Utility of the School Motivation Analysis Test in predicting second language acquisition

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Utility of the School Motivation Analysis Test in predicting second language acquisition

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The School Motivation Analysis Test (SMAT) is a 190-item, objective (T-data), multidimensional instrument for measuring factor analytically derived adolescent motivation dimensions. The SMAT was administered to 109 high school students (63 females, 46 males) enrolled in a Melbourne metropolitan foreign language school. Sten (standard ten) scores on the SMAT dynamic source traits (labelled: Assertiveness, Mating/Sex, Fear/Escape, Narcism, Pugnacity, Protectiveness, Self-sentiment, Superego, School Orientation, and Home Orientation) were used to predict achievement (combined across Comprehension, Grammar, Written Expression, and Oral Expression) via separate stepwise forward multiple regression analyses for each of five subgroups of SMAT variables (Integrated, Unintegrated, Total, Conflict, and Derivative components, respectively). SMAT dynamics accounted for up to 34 per cent of the achievement variance (males) and 26 per cent (females). Integrated Superego and Assertiveness sentiments were significant predictors of learning. However, only for the Total (U + I) stens, was Self-sentiment a significant predictor. The derivative stens accounted for 15 per cent of the achievement variance (males), and 12 per cent (females). Results also showed that gender was a major determinant of achievement outcomes, with males and females exhibiting different patterns of motivational investment in second-language acquisition.

In addition to abilities and enduring personality traits, a variety of motivational dynamic traits influence academic learning outcomes (Boyle, 1987,
The complexity of human motivation structure demands the use of multifactorial measures in predicting achievement (cf. Bardwell & Braaksma, 1985; Boyle, 1983, 1988a; Gardner & Lambert, 1972; Gottfried, 1985; Ururoglu & Walberg, 1986; Zarb, 1981). The major application of multivariate psychometric measurement to human motivation has been the work of the Cattellian school (e.g., Cattell, 1985, 1992; Cattell & Child, 1975; Cattell & Kline, 1977; Gorsuch, 1986; Kline, 1979; Sweney, Anton & Cattell, 1986). Cattell has investigated hundreds of different objective ways of measuring motives using devices drawn from diverse fields (see Cattell, 1985; Cattell & Warburton, 1967), enabling a more subtle index than with use of transparent, self-report questionnaires. The results of this undertaking were encapsulated in the adult Motivation Analysis Test or MAT (Cattell, Horn, Sweney & Radcliffe, 1964), and subsequently also in the School Motivation Analysis Test (SMAT-Krug, Cattell & Sweney, 1976).

The SMAT is an objective (T-data) measure of interests, attitudes, drive strengths, and specific motivations. It is a multidimensional instrument designed specifically to measure the major motivational dynamic source traits of 12 to 17-year-old adolescents, discerned factor analytically. Unlike self-report inventories which suffer the problem of item transparency (Boyle, 1985a), nowhere in the SMAT are respondents requested to estimate their own motivation levels. A major advantage of the SMAT is that respondents cannot readily ascertain which constructs are being measured by the respective items, thereby avoiding the problems of faking and motivational distortion associated with item transparency. As Krug et al. (1976, p. 5) pointed out, use of objective items reduces measurement error from students 'not consciously knowing the real strength of
their interests, from deliberate faking, and from the superficiality and invalidity of many "projective", "preference", and "opinionnaire" approaches'. Cattell has investigated hundreds of objective test devices for measuring human motives, as catalogued in the compendium by Cattell & Warburton (1967). From these objective tests, the SMAT uses four types of measurement device labelled: Utilities (Uses), Word Association (Paired Choices), Autism and Information (Knowledge). For example, as Krug et al. (p. 8) pointed out, 'in the Autism device the individual is presented with questions which, on the surface, have a true answer. The answer alternatives are arranged on a continuum and motivation level is assessed by the degree of distortion in the direction of the attitude ... these devices owe much of their success to their indirect nature and their consequent resistance to faking or self-misconception on the part of the subject.' In the Word Association subtest/device, the respondent indicates a preference between various paired choices; in the Utilities device, the individual chooses between alternative uses for the stimulus items; and in the Information device, factual knowledge questions are the stimuli. The Autism device, which measures distortion of the cognitive field, as evidenced through misperception and misbelief, and the remaining devices, attempt to tap the individual's interest in diverse areas of the human motivation sphere.

