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THE PREDICTION OF ACADEMIC SUCCESS:
AN INTERIM REPORT

Marlene A. Hamilton

Introduction

Prediction-type research deals, in a general sense, with the functional relations between a criterion of success and events occurring before. One chooses a number of tests or measures for tryout, and then determines their predictive effectiveness in respect of the designated criterion. In this investigation, the main focus is to enquire into the extent to which measures of a student’s ability, coupled with other related inputs (the “events occurring before”) predict success or failure in an academic course of study. The methodology employed is that of a longitudinal study begun in 1975, concerned with tracing the level of academic performance of a group of Jamaican students from High School through University. At time of writing, these students are completing their third (and for some, final) year at University; hence this interim report deals mainly with salient points of their High School history, focussing on the predictive value of selected variables (including the General Certificate of Education “Ordinary” level results) on performance at “Advanced” level. Data have been subjected to multiple regression computations in attempting to arrive at the best predictors of “A” level performance.

There have been numerous studies mounted along similar lines, but to date, no such work has been published for Jamaica specifically. On the international scene, research has pointed to several possible influential inputs to academic success. Rosen et al. [25], Havighurst and Bresee [8], Morris [21], Stevens [28] and others, have found socio-economic status to be directly related to students’ performance in High School, most of these researchers identifying specific aspects of S.E.S. — parental occupation, interest and encouragement, intellectual tone of the home and the like — as having a particularly important role in boosting performance.

The school environment has also been shown to exert a dominant effect on achievement, although some controversy exists as to whether school or home plays the bigger part. Douglas [34] is of the opinion that a “good” school can compensate for the inadequacies of the home; and while not concerning themselves with the home/school controversy, Himmelweit and


Swift [10] do attest to the strong influence which the school exerts on students’ performance. Aspects of the school environment such as emphasis on examinations (as well as the general academic orientation level), highly qualified staff, good teaching and favourable conditions of the school plant itself, have all been highlighted in this context (Reid [24], Rosenfield et al. [26], the Joint Working Party on Sixth Form Curriculum and Examinations in the United Kingdom [27]).

In terms of personal properties of the students themselves, study habits, academic orientation, previous educational experiences and level of mental functioning emerge as important qualities. Heim and Watts [9] identified a markedly significant relationship between overall success at “O” and “A” levels with scores on a high level test of reasoning, while MacFarlane Smith [18] and others have noted the input of cognitive aspects such as abstract reasoning and spatial ability on performance, especially in the sciences. In her locally based research, Leo-Rhynie [16] concluded that these concerns represented intellectual skills well suited to “A” level, where fairly complex cognitive tasks are required.

Good study habits have been linked to performance in numerous studies (Lavin [15], Entwistle and Entwistle [4], Holtzman and Brown [11] and many others), while attitudes to, and interest in specific subjects, coupled with vocational aspirations, have been equally well supported as important inputs to academic success (Jordan [14], Evans [5], Biggs [2]).

In terms of previous examination results, one’s early educational experiences have been proven to markedly affect later performance. The predictive value of the Common Entrance Examination to High School (11+) has been demonstrated locally in terms of “O” level achievement (Manley [19], Thompson [29], Hamilton [7]), and in similar manner, “O” level performance has been shown to predict “A” level achievement (NFER Report [23], Morris [22], Lewis [17], Heim and Watts [9], Leo-Rhynie [16], Morris [21]). School assessment has also been identified as a useful predictor of performance at “A” level — in fact, the NFER Report [23] makes the point that

the predictive contribution of “O” level and school assessment is greater than had been supposed (p. 63).

Although Lewis [17] cautions that success at Advanced Level is more likely in subjects in which a high, rather than merely an adequate Ordinary Level grade has been obtained (p. 94).

It thus appears, from reviewing the literature, that the aspects considered above represent the most promising variables for research purposes.

Delimiting the Sample

In 1975, a sample of 576 students preparing to sit the G.C.E. “O” level examinations was drawn at random from seven High Schools in urban and rural Jamaica. Certain conditions were proposed, in that the sample was to be spread “across the board”, including all streams, and with students drawn from single sex as well as co-educational institutions. Information on 30 independent variables (classified as Educational, Personality and Environmental) was ascertained, and performance on the “O” level examinations was employed as the criterion measure. (A complete report of the findings appears elsewhere).

