concern about the lack of recognition of the Basic Proficiency qualification.

Vigorous promotion of the aims and goals of the Council both within and outside the region, and involvement of teachers in various aspects of its work were some of the means employed to meet the requirements of the first mandate. The CXC Report for the Year 1980 affirmed that:

The General Proficiency Certificate Grades I and II was recognized as being equivalent to GCE O level Grades A, B and C by the University of the West Indies, by the University of Guyana and by the Joint Matriculation Board of the United Kingdom, which serves the Universities of Manchester, Liverpool, Leeds, Sheffield and Birmingham, as well as by admission offices in the USA and Canada. (p. 9)

To date, CXC has not undertaken Advanced Level Certification, and so, upon acquisition of CXC certificates, Caribbean students who enter the sixth form are prepared to write the Cambridge General Certificate of Education, Advanced Level. The degree of continuity between the fifth form experiences of students prepared for a Caribbean examination and the sixth form course of study in preparation for a foreign examination, is an issue that might impact on A level success.

CXC Biology was introduced in 1985 at the General Proficiency Level and certification at Grades I or II is regarded in most secondary schools as the necessary prior experience for students entering the sixth form to pursue either Biology, Zoology or Botany, or both Zoology and Botany at the Advanced Level of Cambridge General Certificate of Education. Prior to 1985, the Cambridge General Certificate of Education O level pass at grade A, B or C was the entry criterion for pursuing these A level subjects.

This study will seek to ascertain the level of correlation between CXC Biology passes at Grades I and II and A level passes in Biology. CXC assesses candidates on global performance as well as on sub-skills or attitudes, and assigns profile grades on these. In Biology, the four profiles are Recall and Understanding, Enquiry Skills, Practical Skills and Attitudes. The study will, therefore, also attempt to determine which of these profiles or combination of profiles best predict A level success. In
addition, the correlation between the GCE O level grades A, B and C, and A level pass in Biology will be explored.

Research Questions


2. How does CXC General Proficiency Grade I or II compare with GCE O level grade A, B or C as a predictor of A level success in Biology?

3. Which single profile or combination of profiles in CXC Biology best predict Advanced Level success in Biology?

4. Does the predictive validity of CXC grades for A level success vary with school type?

Literature Review

The large number of variables affecting examination performance places anyone attempting to make predictions about examination success on very slippery ground. Yet, it is a fact of school life that such predictions have at times to be made as, for example, in academic counselling of students and in the selection of students for the limited number of available places in subject streams or classes. The most frequently used basis for prediction of future success is past examination performance. Although it seems likely that previous examination performance should be a good predictor of future success, the empirical evidence suggests the exercise of caution in its use. Choppin (1972), for example, found only low correlations between A level grades and university degree classification. One could expect that where the predictor and criterion examinations are set by the same examination board, as with GCE O level and A level, the close connection between syllabuses and the common elements in the schemes of assessment, could make the levels of prediction possibly higher than when the two examinations are set by different boards. In a study of O level grades as predictors of A level success for UCCA applicants in Britain, Murphy (1981) obtained
correlations for Biology ranging from .25 to .54. He suggests that the approximate nature of the grading system as well as the unreliability of the examinations themselves might be some of the factors responsible for these moderate correlations. This study also revealed only a very approximate relationship between the grade of O level pass and the grade of A level pass, suggesting that where students with low O level grades were allowed into the sixth form, they were as likely to get high A level grades as those who entered the class with higher O level grades.

Hamilton (1981) reports a longitudinal study of 140 Jamaican sixth form students, in which scores on nine variables including O level performance, socio-economic status, school environment, study habits, early education and abstract reasoning ability were regressed on A level performance as the criterion. The results indicated that O level performance was the single best predictor of A level success, accounting for 36.6% of the variance.

The replacement of the Cambridge General Certificate of Education by the Caribbean Examinations Council Examinations has prompted some investigation into its effectiveness as a predictor of A level performance. Such investigations are especially appropriate in view of the claim by CXC that the General Proficiency syllabus aims to produce candidates "with a sufficient breadth of knowledge and depth of understanding which will allow them to undertake study of the specific subject of examination beyond the fifth year of secondary school" (CXC, 1978).

