Dimensions of Adolescent Motivation as Measured by Higher-Order Factors in the School Motivation Analysis Test

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Abstract

Although previous analyses of higher-order motivational dimensions have suggested at least seven major dynamic traits among adults, corresponding analyses among adolescents have not yet been undertaken in any satisfactory manner. To this end, the present article reports the results of a higher-order factor analysis of the subscale intercorrelations for the School Motivation Analysis Test (SMAT) on an Australian sample of 277 Year I 0 students enrolled in various senior high schools. The results suggest that at least six factors maximally account for the common variance in the SMAT. Tentative interpretations of the higher-order factors obtained are made and discussed in terms of their applicability for school psychology.
INTRODUCTION

The School Motivation Analysis Test (SMAT) (Krug, Cattell, & Sweney, 1976) is an objective pencil-and-paper multidimensional instrument designed to index the motivational dynamic traits characteristic of adolescent secondary school students. The SMAT is an extension of the Motivation Analysis Test (MAT) for younger subjects (Cattell, Horn, Sweney, & Radcliffe, 1964), although some of the particular subscales in the SMAT differ slightly from those making up the MAT. The SMAT is purported to quantify at both the unintegrated/unconscious (U) and integrated/conscious (I) level some ten dynamic source traits (six primary drives including Assertiveness, Mating/Heterosexual Drive, Fear, Narcism, Pugnacity, and Protectiveness and four acquired interest patterns labeled Self-Sentiment, Superego, School, and Home). The primary biologically based drives were labeled ergs, while Cattell termed the culturally acquired motivational factors sentiments/sems. A complete description of the motivational dynamic traits measured in the SMAT is provided in the test handbook (Krug et al., 1976, pp. 9-11).

The importance of measuring motivational characteristics resides in the fact that adolescents acquire very different patterns of interest, even when differences in personality traits and abilities are ruled out. In order to obtain as complete a picture as possible of why adolescents exhibit the behaviors they do in school, as well as why they achieve the academic results they do, it is essential to obtain measures of their attitudes, interests, drives, and specific motivations. As Krug et al. (1976, p. 5) pointed out, School records of SMAT scores will be useful not only in understanding the child's school performance, but in helping the child
with behavior and clinical personality problems. Unlike many ability and some personality measures, the dynamic trait measures will not be expected to remain substantially "fixed" over long periods of time. Changes with time and circumstances are an important part of understanding individual development and offer a strong argument for periodic, group administration of SMAT, apart from individual administration when special diagnosis and guidance is needed.

As for reliability of the SMAT, test-retest coefficients (for retest after week) ranging up to .70 have been reported by Krug et al. (1976, p. 27). These test-retest estimates suggest that the SMAT source traits are not the kind of traits measured in personality inventories (which typically exhibit higher test-retest stabilities) but are more situation-sensitive dynamic motivational dimensions. Boyle and Cattell (1984) demonstrated that the motivational dynamics indexed in the MAT are situation-sensitive to various environmental stimuli, having characteristics more like that of states than enduring and highly stable traits. Nevertheless, derivative SMAT scores (Krug et al., 1976, p. 27) exhibited retest coefficients ranging from .92 to .94, suggesting thereby moderate stability. In regard to SMAT validity, the mean correlations between the primary factors and the subscales in the instrument were reported to be .84 and .78, respectively, for the unintegrated and integrated components (Krug et al., 1976, p. 27), thereby suggesting that the SMAT subscales are construct-valid in terms of their correlations with the pure factors. As for concrete validity, the SMAT has been shown to account for as much as 25% of the variance in academic school learning (e.g., Bartsch, Barton, & Cattell, 1973; Cattell, Barton, & Dielman, 1972; Boyle, 1986a, 1986b, 1987; Boyle & Cattell, 1987), significantly adding to the predictive
variance obtained from IQ measures alone. Other evidence of criterion validity for the SMAT subscales has been provided in the handbook (pp. 32-34).

Analyses of the higher-order dimensionality of the MAT (Boyle, 1983, 1985; Burdsal, 1975) have suggested a number of major motivational factors in adults. The present study extends this line of inquiry to the SMAT, in the hope of ascertaining central motivational dynamics that are predominant among senior high school students.