The 10 dynamic traits measured in the SMAT have been factor analytically derived from an extensive sampling of the adolescent interest domain. Nevertheless, the instrument as it currently stands has certain structural and psychometric limitations (especially in terms of the limited number of dynamic trait factors included) which restrict the generalisability of substantive findings (Boyle, 1986a, 1987, 1988b, 1988c, 1989; Child, 1984). Nevertheless, the
intrapersonal psychological variance measured by the SMAT complements that measured by ability and personality instruments, and is mostly not redundant (cf. Boyle, Stanley & Start, 1985; Boyle, 1987). As Krug et al. (1976, p. 5) pointed out, teenagers with similar personality and ability profiles often acquire markedly different interest patterns, attitudes, and drive strengths. Unlike abilities and enduring personality characteristics, dynamic motivation traits are expected to vary considerably over time and circumstances.

Some of these dynamic traits (ergs) relate directly to biological drives (Assertiveness, Mating/Sex, Fear/Escape, Narcism, Pugnacity-Sadism, and Protectiveness), while others (Self-sentiment, Superego, School Orientation, Home Orientation) represent acquired interest patterns (sentiments) resulting from the interaction of primary drives with environmental experiences (e.g., School Orientation helps the adolescent make friends, play sport, or be a leader). Cattell & Child (1975) maintained that sentiments involve culturally uniform interests which have as their basis emotionally diverse, ergic investments. Cattell & Kline (1977) proposed that the biologically based ergs and the culturally acquired sentiments exhibit complex interrelationships, with attitudes being subsidiary to sentiments, and in turn, sentiments being subsidiary to ergs.

The SMAT dynamic traits represent broad motivation structures (source traits) which influence the individual's particular interests. For each dynamic trait, there are separate scores for the deliberate, organised or integrated (I) component, as well as for the unrealised, unconscious or unintegrated (U) component. The integrated component comprises conscious, reality-directed aspects of an individual's attitudes, whereas the unintegrated component relates to unconscious aspects, not yet integrated into daily life. According to Krug et al. (1976, p. 6), 'the
integrated component more closely reflects the level of satisfaction the individual has attained in some interest area while the unintegrated component reflects the individual's unsatisfied drive or need level'. A full description of these U and I components is provided in Krug et al. (p. 7). These motivational components, which are uncorrelated, may play an important role in influencing academic school achievement. For example, an adolescent might exhibit a high level of achievement motivation and self-assertion, but may be unable to achieve his/her goals. Hence, the SMAT I-Assertiveness score would be low, whereas the U-Assertiveness score would be high. The U and I distinction is the same across both ergs and sentiments, the only difference being the origin of the respective dynamic traits (biologically inherited vs. culturally acquired). However, once a motivation structure is established, its origin is irrelevant.

Since each of the dynamic traits can be measured in terms of separate unintegrated and integrated components, the SMAT therefore provides 20 separate U and I primary scores. Krug et al. (1976) reported that the intercorrelations among the primary scales are by and large trivial and non-significant, supporting the view that the primary scales provide essentially independent information. If for each dynamic trait, these unintegrated and integrated components are added together, a Total Motivation score is obtained \(T = U+I\). If the integrated components are subtracted from the unintegrated components, Conflict scores are obtained \(C = U-I\). The conflict score represents the level of dynamic conflict (excess of drive over satisfaction) in relation to a specific dynamic trait. Not only is it possible to have conflict between the unintegrated and integrated components of a given erg or sentiment but also conflict can occur between different dynamic traits. Even though the primary dynamic traits are essentially uncorrelated, it is
still possible for these structures to conflict with one another, as for example, when the Career sentiment interferes with expression of the Sweet-heart/Spouse sentiment, leading to marital discord.

