The role of the Learning Potential Computerized Adaptive Test (LPCAT) in the vocational guidance assessment of adolescents

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Abstract

In the present study, the role of learning potential assessment as part of cognitive assessment for vocational guidance was investigated for a population (N=262) of junior secondary students. Mean scores, distribution of scores, inter-correlation of scores and predictive validity were evaluated. The mean learning potential scores indicated a level of general reasoning and learning potential higher than the academic level of the students at the time of assessment and the distribution of the scores indicated tertiary level potential for some learners. Statistically significant correlations were found between the LPCAT learning potential scores and three sub-tests of the Differential Aptitude Test (Form R) (DAT-R) namely Verbal Reasoning, Comparison and Spatial Perception. Furthermore, all cognitive scores showed statistically significant correlations with the aggregate end-of-year academic performance in English, Life Orientation and Mathematics. Based on the results of this study, verbal reasoning is a better predictor of aggregate academic performance than learning potential based on non-verbal figural reasoning. A total of 35.3% of the variance in academic performance was predicted by combining learning potential and aptitude scores. The unique explanation of variance in academic performance by means of the LPCAT post-test results alone was 12.9%, while for Verbal Reasoning aptitude alone it was 29.2%.

[INSERT 6-8 KEY WORDS]

Learning potential, vocational guidance, Learning Potential Computerised Adaptive Test (LPCAT), adolescents, predictive validity.

Introduction

During their second year in secondary school, learners are faced with the daunting task of choosing the academic subjects they will continue with at senior secondary level. In the long run, this decision about subject choices will impact on their future career options and therefore constitutes a vital life decision. Certain subjects are a prerequisite for specific educational qualifications - for example, Higher Grade Mathematics at senior secondary level is required, *inter alia*, for Engineering, Medical studies and Technical training – hence, not having the required subjects, will limit study and career-related options. Without additional vocational assessment information available, learners often make these subject choices on the strength of their academic results only. Having additional vocational assessment information available could assist and guide them and their teachers and parents to make appropriate choices about their future career and vocational options. Traditionally, the assessment of personality, cognitive ability, interest and motivation has formed the core of career guidance assessment. In the cognitive domain, the measurement of learning potential provides additional information that can be used for decision making. In the present study, a battery of assessments including measures of aptitude, learning potential, interest and motivation was administered to a sample of junior secondary learners. All the learners who participated were provided with individual feedback for vocational guidance in the same year when they were required to make their subject choices for their senior secondary school years.

Although the concept of learning potential has been around for a long time, and has generally been well received, the empirical evidence in support of learning potential assessment has been somewhat limited (Grigorenko & Sternberg, 1998). According to Caffrey, Fuchs and Fuchs (2008), concerns about dynamic assessment generally relate to the fuzziness of the construct, unknown technical characteristics and labour-intensive administration and scoring. These issues can be addressed by using the modern assessment techniques of item response theory (IRT) and computerised adaptive testing (CAT) (De Beer, 2010a; Van der Linden, 2008a, 2008b). It is important to continue to provide empirical evidence of the value of the measurement of learning potential in educational contexts (De Beer, 2010b; Van der Merwe & De Beer, 2006).

The purpose of educational assessment is to evaluate current achievement and to predict future achievement (Caffrey et al., 2008), while vocational assessment is aimed at providing information to guide

the vocational decision-making processes and generally includes assessment of personality, cognitive ability, interest and motivation (see Figure 1). These broad fields provide information that can guide individuals' career-related or vocational decision making. Cognitive ability assessment has traditionally focused on the measurement of intelligence and aptitude. Individual measurement of learning potential can add valuable additional information and facilitate decision making, particularly in contexts in which there are differences in educational and socioeconomic background (Grigorenko & Sternberg, 1998; Haywood, 2008; Lidz, 1987a, 1987b; Owen, 1998).

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Figure 1 about here

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Advantages of technology in assessment

Since the 1950s and 1960s, when high speed scanners were used to score test protocols, technology and computer technology have revolutionised assessment and one could argue that computers are now an integral part of assessment in some or other way – during test development, for item and data analyses or for test administration (Davies, Foxcroft, Griessel & Tredoux, 2009). Computers and computerised and adaptive testing have become far more common and the use of technology in assessment adds value in terms of accuracy and time efficiency (Van der Linden, 2008a).

One of the most basic assumptions of psychological assessment is that the individual being tested will focus and concentrate during the assessment process so that the results obtained can be considered a reflection of optimal performance. The latter is particularly important for assessments in the cognitive domain – including assessment of intelligence, aptitude and learning potential. Adolescents tend to resist assessment processes and are more likely to be skeptical and less than positive about them(Lufi & Darliuk, 2005). For this age group, anything that can arouse their interest to help optimise their participation and performance, and ensure that they remain totally focused during the process, should be welcomed. Compared to paper-and-pencil assessments, computerised assessments are more likely to achieve this. One advantage of computer-based assessments mentioned by Davies et al. (2009) is that test-takers generally find computer-based assessment more enjoyable than traditional paper-based assessment – probably because the latter is similar to academic assessment and examinations.