At the start of the following academic year (1975/1976) the writer identified those of the original sample who had entered Sixth Form, intending to pursue “A” levels, along with the options they had decided upon. Cards which had been key-punched for these students (176 in all, 30.6 percent of the “O” level sample) were retrieved, the intention being to retain information on certain relevant variables for the follow-up investigation.

During their second year in Sixth Form, this sample was checked again, and it was discovered that some 36 Ss had “dropped out” of the “A” level course. As a result, there remained 140 Ss (24.3 percent of the “O” level sample) whose progress through to graduation was traced. For these students, school marks on the “A” level “screen test” (written at the end of the first year in Sixth Form) were ascertained, and performance in the “A” level examinations (1977) recorded as the criterion measure. In all, data on ten variables were collated for the 140 Ss.

Table 1 illustrates the composition of the sample sex-wise, at Fifth and Sixth Form.
TABLE 1

Composition of the Sample According to Sex of Ss

<table>
<thead>
<tr>
<th>Level</th>
<th>No. of Male Ss</th>
<th>No. of Female Ss</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth Form</td>
<td>248</td>
<td>328</td>
<td>576</td>
</tr>
<tr>
<td>Year 1 Sixth</td>
<td>82</td>
<td>94</td>
<td>176</td>
</tr>
<tr>
<td>Year 2 Sixth</td>
<td>71</td>
<td>69</td>
<td>140</td>
</tr>
</tbody>
</table>

Description of the Variables

Var-1 – Early Education (EEd): Scores on this variable reflected the cumulative effects of early education, including considerations such as the age at which a student started school, the type of school he or she attended, as well as performance on the 11+ examination for entry to High School. Scaling of responses on these items gave a range of 0 to 15 derived as follows:

Age 3/Prep School/11+ pass = 15  Age 3/Prep School/no 11+ pass = 7
Age 3/Primary School/11+ pass = 14  Age 3/Primary School/no 11+ pass = 6
Age 4/Prep School/11+ pass = 13  Age 4/Prep School/no 11+ pass = 5
Age 4/Primary School/11+ pass = 12  Age 4/Primary School/no 11+ pass = 4
Age 5/Prep School/11+ pass = 11  Age 5/Prep School/no 11+ pass = 3
Age 5/Primary School/11+ pass = 10  Age 5/Primary School/no 11+ pass = 2
Age 6/Prep School/11+ pass = 9  Age 6/Prep School/no 11+ pass = 1
Age 6/Primary School/11+ pass = 8  Age 6/Primary School/no 11+ pass = 0

(The last set of scores in both “passes” and “failures” of the 11+ also obtained for those who started school later than at age six years).

The rationale on which this scaling was based was as follows: it has been well substantiated that provided the experiences a child encounters are favourable, the earlier he goes to school, the more likely he is to gain the sound foundation necessary for later academic success. The private Preparatory Schools generally provide more favourable learning experiences than the overcrowded Primary Schools, which, in the main, lack all but the barest educational facilities and the like. The 11+ examination marks the termination of pre-secondary schooling, and provides an indication of the child's educational achievement level up to that point.

Var-2 – Socio-Economic Status (S.E.S.): The complexity of social class identification was recognised, so it was decided to employ a measurement procedure widely used in local research – that of identifying parental occupational level – and to couple it with additional information on parents' level of education, influence on, and interest in the child's education, intellectuality of the home, and relevant biographic data (birth order, family size, stability of family life). The Miller Occupational Index2 was used to rate parental occupational level, and this, together with scores from the other items, provided a range from 0 to 25 points on this variable.

Var-3 – School Environment (SchEnv): There were several aspects considered in the measurement of this variable – ratings of the school plant (library, laboratories, geography room, equipment, facilities, etc.) timetabling (length and frequency of periods) as well as ratings of the teachers themselves (qualifications and experience) since they represent an important part of the school environment. Ratings were determined on a school basis, as well as for each student specifically (in accordance with the options being pursued). In other words, while a student studying arts options might have, in his score, an input reflecting the school's science facilities in general, for example:

- the number of laboratories
- basic equipment, including gas, water and electrical outlets
- accommodation provided for the student body in the laboratories, etc.

there would be no specific input for science facilities added to this score. However, his counterpart taking Zoology, in addition to the general measure calculated for the school, would gain extra points which take into account details of the provisions made for teaching Zoology specifically.