Conflicts can occur separately between ergs, between sentiments, and/or between ergs and sentiments combined. Secondary scores can be calculated for each of the dynamic traits measured in the SMAT instrument. As Boyle (1988a, pp. 774-776) reported, one formulation for active conflict (C.) is:

\[ C_i = w_1 \left( \alpha_{ijk} + \alpha_{ijk2} \right) - w_2 \left( \alpha_{ijk2} - \alpha_{ijk3} + p \right) \]

Where k is the strength of the response course of action, w1 and w2 are the weights for the two alternative action courses. Thus, for the motive strength in any given attitude (ik), the particular attitude is represented by j, for ambient situation k. The constant (p) is a correction term which minimises the difference between the two competing action courses. For a rather more detailed account of the aspects pertaining to the mathematical quantification of motivation conflict, the reader is referred to Boyle (1988a), where this issue has been discussed at some length.

In addition, five derivative (second-order) SMAT scores are labelled: Total Autism- Optimism (sum of 10 Autism scores-the individual's tendency to distort reality); General Information-Intelligence (sum of 10 Information device scores the individual's crystallised ability level); Total Integration (level of satisfaction as compared with drive levels); Total Personal Interest (overall drive/interest level); Total Conflict (general frustration- low satisfaction compared with drive level). As Krug et al. (1976, p. 27) stated, “each of these five derivative scores is based on a correspondingly larger number of items than the primary trait scores. The
Information-Intelligence and Autism-Optimism scores, for example, are based on 50 items each while the remaining three derivatives actually use all 190 SMAT test items in their calculation”. Consequently, the reliabilities for the derivative scores should be appreciably higher than those for the primary dynamic trait factors (see below).

Previous research has indicated that school learning is best predicted by a combination of ability, personality, and motivational dynamic factors (e.g., Barton, Dielman & Cattell, 1972; Bartsch, Barton & Cattell, 1973; Boyle, 1983, 1986a, 1987; Cattell, Barton & Dielman, 1972; Dielman, Barton & Cattell, 1971, 1973). Highly significant correlations were found for Social Studies, Science, Mathematics, and English language acquisition (see Krug et al., 1976, p. 30). Gains in predictive validity when the SMAT integrated scores were added to intelligence scores ranged from 33 per cent for Mathematics to 122 per cent for English, as indicated by enhanced multiple correlations. It has been observed however (Dielman et al., 1971) that whereas virtually all the integrated components are predictive of academic achievement (correlations ranging from .18 to .49), the unintegrated components play relatively little role. Therefore, one aim of the present study is to test this proposition (see Hypotheses below).

Cattell & Child (1975) have reviewed several of the studies which have used the SMAT as a predictor of academic school grades. Dielman et al. (1973) reported that the SMAT dynamic traits accounted for up to 25 per cent of the variance in school grades, aside from that contributed by personality and ability measures. Kline (1979, pp. 221-222) acknowledged that dynamic trait measures significantly predict achievement variance, but argued that the correlations are generally fairly low. Boyle (1983, 1988c) demonstrated a threshold of activation effect, wherein
the role of non-ability intrapersonal psychological variables in influencing academic learning outcomes was greatly augmented under emotionally stressful conditions. Therefore, even though correlations of non-ability variables generally may be rather low under neutral, non-stressful conditions, this is not the case under heightened emotional activation.

While several motivational variables are known to influence second-language learning (cf. Boyle, 1985b; Gardner & Lambert, 1972; Randhawa & Korpan, 1973; Singleton & Little, 1991), little attention has been devoted to the specific motivation dynamic traits measured in the SMAT. Accordingly, another goal of the present study was to ascertain which dynamic traits significantly influence such learning. One question was, “To what extent do the primary scores (both unintegrated and integrated components), secondary scores (total, conflict, and derivative) predict academic achievement?” From Boyle & Cattell (1987), it was expected that both Self-sentiment and Superego, which had been labelled by Kline (1979) as the ‘master sentiments’ along with the Assertiveness erg, would correlate significantly with second-language acquisition. According to Krug et al. (1976, p. 9), “The self-assertive erg is a natural striving for pre-eminence. It will show itself in competitiveness, in pride, and ... also in mastery of nature and therefore in science, adventure, constructive achievement... .” Another question concerned the possibility of gender differences, as Krug et al. (p. 31) had reported that several of the SMAT scales exhibit significant sex differences. The specific hypotheses are listed below:
Hypotheses

**H1:** that the SMAT motivation dynamic factors will account for up to 20-25 per cent of the achievement variance associated with second-language learning.