Leo-Rhynie (1984) investigated the predictive value of past performance based on GCE O level and/or CXC grades, depending on which were available, using a method of assigning numerical values which equated GCE and CXC grades. The study also investigated teachers' estimates as predictors of A level performance. She reports that for most subjects, the correlation between past performance and A level performance, and between teacher estimates and A level performance were equally significant. However, teachers' estimates were better predictors in all subjects except Chemistry and Biology where past performance was the more effective predictor. For Biology, past performance (based on GCE O level results) gave correlations of .67 and .31 for females and males respectively with A level performance. It is interesting that the sex differences revealed in these correlations are supported by the findings of others outside of the Caribbean. Mc Cammon, Golden, and Wuensch
(1988) also suggested that females are more predictable than males in this respect.

A number of studies have identified factors other than intellectual ability that are likely to affect girls' examination performance. De Boer (1986) and Zarega, Haertel, Isai, and Walberg (1986) suggest that girls might be more diligent than boys in their application to study. Hamilton (1987) reports a difference in performance between Jamaican sixth form girls attending single sex and those attending co-educational schools.

No investigations of the predictive validity of CXC Biology have been found in the literature, since this subject only came on stream in 1985 and, at least in some territories, did not replace the GCE O level Biology until later. This study investigates this relationship for a sample of Trinidad students and seeks to determine which of the four profiles or combinations of them best predict A level success.

In an evaluation of the 1985 CXC Biology syllabus, West (1989) reports a pass rate of 17% in his sample. In that year, the profile in which the largest number of Grades A was reported was Attitude, followed by Practical Skills, Enquiry Skills, and Recall and Understanding, in decreasing order. In 1986, although the overall pass rate increased to 46%, the order of award of profile grade A remained the same.

The issue of predictive validity is closely related to that of content validity, and the degree of agreement between the predictor and the criterion. Where the two examinations are set by different bodies, this agreement is not likely to be a very close one in terms of content, but may be closer in terms of the skills and attitudes, to the extent that these skills and attitudes are universally regarded as important within the discipline. The results of the regression analysis of CXC profiles on A level performance to be undertaken in the present study, are expected to be instructive in this regard.

Method

Sample: The sample consisted of 287 students who sat the Cambridge Advanced Level Examinations in the four years 1986, 1987, 1988 and 1989; and includes students from (i) one Government Sixth Form College,
(ii) Six seven-year schools, five of which are denominational and the other state-owned, and (iii) three Senior Comprehensive schools. The majority of students in the seven-year schools have attended these schools for all of their secondary school years, while most of those students from the Senior Comprehensive Schools and all those from the Sixth Form School transferred to those institutions from five- or seven-year secondary schools. The sample thus includes students drawn from all the types of secondary school experiences possible in the Trinidad and Tobago education system. Of the total sample, 135 wrote the Cambridge O level Biology examination at the end of the fifth year of secondary school, while the remaining 152 students sat the CXC examination in that subject.

**Data Collection and Analysis:** Advanced level grades for each student in the sample were obtained from the school records. The certificate is awarded at Grades A to E. A Grade O indicates that the candidate's performance was approximately equivalent to that of an Ordinary level candidate, while a Grade F denotes a performance below that standard. For purposes of analysis, each student in the sample was awarded an A level score ranging from 7 to 1; a score of 7 for a Grade A and a score of 1 for an F.

The CXC or O level grades received two years prior to their A level examinations were recorded for all students in the sample. For those students who had taken the CXC examinations, profile grades were also recorded. These were assigned scores of 1, 2 or 3 for Grades C, B and A respectively. For CXC overall grades, the scores assigned were in reverse order of the grades awarded, that is, Grades I and II were awarded a score of 2 and 1 respectively. O level grades were scored in a similar manner—Grades A, B and C were assigned scores of 3, 2 and 1 respectively.

