**Study on the Correlation between Examination and SBA Project Marks
and the Latent Factor in
Hong Kong Advanced Supplementary Level Liberal Studies**

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Introduction

1. Candidates taking the Hong Kong Advanced Supplementary (AS) Level Liberal Studies (LS) are requested to choose two of the following six modules, namely: (i) *Hong Kong Studies*; (ii) *Environmental Studies*; (iii) *Human Relationships*; (iv) *The Modern World*; (v) *Science, Technology & Society*; and (vi) *China Today*. For their assessment, they must attend the two corresponding written examinations and submit a project report on one of their chosen modules. Thus, there are three component marks for assessment, namely: (i) an examination mark for the first chosen module; (ii) an examination mark for the second chosen module; and (iii) a project mark for one of the chosen modules. Currently, these three component marks are added together to produce one overall performance mark.

2. The aims of this study were twofold. The first was to examine the correlation among the three component marks. Despite the fact that differences in topics and different forms of assessment (i.e., examinations and project) are likely to result in a certain degree of differentiation in a student's performance in each component, it was expected that all three marks would have certain commonalities, since they all assess the same kind of critical and independent thinking capabilities. In view of this, it was expected that the study would show a moderate correlation among the three component marks. The second aim was to examine whether the three component marks of each student can be efficiently summarised as one single latent factor affecting the student's performance. This involved investigating the unidimensionality of the assessments as a whole, in other words, the extent to which the component marks can be explained by a single trait or factor.

3. The study involved examining the 2004 AS Level assessment results of all students (a total of around 1,300), and was divided into two parts. In the first part, the correlation of component marks was examined in three ways: (i) the correlation between the examination marks of two different modules; (ii) the correlation between the project mark and the total examination marks; and (iii) the correlation between the project mark and the examination mark of a particular module. In the second part, Exploratory Factor Analysis (a process that finds out the latent traits, or unobserved variables, that lie behind the observed variables, i.e., examination marks and project marks) was used to

investigate the dimensionality of the assessment results, i.e., the number of latent traits or factors being assessed.

Examining Correlations among Liberal Studies Assessments

(A) Correlation between examination marks

4. To begin with, we examined the correlation between the two examination marks of each student. By examining the correlation of the marks achieved by each student in each of the two modules they chose, we arrived at correlation coefficients that illustrated the relationship or interdependence between these two marks.

5. Based on the 2004 examination results, there were a total of thirteen different combinations of two modules from the six modules available. The study examined only those combinations chosen by a large number of students, and excluded those with less than 50 students enrolled.

6. From the results, it is observed that the correlation coefficient between two examination marks is moderate, as expected. (Note: A correlation coefficient of +1 indicates a perfect relationship, a correlation coefficient of -1 indicates a perfect negative relationship, and a correlation coefficient of 0 indicates no relationship.) Such moderate correlation may indicate that the written examinations of different modules may measure a single trait.

(B) Correlation between project mark and total examination marks

7. Next, we added the two individual examination marks together to obtain the total examination marks for each student, and compiled the correlation coefficients between the project mark and the total examination marks accordingly. As in case *(A)* above, we compiled the statistics for thirteen combinations.

8. Again, we examined only those combinations chosen by a large number of students, and excluded those with less than 50 students enrolled. The results show a moderate correlation between project mark and total examination marks. As expected, the correlation in this instance was slightly weaker than the correlation between examination marks, due the difference in the form of assessment between project and examination.

9.   Lastly, we studied the correlation between the project mark for a particular module and the corresponding examination mark for that module (as opposed to the total examination marks of the two modules). In this case, we compiled the correlation coefficient for each of the six modules.

10.   Again, examining only those combinations chosen by a large number of students, and excluding those with less than 50 students enrolled, we observed a moderate correlation between the project mark and the corresponding examination mark. These results are in line with those observed in case *(B)* above.

Examining the Dimensionality of Liberal Studies Assessments

Exploratory factor analysis

11.   Exploratory factor analysis (EFA) aims to represent a large number of relationships among interval-level variables in a concise manner. EFA postulates that there is a set of latent variables, usually of lower dimensionality (i.e., smaller in number), that underlies the larger number of variables that are actually observed or measured. In other words, EFA is directed at explaining the relationships between variables by exploring the latent factors underlying them. In this study we applied EFA to the component marks of those students choosing the modules *Hong Kong Studies* and *Human Relations*, as this combination has the largest number of students enrolled among all alternatives. As student performance in these two modules should be representative of that of the whole population of candidates, it is expected that results drawn from this group can be generalised to those choosing other combinations.

12.   We summarised the relationships among the component marks by using the corresponding correlation matrix. Through EFA, we captured the information in the correlation matrix by means of a smaller number of latent factors and with minimal loss of information.

13.   The first step was to determine the appropriate number of factors to be extracted. Table 1 below contains information regarding possible factors and their relative explanatory power.

Table 1: The relative explanatory power of possible factors

Factor	Eigenvalue (Explanatory Power)	Percentage of Variance	Cumulative Percentage of Variance
1	1.616	53.9	53.9
2	0.773	25.8	79.7
3	0.610	20.3	100.0

14. The two most commonly used criteria for determining the number of factors are latent root criterion (i.e., where only those factors with an eigenvalue greater than 1 are considered significant) and percentage of variance criterion, which is based on the percentages of the variance explained by all factors extracted so far. (In social sciences studies, it is not uncommon to consider a solution that accounts for around 60%, or even less, of the total variance as a satisfactory solution.)

15. Table 2 below tabulates the factor loadings (i.e., the correlation between the variables and the latent factor) for each observed variable when one factor is retained.

Table 2: Factor loadings when one factor is retained

Variable	Factor Loading
Hong Kong Studies Exam. Mark	0.59
Human Relationships Exam Mark	0.66
Project Mark (for one of the chosen modules)	0.43

Summary of findings and future work

Findings

16. There are three components for assessing student performance in LS, namely: (i) the examination mark of the first chosen module; (ii) the examination mark of the second chosen module; and (iii) the project mark for one of the chosen modules. The results of this study showed that:

   (a) Moderate correlation was observed among these components.
   (b) Comparatively speaking, the correlation between the two examination marks was stronger than that between the project mark and the examination marks.
   (c) In view of the moderate correlation, it is plausible that all of these components share commonalities to a certain extent, i.e., that they all

reflect one single latent trait of a student.

(d) Exploratory Factor Analysis of the assessment results of students who took both Hong Kong Studies and Human Relationships indicated that a single factor was sufficient to explain more than 50% of the total variation of the scores observed (Table 1). (As student performance in these two modules should be representative of that of the whole population of candidates, it is expected that results drawn from this group are also applicable to others.)

Future Work

17. This study indicates the plausibility that there could be one latent factor underlying the three component marks of the LS AS Level examination. The next phase of research study involves conducting qualitative analysis on ASL LS examination scripts in order to enhance understanding of student performance at various grades.