**H2:** that the sten scores for the integrated dynamics will significantly predict achievement, whereas scores for the unintegrated dynamics will exhibit relatively few predictive relationships.

**H3:** that specifically, the integrated 'master sentiments' (Superego and Self-sentiment, along with Assertiveness) will significantly predict achievement scores.

**H4:** that the SMAT derivative stens will be more reliable than the separate unintegrated and integrated stens, and that they will be significantly better predictors of learning outcomes than the primary trait dimensions.

**H5:** that males and females will exhibit different patterns of motivational investments in second-language learning; specifically, it is predicted that females will invest significantly more dynamic traits in learning, accounting for a greater proportion of the achievement variance than is the case for males.

Method

Sample

The sample comprised 109 high school students in Grades 7 to 12 (inclusive) attending a foreign language (Greek) school in metropolitan Melbourne, Australia. The mean age of the 63 girls and 46 boys was 14.3 years. SMAT normative tables are based on a mean age of 14.5 years, thereby supporting the applicability of these normative data for use in the present study. Moreover, Boyle, Start & Hall (1988) have shown that the USA SMAT norms are relatively valid for use in the Australian context. All students' parents had lived in Australia
for over 18 years. Since all students had been born in Australia, and were therefore fluent in English, use of the SMAT seemed appropriate.

**Multivariate Measures**

All students completed the 190-item SMAT instrument. The SMAT is a more sophisticated and comprehensive measure of adolescent motivation than are the narrowly specific, integrative and instrumental measures devised, for example, by Gardner & Lambert (1972). Each of the SMAT scales comprises at least 19 items, enabling adequate reliabilities for the dynamic trait dimensions. Krug et al. (1976) reported lower-bound test-retest estimates of reliability for the SMAT dynamic trait scales over a one-week interval, ranging from 0.47 to 0.69 (median r = 0.58) for the unintegrated components; from 0.32 to 0.85 (median r = 0.53) for the integrated components; from 0.39 to 0.73 (median r = 0.63) for the total components; and from 0.41 to 0.95 (median r = 0.50) for the conflict components, respectively. However, 'motivation scores are inherently less stable than personality or ability scores. This is especially true in younger individuals whose goals and interests may not yet be particularly well defined' (Krug et al., p. 27). Nevertheless, reliability estimates for the SMAT derivative scores were all high. K.R21 coefficients of internal consistency were 0.86 for Total Autism-Optimism, and 0.88 for General Information-Intelligence. Test-retest co-efficients (over a retest interval of one week) were 0.92 for Total Integration, 0.94 for Total Personal Interest, and 0.94 for Total Conflict. In addition, concept validity coefficients (correlations of SMAT scales with the pure factors defining them) for the unintegrated components ranged from 0.72 to 0.92 (median= 0.86), and for the integrated components, from 0.42 to 0.92 (median= 0.81), respectively. These
validity estimates however, clearly represent upper-bound estimates of the actual validities.

The multidimensional SMAT instrument yields several sten scores in addition to the unintegrated and integrated primary scores, including two secondary Total (U + I), and Conflict (U - I) scores for each of the 10 dynamic traits (Assertiveness, Mating, Fear, Narcism, Pugnacity, Protectiveness, Self-sentiment, Superego, School Orientation, Home Orientation), and five derivative scores (see above). Language acquisition was graded by experienced teachers on a six-point Likert-type scale on the basis of achievement of the source objectives for Comprehension, Grammar, Written Expression, and Oral Expression. These four dependent variables were regarded by the teachers as important indicators of language acquisition. Consequently, use of these measures of achievement enabled the least possible disruption of normal teaching and assessment practices. The predictive validity of these dependent variables had been demonstrated repeatedly over a period of several years, in situ.