Kendall rank order correlation coefficients (tau) were computed between all of the following variables: Sex, school type, O level or CXC score, A level score, and profiles scores in the case of CXC candidates. The sample was divided by sex and by seven-year or four- and two-year schools, and separate correlations were computed for these groups. The use of Kendall’s rank order correlation coefficients was based on the fact that letter grades do not represent a true interval scale. Nevertheless,
step-wise multiple regression analysis was carried out, regressing CXC grade score and the four profile scores on A level score as the criterion.

**Results**

Table I shows the rank order correlation coefficients between O level and A level GCE grades, broken down by sex and school type.

**Table I**

Kendall Rank Order Correlation Coeff. for GCE O level Grades and A level Grades for Seven-year and Other School Types

<table>
<thead>
<tr>
<th>Sch. Type (No. of Years)</th>
<th>Sex</th>
<th>n</th>
<th>Tau</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 4, &amp; 7</td>
<td>M&amp;F</td>
<td>135</td>
<td>.3959</td>
<td>.001</td>
</tr>
<tr>
<td>7</td>
<td>M&amp;F</td>
<td>67</td>
<td>.4719</td>
<td>.001</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>M&amp;F</td>
<td>68</td>
<td>.3088</td>
<td>.003</td>
</tr>
<tr>
<td>2, 4, &amp; 7</td>
<td>M</td>
<td>79</td>
<td>.3611</td>
<td>.001</td>
</tr>
<tr>
<td>2, 4, &amp; 7</td>
<td>F</td>
<td>56</td>
<td>.4430</td>
<td>.001</td>
</tr>
<tr>
<td>2, 4, &amp; 7</td>
<td>M</td>
<td>49</td>
<td>.3097</td>
<td>.007</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>18</td>
<td>.5597</td>
<td>.004</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>M</td>
<td>30</td>
<td>.4430</td>
<td>.003</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>F</td>
<td>38</td>
<td>.1039</td>
<td>.237</td>
</tr>
</tbody>
</table>

It should be noted that the overall coefficient for both sexes in all school types is .3959 (p = .001) and that the rank order correlation coefficient for females is higher than that for the males—.4430 (p = .001) and .3611 (p = .001) respectively. This is also true when the sample is broken down by school type, except in the case of the two- and four-year schools where
the correlation is higher for the males. Table I also shows that the rank order correlation coefficient for both sexes in higher for the seven-year schools than for the two- and four-year schools.

Considering CXC overall grades as the predictor, the rank order correlation coefficients for both sexes in all school types is .3583 (p = .001) and, as in the case of the GCE O level, the coefficient for females is higher than that for the males—.3610 (p = .001) and .1121 (p = .005) respectively, although in this case the coefficient for the males is not significant. Indeed, none of the coefficients for males in any school type reaches significance. Again, the coefficients are higher for the seven-year schools than for the other type. Table II presents the details:

Table II

Kendall Rank Order Correlation Coefficients for CXC Overall Grades and A Level Grades.

<table>
<thead>
<tr>
<th>Sch. Type (No. of years)</th>
<th>Sex</th>
<th>n</th>
<th>Tau</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 4, &amp; 7</td>
<td>M&amp;F</td>
<td>152</td>
<td>.3583</td>
<td>.001</td>
</tr>
<tr>
<td>7</td>
<td>M&amp;F</td>
<td>128</td>
<td>.3794</td>
<td>.001</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>M&amp;F</td>
<td>24</td>
<td>.0889</td>
<td>.317</td>
</tr>
<tr>
<td>2, 4, &amp; 7</td>
<td>M</td>
<td>40</td>
<td>.1121</td>
<td>.220</td>
</tr>
<tr>
<td>2, 4, &amp; 7</td>
<td>F</td>
<td>112</td>
<td>.3610</td>
<td>.001</td>
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<tr>
<td>7</td>
<td>M</td>
<td>31</td>
<td>.0172</td>
<td>.459</td>
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<td>7</td>
<td>F</td>
<td>97</td>
<td>.3663</td>
<td>.001</td>
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<tr>
<td>2 &amp; 4</td>
<td>M</td>
<td>9</td>
<td>.0459</td>
<td>.079</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>F</td>
<td>15</td>
<td>.0237</td>
<td>.174</td>
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</tbody>
</table>
Table III gives rank order correlation coefficients between individual CXC profiles and A level grades. All profiles are significantly correlated with the A level performance when two-, four- and seven-year schools are combined. However, when the CXC sample is separated by school type, the correlations for the two- and four-year schools fail to reach significance.