METHODS

Subjects

The sample comprised 277 Australian Year 10 students (99 boys; 178 girls) whose combined mean age was 15.4 years (SD=0.5 years). The SMAT was designed for use with adolescents aged 12 through 17 years. The present sample ranged in age from 14 through 17 years. In deriving the sample, the school was the initial sampling unit. In selecting schools an attempt was made to ensure that the sample represented a wide range of socioeconomic and geographic influences in the Australian society. Research (Boyle, Start, & Hall, 1988) has shown that the norms developed for the SMAT are applicable also for use in Australia. The schools selected included a city boys' technical school, a suburban high school, a country high school, and a city girls' high school. The 277 students responded to the SMAT items as part of a larger study on the prediction of academic performance on the basis of intrapersonal motivational variables.

Design and Procedure

Given the unreliability of item responses, the 20 separate SMAT subscale scores were intercorrelated, resulting in a 20 X 20 matrix of intercorrelations that
served as the starting point for the higher-order factor analysis. In accord with principles of sound factor analysis methodology (cf. Boyle, 1988; Cattell, 1978; Gorsuch, 1983) an iterative principal factoring procedure was utilized together with rotation to oblique simple structure. Initial lower-bound communality estimates were squared multiple correlations (SMCs) that were refined through an iterative procedure requiring 81 iterations of the factor matrix to reach convergence at the fifth decimal place (an extremely accurate criterion for estimates of the common factor variance). As Lee and Comrey (1979, p. 301) have indicated, methods such as principal components that fail to take account of the common factor model result in inflated estimates of communality and thereby add spurious common factor variance into the solution. This issue is especially important when working with small factor matrices such as often occur in higher-order factoring.

RESULTS AND DISCUSSION

Application of the Scree test (Hakstian, Rogers, & Cattell, 1982) suggested that six higher-order SMAT factors could be validly extracted and rotated to oblique simple structure via the SPSS direct Oblimin method. The resultant ±.10 hyperplane count was 60.83% for the factor pattern solution, suggesting that a reasonably good approximation to simple structure had been obtained. While use of an iterative procedure undoubtedly reduced the size of communalities, those for U-Assertiveness, I-Mating, and I-Narcism were unacceptably low, suggesting that these factors are measured less than adequately in the current version of the SMAT. The factor pattern solution for all six higher-order SMAT factors is presented in Table 1.
Factor 1

Factor 1 (11.6% of the unrotated principal components variance) contrasted U-Mating and U-Narcism with U-Superego, U-School, and U-Home. According to Krug et al. (1976, p. 10), the sentiment in respect to school represents the totality of the teen-ager's interest in his school activities. Although the attitudes here include classroom activities, athletics, attachment to the teacher, interest in peers, and school reputation, the emphasis is on scholarship and classroom interests, since prediction is more frequently needed in this area.

Given the above communality estimates, it is evident that the motivational dynamic traits pertaining to School and Pugnacity exhibited the most variance. None of the factor correlations were statistically significant, indicating that at the higher-order level of motivational structure, the dimensions are indeed essentially orthogonal. However, application of an orthogonal rotation in the absence of this finding would not be justified. Clearly, the proof of orthogonality resides in the finding of non-significant factor correlations following oblique rotation.

As both U-School and U-Superego exhibited the highest factor loadings, the interpretation of this factor suggests the incompatibility of egocentric self-gratification with orientation towards, and respect predominantly for, one's school and to a lesser extent one's home and family. In other words, adolescents seemingly experience a conflict between their own instinctive (in the Freudian sense) desires and a moral, responsible attitude to life. Being the first higher-order
factor extracted, it is likely that this conflict is a major issue in the motivation of many teenagers, as school psychologists may well recognize.