Procedure

The SMAT was administered during Saturday morning classes, across all grade levels. Pearson product-moment correlations were computed between Sex, SMAT predictor variables, and the combined achievement variable (see below). The manner in which the independent variables predicted the achievement criterion was examined by performing stepwise forward multiple regression analyses via SPssx (SPSS Inc., 1992). As it was hypothesised that gender differences would play a significant role in influencing academic learning outcomes, multiple regression analyses were performed separately for males and
females. For the combined achievement variable, the following five sets of predictor variables were entered into separate regression analyses for males and females separately: (1) unintegrated stens; (2) integrated stens; (3) total motivation stens; (4) conflict stens; (5) derivative stens.

Results and Discussion

In order to reduce the number of analyses performed, and to increase statistical power, the four highly intercorrelated dependent variables were collapsed into a single achievement variable. Since the first principal component of the correlations among the dependent variables appeared similar for a given set of predictors, use of a combined Achievement variable seemed justified. As expected, the four dependent variables were all highly and positively intercorrelated (Grammar correlated with Comprehension 0.89; Written Expression correlated with Comprehension 0.83; Oral Expression correlated with Comprehension 0.63; Written Expression correlated with Grammar 0.83; Oral Expression correlated with Grammar 0.69; Oral Expression correlated with Written Expression 0.71).

The combined sample mean stens and standard deviations for each of the SMAT variables are presented in Table 1. As is evident, most of the mean scores were in the middle of the sten range, indicating only moderate levels of motivation (under neutral emotional conditions - cf. Boyle, 1983). Likewise, the derivative sten scores were all in the mid-range of possible values. Of the total possible 45 sten scores, nine (20 per cent) differed significantly across sex.

The univariate ANOVA results were as follows: U-Superego, F(1,107) = 5.89, p<.02; I-Protectiveness, F(1,107) = 14.54, p<.01; I-Self-sentiment, F(1,107) =
8.98, p<.01; I-Superego, F(1,107) = 4.90, p<.03; I-Home, F(1,107) = 5.88, p<.02; T-Protectiveness, F(1,107) = 6.83, p<.01; T-Self-sentiment, F(1,107) = 9.57, p<.01; C-Protectiveness, F(1,107) = 4.96, p<.03; and C-Superego, F(1,107) = 8.58, p<.01.

Males obtained a higher mean score on U-Superego (5.59 vs. 4.76), whereas females obtained a higher mean score on I-Superego (5.30 vs. 4.46). Likewise, the mean C-Superego score for males was significantly higher than that for females (5.87 vs. 4.76), suggesting that males have less integration of this dynamic trait in their daily lives, and consequently greater conflict surrounding it than do females, in general. On the other hand, females exhibited a significantly higher mean score on C-Protectiveness (6.64 vs. 5.80), while males had higher mean scores on I-Protectiveness (5.02 vs. 3.56), and T-Protectiveness (5.46 vs. 4.46), suggesting that the issue of protectiveness is more problematic for females than for males.

Both I-Self-sentiment and T-Self-sentiment were significantly higher for females (5.44 vs. 4.57 and 5.78 vs. 4.76, respectively), suggesting that the self-concepts of females may be better integrated than is the case for males, generally. Since there appeared to be differences in motivational structure across gender, it was expected that males and females would exhibit significant differences in terms of their scores on SMAT dynamic trait predictors and also on the combined achievement variable.
Table 1
Mean stens and standard deviations for SMAT variables (N=109)