**Table III**

Kendall Rank Order Correlation Coefficient for CXC Profiles and A Level Grade.

<table>
<thead>
<tr>
<th>Sch. Type (yrs.)</th>
<th>Sex</th>
<th>n</th>
<th>RU Sig.</th>
<th>ES Sig.</th>
<th>PS Sig.</th>
<th>A Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>M&amp;F</td>
<td>128</td>
<td>.4585</td>
<td>.001</td>
<td>.3661</td>
<td>.001</td>
</tr>
<tr>
<td>2 &amp; 4</td>
<td>M&amp;F</td>
<td>24</td>
<td>.0447</td>
<td>.405</td>
<td>-.0671</td>
<td>.360</td>
</tr>
<tr>
<td>2,4 &amp; 7</td>
<td>M&amp;F</td>
<td>152</td>
<td>.4259</td>
<td>.001</td>
<td>.3450</td>
<td>.001</td>
</tr>
</tbody>
</table>

**Key:** RU = Recall and Understanding
ES = Enquiry Skills
PS = Practical Skills
A = Attitude

The results of the multiple regression analysis for CXC profile grades for females in 7 year schools are shown in Table IV.
Table IV

Multiple Regression Table for CXC Profiles and A Level Grade for Girls in 7-year Schools.

<table>
<thead>
<tr>
<th>CXC Profile</th>
<th>Multiple R</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU</td>
<td>.54244</td>
<td>.29424</td>
</tr>
<tr>
<td>A</td>
<td>.56532</td>
<td>.31958</td>
</tr>
<tr>
<td>ES</td>
<td>.57707</td>
<td>.33301</td>
</tr>
<tr>
<td>PS</td>
<td>.587719</td>
<td>.33305</td>
</tr>
</tbody>
</table>

Key: RU = Recall and Understanding  
     A = Attitude  
     ES = Enquiry Skills  
     PS = Practical Skills

Discussion

These results suggest that overall GCE O level performance served as a slightly better predictor of A level performance than did CXC grades (Rank Order Correlation coefficients approximately 0.04 and 0.36 respectively). The coefficient for GCE is somewhat lower than that reported in 1984 by Leo-Rhynie (.64) but the larger sample size used in the present study (135 as opposed to 42 in the 1984 study) suggests that the present correlation values might be more representative of the Trinidad and Tobago population. It should not be surprising to find that GCE O level serves as a better predictor of A level performance, since in this case both the predictor and the criterion examinations are set by the same examining body, and are more likely to reflect common schemes of assessment and a degree of continuity of content, both in terms of topics and skill requirements.
Sex differences in the reliability of prediction from both GCE O level and CXC are interesting. Previous work, both in the region (Leo-Rhynie, 1984) and internationally (Mc Cammon, Golden, & Wuensch, 1988) support the findings of this study that girls' examination results are more reliably predicted from past examination performance that are boys' results. A possible explanation for this lies in the differences in application to study observed between girls and boys. For example, De Boer (1986) found, in a study based on self-report data, that girls worked harder than did boys while Zarega et al (1986) noted that girls reported doing more homework than boys. It might be that for girls, where attitudes to school appear to be more positive and application to study seems to be greater, intellectual ability as measured by past examination performance is the most important predictor. For boys, on the other hand, who often apply themselves less diligently, application to study in the sixth form may prove to be a more reliable determinant of A level performance, than intellectual ability.