No predetermined range of scores could be identified for this variable, since several components of the measure (for example, number of teachers involved at the Sixth Form level) differed widely among the institutions.

Var-4 – Academic Orientation (AOC): Measures of vocational aspirations, favourite subject and “type” of student (orientation towards arts or sciences) comprised this variable, higher scores being awarded when these three aspects complemented each other and were in accordance with the options to be taken at “A” level. For example, a student hoping to become a Chemist, who selected Chemistry as his favourite subject, who considered himself a science
student, and who was reading Chemistry at “A” level, would obtain a much higher score than one for whom those aspects were not congruent with each other. Scores on this measure ranged from 0 to 11.

Var-5 — Study Habits (StHab): Measures of this variable included reading habits as well as students’ methods and habits pertaining to academic study – completion of home-work assignments, methods employed in studying, and amount of time devoted to private study. The range of scores on this variable was 0 to 8, obtained by totalling all scores awarded to the various component parts.

Var-6 — Abstract Reasoning (AbReas): The Differential Aptitudes Test of Abstract Reasoning, consisting of 50 items, had been given to the sample while in their Fifth Form year. Scores were retained for the present analysis, the range being 0 to 50.

Var-7 — Space Relations (SpRel): As in Var-6, scores obtained from the D.A.T. Space Relations instrument administered at Fifth Form were retrieved, the range in this instance, being 0 to 40.

Var-8 — G.C.E. “O” Level Performance (OLev): The scaling method employed by Cambridge in grading these examinations (Grades 1 and 2 being distinction, Grades 3 to 6, pass, and 7 to 9 failing grades) was reversed so that the higher grades would represent a better level of performance. Grades on all subjects taken at “O” level were therefore ascertained, reversed and summated to provide the index needed.

Var-9 — Screen Test Performance (ScrT): Obtaining an index for this variable proved more difficult, in view of the fact that this measure had to be obtained from internal school examinations taken at the end of the first year of Sixth Form. The attempt was made to convert marks given to an approximation of the Cambridge grading system (reversed), and, as in the case of Var-8 these were totalled to provide one index.

Var-10 — G.C.E. “A” Level Performance (ALev): This variable was also dealt with as in Var-8 — the Cambridge grades being reversed and totalled — and the resultant index was employed as the criterion measure in this research.

The Findings

The list of variables, their coding, mean scores and standard deviations, are displayed in Table 2 for the total sample of 140 Ss.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Var-1 EEd</td>
<td>10.865</td>
<td>4.034</td>
</tr>
<tr>
<td>Var-2 SES</td>
<td>17.652</td>
<td>3.110</td>
</tr>
<tr>
<td>Var-3 SchEnv</td>
<td>259.858</td>
<td>49.046</td>
</tr>
<tr>
<td>Var-4 AcOr</td>
<td>6.780</td>
<td>2.998</td>
</tr>
<tr>
<td>Var-5 StHab</td>
<td>4.965</td>
<td>1.227</td>
</tr>
<tr>
<td>Var-6 AbReas</td>
<td>33.376</td>
<td>7.345</td>
</tr>
<tr>
<td>Var-7 SpRel</td>
<td>10.213</td>
<td>6.681</td>
</tr>
<tr>
<td>Var-8 OLev</td>
<td>37.801</td>
<td>12.037</td>
</tr>
<tr>
<td>Var-9 ScrT</td>
<td>22.000</td>
<td>7.598</td>
</tr>
<tr>
<td>Var-10 ALev</td>
<td>16.028</td>
<td>6.662</td>
</tr>
</tbody>
</table>

Reliabilities were not estimated for each of these variables, since, in the main, they represent dimensions of the cognitive/intellectual domain which, along with Socio-Economic Status, have, in numerous other researches, been generally found to exhibit reliability estimates in the order of .7 to .8. One notes, however, the large standard deviations on Space Relations (Var-7) and the performance measures (Vars-8, 9 and 10) pointing to the very diverse spread of scores gained.