<table>
<thead>
<tr>
<th>Dynamic Trait</th>
<th>Unintegrated</th>
<th>Integrated</th>
<th>Total</th>
<th>Conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Assertiveness</td>
<td>5.26</td>
<td>1.88</td>
<td>3.58</td>
<td>1.75</td>
</tr>
<tr>
<td>Mating</td>
<td>5.20</td>
<td>1.99</td>
<td>5.12</td>
<td>1.93</td>
</tr>
<tr>
<td>Fear</td>
<td>5.58</td>
<td>1.57</td>
<td>4.62</td>
<td>2.01</td>
</tr>
<tr>
<td>Narcism</td>
<td>5.59</td>
<td>1.86</td>
<td>4.59</td>
<td>1.75</td>
</tr>
<tr>
<td>Pugnacity</td>
<td>6.32</td>
<td>1.98</td>
<td>5.13</td>
<td>1.80</td>
</tr>
<tr>
<td>Protectiveness</td>
<td>5.67</td>
<td>1.93</td>
<td>4.17</td>
<td>2.10</td>
</tr>
<tr>
<td>Self-Sentiment</td>
<td>5.39</td>
<td>1.90</td>
<td>5.07</td>
<td>1.57</td>
</tr>
<tr>
<td>Superego</td>
<td>5.11</td>
<td>1.79</td>
<td>4.94</td>
<td>2.00</td>
</tr>
<tr>
<td>School</td>
<td>6.37</td>
<td>1.63</td>
<td>5.57</td>
<td>2.95</td>
</tr>
<tr>
<td>Home</td>
<td>5.57</td>
<td>1.89</td>
<td>4.52</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Derivative scores

<table>
<thead>
<tr>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Autism-Optimism</td>
<td>6.16</td>
</tr>
<tr>
<td>General Information-Intelligence</td>
<td>4.74</td>
</tr>
<tr>
<td>Total Integration</td>
<td>4.36</td>
</tr>
<tr>
<td>Total Personal Interest</td>
<td>4.70</td>
</tr>
<tr>
<td>Total Conflict</td>
<td>6.18</td>
</tr>
</tbody>
</table>
### Table 2. Intercorrelations between Sex, SMAT variables, and Achievement

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sex</th>
<th>Unintegrated State</th>
<th>Integrated State</th>
<th>Total State</th>
<th>Conflict State</th>
<th>Derivative State</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-As</td>
<td>-16</td>
<td>-14</td>
<td>-12</td>
<td>-8</td>
<td>-6</td>
<td>-4</td>
<td>-2</td>
</tr>
<tr>
<td>U-Ma</td>
<td>-12</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
</tr>
<tr>
<td>U-Fr</td>
<td>-14</td>
<td>-13</td>
<td>-12</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
</tr>
<tr>
<td>U-Br</td>
<td>-13</td>
<td>-12</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
</tr>
<tr>
<td>U-Fy</td>
<td>-12</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
</tr>
<tr>
<td>U-Pr</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
<td>-5</td>
</tr>
<tr>
<td>U-Bo</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
<td>-5</td>
</tr>
<tr>
<td>U-Mi</td>
<td>-11</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
<td>-5</td>
</tr>
<tr>
<td>U-Ma</td>
<td>-10</td>
<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
<td>-5</td>
<td>-4</td>
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<td>U-Pr</td>
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<td>-5</td>
<td>-4</td>
</tr>
<tr>
<td>U-Bo</td>
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<td>-9</td>
<td>-8</td>
<td>-7</td>
<td>-6</td>
<td>-5</td>
<td>-4</td>
</tr>
</tbody>
</table>

**Notes.** Decimal points are omitted. Correlations are shown to two decimal places only. Correlations ≥.16 are significant at 5% level; correlations ≥.26 are significant at 1% level (1-tailed test).

Assortiveness (As); Mating (Ma); Fear (Fr); Narcissism (N); Pugnacity (P); Protectiveness (Pr); Self-Sentiment (S); Superego (Se); School (Sc); Home (Ho).

Derivatives: Total Autism-Optimism (TAO); General Information-Intelligence (GII); Total Integration (TI); Total Personal Interest (TPI); Total Conflict (TC).

Integrated (I), unintegrated (U), total (T), and conflict (C) components are shown separately (e.g., U-As and I-As) for each dynamic trait.
Pearson product-moment intercorrelations for all variables including Sex, SMAT predictor variables, and the achievement variable for the combined sample are shown in Table 2. Moderate correlations were found for each of the six biologically based ergs, while the culturally acquired sentiments were less-highly intercorrelated. With multiple predictor variables there is always the possibility of multicollinearity. As is evident, the proportion of trivial, non-significant correlations in Table 2 was quite high (67.4 per cent). Hence multicollinearity did not appear to be a major problem, suggesting that the data were suitable for undertaking multiple regression analyses.