The relatively low correlations point to the fact that a large number of variables other than past performance determine future academic success. In the two years which intervene between O level/CXC and A level, such variables as psychological factors associated with maturation and school experience, are likely to have a profound effect on A level results. The present study gives some support to the importance of school experiences in the determination of A level performance. Both GCE O level and CXC prove to be more reliable predictors of A level success in the seven-year schools than in the two- and four-year schools. It is true that based on the Common Entrance Test results, the seven-year schools receive the highest achievers, but since entry requirements into the sixth form for all schools is a Grade I or II, the effect of ability differences can be considered to be reduced by the time that students enter the sixth form.

The observed differences in the reliability of prediction must, therefore, be due to differences in the school experiences of students who attend sixth form in seven-year schools and those who go to two- or four-year schools. One such difference might well be due to the fact that most sixth formers in the seven-year schools have been students of the same school for their entire secondary school careers, while their counterparts in the two- and four-year institutions have experienced some measure of discontinuity in the teaching strategies, school climate and administrative structures in which the teaching and learning occurs. In addition, the
seven-year schools have long established sixth form traditions and are more likely to have developed the staff and material resources needed for effective teaching and learning in the sixth form. This factor becomes even more crucial in light of the fact that the A level syllabus gives relatively little guidance as to the scope and depth of treatment required. The absence of stated objectives in that syllabus gives the teacher little beside experience of past A level teaching to rely on. Sixth form teachers in the four-year schools are likely to be somewhat disadvantaged in this respect.

Another factor mediating the effect of school type revealed in the results of the present study might well be the fact that, of the six seven-year schools included in the sample only one was co-educational, while the two-year Sixth Form school and all of the four-year Senior Comprehensive schools were. Hamilton (1987), in a study of Advanced level performance in science in Jamaican schools has reported that girls in the single-sex schools have out-performed their counterparts attending co-educational schools in the sciences, and that girls gained a larger percentage of passes than did the boys in the biological sciences. It may be that the higher correlations between both GCE O level and CXC for girls in seven-year schools over girls in the two- and four-year coeducational schools is due in part to the interaction between gender and school type.

Perhaps the most important finding of this study has to do with the ability of CXC profile grades to serve as predictors of A level examination results. The results of the multiple regression analysis indicate that of the four profiles, Recall and Understanding accounted for 29% of the variance in A level performance; Attitude accounted for an additional 3%, and Enquiry Skills only contributed 1% over the combined effect of Recall and Understanding and Attitude. A further 1% was accounted for by Practical Skills. The weighting of these profiles in the determination of the overall score is: Recall and Understanding--35%; Enquiry Skills--5%; Practical Skills--20% and Attitudes--20%. Clearly, the order in which these profiles appear in the regression equation is not due to their weighting towards the final grade, but reflects their real importance as predictors of A level performance.

The issue of predictive validity is related to that of content validity. If the content, in terms of knowledge and skill requirements of the criterion
examination, is similar to that of the predictor, then higher correlations are likely to exist between predictor and criterion. Perusal and analysis of the A level Biology examination papers for 1988 and 1989 revealed that approximately 68% of the questions could be classified as recall and understanding questions. If, in fact, the A level Biology examination generally tests recall and understanding of facts more that it does inquiry, then schools might be well advised to take the CXC recall and understanding profile as well as overall grade into consideration when making selections for sixth form entry.

The problem of low A level examination performance is one that needs attention. It is clear that a large number of variables intervene between the writing of the CXC examination and the A level examination, to determine the outcome of the latter. Possibly, the establishment of sixth form schools where the material and human resources could be most effectively employed would reduce the present wastage with its consequent lowering of achievement levels. In addition, it seems imperative that CXC begins to provide Advanced level certification so that Caribbean students could benefit from a system that allows continuity of experience throughout their seven years of secondary schooling. It is likely that prediction of success in such an examination, from the CXC General Proficiency level, would be more reliable, and that selection for sixth form entry could be placed on a surer footing.

References


