

Executive Summary of the Impact of the LogicMills® ATS® Course on Academic Performance

Introduction

This executive summary presents the findings of the Ministry of Education Innovation Fund (MIF) grant project “Explicit Teaching of Analytical Thinking Skills Through Games-Based Facilitation for All Courses (in Primary and Secondary Schools) for Higher Academic Achievement”. The project began in June 2008 and all training of students, data collection, and independent data analysis were completed by March 2010. Results for both Primary and Secondary schools are summarized below; page references are keyed to the full Report.

Description of Study and Findings

The present study is one of the largest, most rigorous and comprehensive studies on the teaching of thinking skills ever conducted. First, the sample size of the present study is large when compared with similar studies in the field. The present study involved data gathered from 1093 Primary School students (847 of whom underwent full ATS training, the remainder serving as controls) and 980 Secondary School students (implementation was phased so that approximately half of the students were controls at each school). (See pp. 3-8.)

Second, the schools participating in the study varied from neighborhood to elite schools. This, taken together with the large number of participants, helped ensure that the results obtained by the study are representative of a significant cross-section of the Singapore student population.

Third, the quality of data collected was consistently high and the quantity of data obtained large: there are approximately 1,000,000 data points in the study. The study consistently adhered to the highest professional standards and practices established by the global scholarly community. Consequently, the results obtained are valid and acceptable to a global academic audience. The benchmarks against which the ATS course was measured are either comparable to or exceed the standards set by practitioners in education and the social sciences generally.

Overall assessment: **Results are extremely positive.** (See p. 27, Conclusions.)

Primary Schools

On a common Practice Examination (Prelim) set and administered by the Primary schools immediately prior to the PSLE, students with ATS training outperformed control students by **30.17% in Mathematics, 23.29% in Science, and 24.51% in English.** (See pp. 12-13).

Adopting the most conservative model, the present study revealed that LM training **boosts average PSLE scores by about 9 points** (pts = 8.856, sig. = .000, $r^2 = .849$). (See pp. 14-15.) As the report notes, this translates to a 5% improvement on the PSLE, and so a student with ATS training would be expected to enter Secondary school approximately **2,400 places higher** than they would have otherwise. Moreover, the 9 point improvement is highly conservative; the **data suggest that improvements in PSLE score as a result of LM training can be substantially higher, ranging over 40 points** (sig. = .000, $r^2 = .700$; see pp. 15-16 and Table 4a). This translates to a **22% improvement on the PSLE.** Other models

indicate that the impact of LM training is typically **16.8% improvement on the PSLE** (sig. = .000, $r^2 = .097$; see pp. 13-14).

Comparing students across ability, it was found that academically weaker students gain more in test scores from LM training than academically stronger ones. This was predicted: given that there is an upper limit to what can be attained (very roughly, a 300 maximum score on the PSLE) and that there is normalization of PSLE scores, it is mathematically impossible for a talented student already scoring in the upper range of the PSLE to improve their score by a large percentage. Weaker students, by contrast, have considerably more room for increased performance. Thus, in the study it was found that it was possible for LM training to boost the performance of a student currently scoring in the range of 150 by up to 60 PSLE points. (See p. 17 lines 16-28.) Such results are not even possible at a school where the average PSLE score is over 230, since the highest PSLE score in Singapore for 2009 was 291. (For this analysis see p. 17.)

Another point of note is that ATS instruction was given to PSLE-takers at only three out of the 177 primary schools in Singapore. This translates to 1.7% of all Primary schools. However, **LM-trained students accounted for 10% of all the students in Singapore who scored 275 and above on the 2009 PSLE.** (Data from public sources.)

Secondary Schools

The greater amount of data collected for secondary schools allows for an even more nuanced picture. **Secondary school students likewise saw improvement across all their English medium subjects.** (See p. 27, Conclusions.)

Key findings include the following:

- (1) ATS training **develops thinking skills.** That is, LM training imparts process skills (i.e., ‘know how’) and does not just add to the students’ content knowledge (i.e., ‘know that’). Two findings support this. First, consolidation of benefits accruing from LM training follows a J-curve. In other words, there is a brief initial deprovement followed by a long period of steady improvement in performance. Second, the affects of LM training are long-term stable and positive. Thus, while control students can, with subsequent LM training, narrow the performance gap between themselves and experimental students, experimental students retained an absolute performance edge. (See pp. 20-24.)
- (2) **Effectiveness varies with method of implementation.** ATS was most effective when implemented as a standard in-curriculum subject taught twice a week. At the other implementation extreme, ATS was less effective when taught irregularly (i.e., like an ECA) and made susceptible to poor attendance (especially during holiday sessions). When implemented using an intermediate model, say that of an in-curriculum adjunct subject like drama, then intermediate results are obtained. The more ATS implementation approaches that of a core subject, the greater its positive impact. (See pp. 22-23.)

- (3) While ATS training is effective across academic streams, it is **most effective for academically weaker students**. When a comparison is done across streams, we find that **N(T) students can score up to 29.1% higher** with LM training. (See pp. 25-26.) This mirrors the finding in Primary schools that lower ability students benefit more from LM training than students who are academically strong. It was also found that ATS benefitted Express students more than N(A) students. (See pp. 23-26.)
- (4) LM training improves student performance across all English medium subjects. Furthermore, **magnitude of impact varies by subject**. The study found that students benefitted most in Geography and History, then in Mathematics, Literature, English, and Science. One possible explanation for the pre-eminence of Geography and History is that the common test questions selected by the schools in these subjects emphasized thinking and interpretation skills instead of straight recall. This supports the claim that ATS develops thinking skills that are both widely applicable and transferable across academic disciplines. (See p. 27, Table 8.)

Primary and Secondary Overview

Taking into account the various stream and subject analyses presented in the report, it is reasonable to expect that **LM training, optimally implemented, benefits students from 5% to 25% (or more: see para. 1 in Primary Schools above and also point (3) above) in their academic performance**. Additionally, no upper plateau in improvement was observed, as all training concluded after 30 hours. Results support the conclusion that the more ATS students are taught the better their performance, and the more ATS is treated as an in-curriculum subject the greater the reliability and magnitude of improvement. This study strongly supports the conclusion that the thinking skills imparted through the ATS course have a significant positive impact on all English-medium disciplines for both Primary and Secondary students. (See p. 27, Conclusions.)

*** Disclaimer: It should be noted that, as a matter of policy, the Singapore Ministry of Education does not make commercial endorsements. Mention of this MIF study or the results obtained should not be construed as an official endorsement either of ATS or of LogicMills.