**Multiple Regression Analyses**

Results from the multiple regression analyses are presented in Table 3 for males and females separately. Analyses were conducted separately for the integrated (I), unintegrated (U), total (T), conflict (C), and derivative (D) predictor variables. The ratio of subjects to variables was approximately 11 to 1 (for the U, I, T, and C stens; and 22 to 1 for the D stens), enabling valid results to be obtained, as the minimum number of subjects per variable recommended for multivariate statistical analyses is usually 10 to 1 (cf. Baggaley, 1982; Draper & Smith, 1981; Pedhazur, 1982). The multiple regression findings can be summarised as follows:

**Unintegrated stens:** For males, only Protectiveness positively predicted achievement (23 per cent of variance predicted). The remaining unintegrated predictors had a negative impact on second-language acquisition (Superego, Assertiveness, Pugnacity, and Mating). Therefore, motivation structures which are unintegrated into an individual's daily life may be problematic, having a debilitating influence on academic achievement. For females, Self-sentiment,
Home Orientation, and Mating were negative predictors, while School Orientation, Narcism and Protectiveness positively predicted performance (25 per cent of variance predicted). In both males and females, the greater the level of unintegrated sexual drive (Mating erg), the less successful their academic performance. Also, for both males and females, the stronger the level of Protectiveness, the better the learning outcome. The contribution of ergs and sentiments otherwise differed markedly across sex.

Integrated stens: Results for males showed that Protectiveness and Pugnacity contributed positively, whereas Assertiveness, Fear, and Superego related negatively to second-language acquisition (25 per cent predicted variance). For females, only Fear contributed positively, whereas Pugnacity, Superego, Assertiveness, School Orientation, and Home Orientation all related negatively to performance (20 per cent predicted variance). Again, the profile of ergs and sentiments predicting learning outcomes was noticeably different across gender.

Total stens: For males, total (U + I) scores on School Orientation and Protectiveness were significant positive predictors of second-language acquisition (34 per cent predicted variance). However, Superego, Assertiveness, Fear, and Mating all contributed negatively. For females, all six predictors were negatively related to learning outcomes (20 per cent predicted variance).

Conflict stens: Interestingly, for males (17 per cent predicted variance), the higher the degree of conflict involving Home Orientation and Fear, the higher were achievement outcomes. However, conflict concerning Pugnacity and School had a negative impact on learning. For females (26 per cent predicted variance), School and Pugnacity directly predicted learning outcomes, while Self-sentiment and Home exhibited a negative impact.
Derivative stens: Of the five SMAT derivatives, Conflict, Integration, and Information-Intelligence all related negatively to learning outcomes for males (15 per cent predicted variance); for females (12 per cent predicted variance), Information-Intelligence and Integration negatively predicted learning outcomes. Thus, at the higher-order level, the pattern of significant predictors across gender appear to be quite similar, the only significant difference being the negative relationship between conflict (U-I) scores and learning outcomes for males, but not for females. This finding, if verified in future studies, possibly suggests that psychological conflict may have a more debilitating influence on school performance for males, and that females may be able to cope with psychological distress better than males, in general.

The above proportions of variance accounted for must be viewed in the context that the study was undertaken under neutral emotional conditions. As Boyle (1983) has shown, the magnitude of correlations between non-ability intrapersonal variables and achievement variables increases markedly under stressful emotional conditions. Accordingly, the obtained proportions of explained achievement variance must be regarded as lower-bound estimates, suggesting that the dynamic traits measured in the SMAT instrument contribute in an important way to classroom learning.
Table 3. Standardised regression coefficients for predicting achievement