As a prelude to the major statistical analysis proposed — stepwise multiple regression analysis — a correlation matrix had to be computed. This is displayed in Table 3, with the incidence of significant correlations indicated at the 5 percent and 1 percent levels respectively.
Stepwise multiple regression analysis mounted with the nine independent variables against the criterion measure, ALev, explained overall, 50.8 percent variance. The first four independent variables proved to be making significant prediction, as shown in Tables 4 and 5 below, explaining 49 percent variance in the criterion.
TABLE 4
Details of Variables Entered
at Each Step of the Regression Equation

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Multiple R</th>
<th>R Square</th>
<th>R Square Change</th>
<th>Computed T-Value</th>
<th>Sig. of Coeff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLev</td>
<td>0.605</td>
<td>0.366</td>
<td>0.366</td>
<td>8.949</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>SchEnv</td>
<td>0.661</td>
<td>0.442</td>
<td>0.076</td>
<td>4.336</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>ScrT</td>
<td>0.678</td>
<td>0.460</td>
<td>0.018</td>
<td>2.172</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>AcOr</td>
<td>0.700</td>
<td>0.490</td>
<td>0.030</td>
<td>-2.797</td>
<td>p &lt; .01</td>
</tr>
</tbody>
</table>

TABLE 5
Significant Predictor Variables
Emerging from Regression - Step 4

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OLev</td>
<td>0.16131</td>
<td>0.05667</td>
<td>2.846</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>SchEnv</td>
<td>0.03927</td>
<td>0.00931</td>
<td>4.219</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>ScrT</td>
<td>0.24483</td>
<td>0.08723</td>
<td>2.807</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>AcOr</td>
<td>-0.39961</td>
<td>0.14285</td>
<td>-2.797</td>
<td>p &lt; .01</td>
</tr>
</tbody>
</table>

F = 32.608 (p < .01)

As mentioned earlier, these four variables — “Ordinary” Level Performance, School Environment, Screen Test and Academic Orientation — together explain 49 percent of the variance in the criterion, while addition of the other five variables (not shown in the tables) only increases the variance by 1.8 percent to 50.8 percent. OLev explains 36.6 percent, School Environment, 7.6 percent, Screen Test, 1.8 percent, and Academic Orientation, 3 percent.

It is noteworthy that School Environment appears at Step 2, with its significant contribution of 7.6 percent to ALev highlighting the importance of the educational milieu in which a student’s academic potentialities are cultivated. Noteworthy too, is the contribution of Screen Test: although it is highly correlated with OLev, it nevertheless contributes significantly to ALev, being entered into the regression equation at Step 3.

Discussion

It might have been expected that the cognitive variables, Abstract Reasoning and Space Relations, would have contributed to “A” level performance, since the more complex and abstract nature of “A” level studies demands of the student such higher order skills. However, researchers such as Hudson [12] make the point that although possession of these skills is necessary, it is rather the use to which they are put that underscores their importance in an academic setting.

One would have also thought that the importance of good study habits at this level would have been revealed, but this variable did not feature at all. Less unexpected, however, is the absence of an S.E.S. input, since some researchers such as Furneaux [6] suggest that the influence of this variable fades by the time the student enters Sixth Form, and thus has little effect on his achievement.

The emergence of “O” level performance as the best predictor of the criterion, justifies its being employed to rate a student’s eligibility for Sixth Form; and although the examination was not designed to serve this purpose, it is widely used as a predictive measure of “A” level success. Screen Test results, although appearing in the regression equation after OLev, also seem to serve a useful predictive function; while the emergence of Academic Orientation suggests that students who are happier and more comfortable with their choice of options are those more likely to succeed at them.

Possibly the most important outcome of this research is the appearance of the School Environment variable as the second strongest predictor. Despite previous findings which downplay the role of the school environment, it is obvious that, at least at Sixth Form (and one might suggest, throughout High School, since at Sixth Form the cumulative effect of the school’s
influence is represented) this plays a vital part in achievement. It appears,
as Banks and Finlayson [1] imply, that the school exerts an effect on achieve-
ment which is independent of ability and home environment. This effect, it
has been shown, evolves partly from the teachers themselves, as well as from
other features of the school. The implications of teacher effect have long
been recognised: for example, the Joint Working Party on Sixth Form Curri-
culum and Examinations in Great Britain [27] recognised that the high
standards attained at Sixth Form were the result of quality teaching; while
local research mounted by Isaacs [13] and Hamilton [7] has demonstrated
a strong bond between teacher effectiveness and performance of Secondary
level students in Mathematics and Science respectively.