**Factor 2**

Factor 2 (9.2% of variance) loaded predominantly on I-Pugnacity, with a smaller loading on I-Fear. According to Krug et al. (1976, p. 10), "the pugnacity erg takes its energy from the degree of frustration of any other erg whatsoever." As Krug et al. further pointed out, adolescents who are failing at school may be expected to exhibit higher pugnacity scores than students who are succeeding. Krug et al. also suggested that "there are, however, also indications of some inherent 'need to be sadistic; such as appears in items revealing interest in sadistic movies and in fighting and quarrels for their own sake. In any case, the goal seems to be essentially the defeat, obliteration, and destruction of disliked entities." This second factor suggests the strong combination of suspicion and hostility so often exhibited among teenagers during the turbulent "storm and stress" of the adolescent period in Western societies. Again, the school psychologist may be well acquainted with aggressive and disruptive behaviors of this kind, which by their very nature necessitate active intervention.

**Factor 3**

Factor 3 (7.3% of variance) loaded almost exclusively on I-School, with a smaller loading on U-Pugnacity. At the integrated/conscious level, the sentiment toward school involves attitudes such as "I want to work for the reputation of my school, in scholarship and athletics" and "I want to take part fully in classroom work, with my teacher and the other students" (Krug et al., 1976, p. 7). For
teenagers, at least, it would appear that the sentiment toward school forms a very large part of their conscious motivation and awareness in daily life. Naturally, it can be expected that the pressures of schooling, such as the demands of study and mastery of information and concepts, as well as the concerns for obtaining good grades and the fear of failing to do so, will be central in the motivational profiles of many adolescents who feel a need to do well at school and to gain entry to particular colleges or other programs of study. Given the smaller loading on U-Pugnacity, this factor also suggests that it is possible that unconscious, sublimated aggression may even assist academic school performance. Certainly, though, the sentiment toward school plays a large role in many adolescents' lives, and much of their psychological energy is devoted to the issue of schooling.

Factors 4, 5, and 6

Clearly the first three factors accounted for most of the motivational variance among adolescents in the present sample (28.1% versus 19.5% for the remaining factors). Therefore only a brief account of the remaining factors is provided here. Factor 4 (7.0% of variance) contrasted (U +I) Pugnacity with I-Protectiveness and I-Home orientation. This factor suggests the incompatibility of uncontrolled aggression and hostility with a caring and responsible attitude toward one's family and loved ones. Factor 5 (6.6% of variance) loaded predominantly on U-School, with smaller loadings on U-Mating and I-Assertiveness. This factor suggests that schooling is facilitated by sublimated sexual drive on the one hand, and by channeling of assertiveness (as opposed to pugnacity and hostility) directly into academic achievement. Factor 6 (5.9% of variance) contrasted U-Fear with (U +I) Self-Sentiment and also I-Superego. The
largest loadings are for the two "master sentiments" at the integrated level, suggesting the importance of the sentiments toward the self and to one's moral integrity and self-respectability.

**CONCLUSIONS**

Although the above interpretations of the higher-order SMAT factors seem to comply with common sense observations concerning adolescent motivation, they also go part of the way toward providing a more objective, measurement-based analysis of adolescent motivational structure. In this regard, use of the SMAT should provide valuable insights for school psychologists working with adolescents during their formative and often difficult developmental years. The "identity crisis" of adolescent development has been well documented. Use of the SMAT in school psychology should be beneficial in helping adolescents with their specific problems during this period of secondary schooling.

Nevertheless, the SMAT should be viewed not only as an instrument for quantifying adolescent motivational structure but, more importantly, as an assessment and diagnostic tool. For example, knowledge of the comparative strength of U- and I-components in regard to each dynamic trait would indicate if a student is experiencing motivational conflict (preponderance of U- over I-components), or whether particular dynamic traits are integrated reasonably well into the adolescent's daily school life (predominance of I-components). Such advances in the assessment and understanding of adolescent motivation should ultimately benefit the practice of school psychology. At the very least, the present findings should be helpful to school psychologists in their interpretation of the SMAT.
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### Table 1
Higher-Order Oblique Factor Pattern Solution for SMAT (N=277)

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<thead>
<tr>
<th>Subscale</th>
<th>Factor number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
<td>U-Arclteness</td>
<td>-0.05</td>
<td>-0.04</td>
<td>-0.05</td>
<td>0.01</td>
<td>0.18</td>
<td>0.02</td>
<td>0.04</td>
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