<table>
<thead>
<tr>
<th>Traits</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assertiveness</td>
<td>-.22</td>
<td>0.30</td>
<td>-.18</td>
<td>-.33</td>
<td>-.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mating</td>
<td>-.21</td>
<td>-.10</td>
<td>-.16</td>
<td>-.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear</td>
<td>-.25</td>
<td>.11</td>
<td>-.24</td>
<td>-.10</td>
<td>.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narcissim</td>
<td>.20</td>
<td></td>
<td></td>
<td></td>
<td>.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pugnacity</td>
<td>-.24</td>
<td>.11</td>
<td>-.24</td>
<td>-.13</td>
<td>-.23</td>
<td>.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protectiveness</td>
<td>.24</td>
<td>.11</td>
<td>.33</td>
<td>.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Sentiment</td>
<td>-.39</td>
<td></td>
<td>.11</td>
<td>-.18</td>
<td>-.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superego</td>
<td>-.40</td>
<td>-.19</td>
<td>-.19</td>
<td>.87</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>School</td>
<td>.19</td>
<td>-.14</td>
<td>.73</td>
<td>-.22</td>
<td>.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>-.31</td>
<td>-.21</td>
<td>-.35</td>
<td>.28</td>
<td>-.11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Derivative stens:

Males: -.68 Conflict -.47 Integration -.44 Intelligence
Females: -.27 Intelligence -.11 Integration
Conclusions

The present findings provide support for the predictive validity of the SMAT in regard to school learning, suggesting that several of the dynamic traits measured in the SMAT play a significant role in academic performance. Significant relationships between SMAT sten scores and the combined achievement variable were observed as predicted.

In regard to the hypotheses, H1 (that SMAT factors would account for up to 20-25 percent of the achievement variance) was strongly supported. The variance associated with the Total (U + I) stens for the combined sample was 20 per cent (R² = 0.20), clearly supporting the view that motivational dynamics play an important role in school learning. Considering males and females separately, the corresponding proportions of achievement variance accounted for by the unintegrated stens were: males (23 per cent); females (25 per cent); for the integrated stens: males (25 per cent); females (20 per cent); for the total stens: males (34 per cent); females (20 per cent); for the conflict stens: males (17 per cent); females (26 per cent); and for the derivative stens: males (16 per cent); females (11 per cent). Consequently, H1 received substantial support, and this finding adds further weight to the role of non-ability intrapersonal variables in academic learning (cf. Boyle, 1986a, 1987, 1988b; Boyle et al., 1989b).

In contrast, H2 (that the integrated stens would significantly predict second-language achievement, whereas the unintegrated stens would exhibit fewer significant relationships) was not supported. In fact, the number of significant predictors in each instance was exactly the same. Only when analyses were conducted across the combined sample (not reported here) was there a slight advantage for the integrated SMAT predictors.
As for H3 (that the integrated 'master sentiments' Superego and Self-sentiment, as well as Assertiveness would significantly predict academic performance), partial support was forthcoming. For both males and females separately, integrated stens for Assertiveness and Superego emerged as significant predictors, although Self-sentiment did not significantly predict learning outcomes. These findings, nevertheless, support expectations that students who are conscientious and assertive would tend to succeed academically.

No support for H4 (that the derivative stens would be significantly better predictors of learning than would the primary SMAT factors) was obtained. In fact, as perusal of Table 3 shows, the derivative stens accounted for the least amount of predictive variance. This suggests that in using the SMAT instrument, emphasis should be placed more on the primary factors, rather than on the broader derivatives.

Finally, H5 (that females would invest a significantly greater number of motivational dynamic traits into academic performance), was supported for the unintegrated and integrated stens. The results in Table 3 suggest that the number of significant SMAT predictor variables did not differ markedly across gender (except for the total stens, where males exhibited eight significant predictors, in comparison with six significant predictors for females).

Clearly, the SMAT is a useful multidimensional instrument for quantifying the contribution of motivation dynamic traits to academic performance. While one limitation of the present study is the small size of the separate samples of male and female students, the present findings support those of Boyle (1988a, 1988b), Cattell (1985, 1992) and Cattell & Child (1975), in demonstrating the utility of the SMAT as an objective measure of adolescent motivation structure.
References