The Working Party on Post “O” Level Education in Jamaica [20],
having highlighted the inadequacy of the Sixth Form teaching staff, made
the point that ideally such teachers ought to be professionally trained
university graduates of some years’ teaching experience. The Working Party
also recommended the establishment of Sixth Form Colleges, so that the
academic resources (including teachers) required at this level could be pooled;
but to date, this recommendation has not been widely implemented, despite
its obvious worth in both economic and achievement terms, and despite the
fact that there has been a general low level of performance in the “A” level
examinations. In 1976, for example, of the 1,104 students sitting two or
more subjects, only 32.6 percent were successful in gaining at least two
passes.

Two recommendations emanate from the findings of this research. First
of all, in light of the predictive value of “O” level results, it seems desirable
that Sixth Form entry requirements be made more stringent in the hope of
improving “A” level performance. Secondly, the need for the establishment
of Sixth Form Colleges as suggested by the Post “O” Level Working Party
[20] appears more urgent if one hopes ultimately to improve the quality of
the academic environment. The Jamaican Government invests a disproporti-
nate amount of its annual education budget in High School education –
fairly recent allocations being $500 per capita expenditure per annum, as
against $250 for the New Secondary and $100 for the Infant, Primary and
All-Age Schools. Additional funding is made available to High Schools
offering an “A” level course of study, despite the fact that there may be, for
some options, a teacher/pupil ratio as low as 1:3. Features such as this
emphasize the wastefulness of manpower, facilities, equipment and the like
which presently obtain – wastefulness which the country certainly cannot
countenance in its current economic crisis, and which in any event, ought
not to exist at all.

One would expect, or at least hope, that through a Sixth Form
College structure which will draw together the best teachers in each subject
area, which can offer a wider scope of courses of study, and which is able to
provide suitable equipment, better library provision, and in general, a more
favourable learning environment, the chances of there being a higher standard
of performance among the students sitting “Advanced” level examinations
might well be improved.

NOTES

1 The main report is to be found in the author’s Ph.D. thesis, A Study of
   Certain Personality, Educational and Environmental Variables Associated
   with Science Orientation in a Selected Sample of Fifth Form Students in

2 This Index was originally based on the 1960 Jamaica Census, Central

3 These data are presented in an unpublished paper by M. Morrissey, School
   of Education, U.W.I., entitled, “Have Academic Standards in High Schools
   Fallen?” (1980, March).

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[1] BANKS, O., FINLAYSON, D., 1973, Success and Failure in the
   Secondary School, Methuen.

   Arithmetic-Number Anxiety”, Ed. Research 1, pp. 6-21.


CROSS-SECTIONAL STUDY IN SPATIAL ANALOGY AND CODING
Gagindra Persaud

Four chronologically different groups of students — two from a private secondary school and two from the University — were administered a spatial analogy test and a coding test. The results point to marked superiority in performance by the younger groups, especially on the spatial analogy test. The relationships between the two tests range from low negative for the youngest group to positively significant for the oldest group. The relationships between the two tests when the scores were combined for the two younger groups and for the two older groups, do not differ significantly from each other, but that for the older group is again positively significant. The total results of the tests have implications for a theory that intellectual functioning declines as age increases.

Introduction
Decline of intellectual functioning in adults and older individuals can be explained in terms of a large number of factors, acting singly, but more so, collectively. Such factors include general health, nutrition, the ages at which schooling commenced and terminated, the quality of schooling, income, opportunities, occupation, motivation, interests, educational and technological advances and socio-cultural changes. Although it is generally recognized that as individuals grow older their abilities decrease, this decrement is not universal, for it depends quite apart from the factors mentioned above, on the individual and the ability in question. Available research data on this issue are contradictory, which has made it once more an important area of investigation.

The issue of intellectual decline with age is discussed by Guilford [6], and some of the effects of schooling and age on mental growth and decline are discussed by Vernon [16]. Schaie [13] emphasizes that “the universal decline in adult intelligence is at best a methodological artifact and at worst a popular misunderstanding of the relation between individual development and socio-cultural change”. Schaie and Labouvie-Vief [14] report significant cohort differences, that is, differences between generations in intelligence, and have argued that such differences should not be interpreted as age differences, but rather as differences in levels of intellectual functioning attributable to the generation gap. In other words, cultural changes should not be mistaken for age changes, which is often the case in cross-sectional studies.