Learning potential or dynamic assessment (DA)

Dynamic assessment involves a learning experience during assessment (Lidz, 2009) and is generally viewed as an alternative approach which takes into consideration the propensity of examinees to benefit from learning opportunities during the assessment process (Beckmann, 2006; Haywood, 2008; Lidz, 1987a, 1987b). While the concept has been well supported, "insufficient supportive evidence and heavy time requirement" (Lidz, 2009, p. 16) have resulted in limitations to more wide-spread implementation in educational contexts in particular. One of the ways in which DA can be more widely implemented is to make available procedures that are practical and time efficient, and to continue to conduct and make available research results on the validity and reliability of procedures (De Beer, 2010a; Grigorenko & Sternberg, 1998; Lidz, 2009).

Vygotsky (1978) distinguished between performance with and without aid or support (Daniels, 2005; Murphy, 2008). With regard to assessment and instruction, Vygotsky's work has been used extensively in the measurement of learning potential (Grigorenko & Sternberg, 1998; Lidz, 1987a, 1987b; Murphy & Maree, 2006; Sternberg & Grigorenko, 2002). The way in which Vygotsky's concept of the Zone of Proximal Development (ZPD) has been implemented in the assessment of learning potential can be distinguished in terms of a more remedial and diagnostic approach versus a more psychometric or measurement approach (De Beer, 2010a). Measurement difficulties of DA can be addressed by modern item response measurement methods (Embretson, 1996; Kim-Kang & Weiss, 2008; Sijitsma, 1993a, 1993b; Van der Linden, 2008b; Weiss, 1983).

Kozulin (2005, p. 29) described the use of dynamic assessment (DA) "as still being a rather rare alternative to standard psychometric testing" although it is growing in popularity. In the academic domain, the LPCAT has shown predictive validity comparable to that generally found in static standard cognitive assessment for predicting academic performance (De Beer, 2005, 2006; Van der Merwe & De Beer, 2006) – also from a longitudinal perspective (De Beer, 2010b). The advantages of IRT methods, new technology and adaptive testing is that the test administration times are much shorter without losing measurement precision (Unick, Shumway, & Hargreaves, 2008; Van der Linden, 2008b), and it improves the measurement of change at an individual level (Kim-Kang & Weiss, 2008) – thereby countering some of the usual criticism against DA. For example, an increase in empirical results on the psychometric properties, and in particular the predictive

validity of learning potential measures (Caffrey et al., 2008; De Beer, 2010b), have addressed some of the concerns highlighted by Grigorenko and Sternberg (1998).

Context of the research

The multicultural and multilingual South African context poses definite challenges for psychological assessment (Claassen, 1997; Foxcroft, 1997, 2004), and educational and socioeconomical inequalities further complicate assessment. In terms of educational attainment of persons aged 20 years and older, those who had completed secondary level education stood at 23.6% in 2007 (StatsSA, 2008). This indicates that a high percentage (76.4%) of this group has less than completed secondary school education. Attempts to lower the attrition rates should be encouraged – and one way in which this can be done is through vocational assessment and vocational guidance to emphasise the importance of educational attainment for optimal career prospects. Measurement of learning potential allows for additional information to be made available to address some of the challenges of assessment in South Africa.

The Employment Equity Act (1998) provides definite guidelines for assessment in industry in South Africa. While the same principles can be used in the educational domain, vocational guidance assessments in schools have dwindled in the past few decades. It is nevertheless necessary to evaluate the psychometric properties of instruments within the different contexts in which they are applied and to ensure the maintenance of optimal assessment practices. The current study provides psychometric information on different tests that were administered for subject selection and vocational guidance purposes.

Vocational guidance assessment of adolescents

Vocational guidance for adolescents can be considered a crucial investment in their futures by helping to prepare them for their long-term career and life opportunities. Personality, cognitive and interest assessment traditionally provide vital information in this regard. The high percentage of learners who leave without completing their secondary level education is a growing concern in the South African context (Patton, Watson & Creed, 2004; StatsSA, 2008). Learners may be better motivated to complete their secondary level education if they receive vocational assessment and guidance at secondary school level. In addition, a focus on learning potential over and above standard assessments may further encourage learners to optimise their personal potential in terms of educational achievement.

Measurement of aptitude versus learning potential

The measurement of cognitive abilities – an integral part of psychological assessment - includes intelligence tests, ability or aptitude tests, scholastic tests and lately also learning potential tests. The term aptitude is used to describe a specific ability and refers to the individual's "ability to acquire, with training, a special skill or to attain a specific level of performance" – thereby providing information on differential abilities (Van Eeden & De Beer, 2009, p. 141). Such results are often used in an educational context to determine school readiness, to obtain a comprehensive picture of specific aptitudes for vocational guidance or to assist with decision making regarding further training and development – in short, to provide an economical way in which reliable and relevant information about the individual can be obtained for educational or vocational guidance (Claassen, Van Heerden, Vosloo & Wheeler, 2000). Claassen et al. (2000, p. 34) noted that the DAT-R battery "will probably in most instances be used for guidance on the choice of subjects, courses and occupations". However, they also stress that these results should be used together with other assessment results and data such as personal circumstances, school achievement, etcetera. They furthermore emphasise (Claassen et al., 2000, p. 33) that "the use of aptitude tests is based on the assumption that all the learners have more or less the same experience of the characteristic that is being measured." In the South African context this assumption cannot always be made – which is why the use of learning potential measures should be considered for use alongside the more traditional forms of assessments (De Beer, 2005; Murphy & Maree, 2006; Owen, 1998).

For the purpose of the present article, the focus is on the comparison of the learning potential scores of the LPCAT (De Beer, 2005) with selected aptitude scores obtained with the Differential Aptitude Test Form R (DAT-R, Claassen et al., 2000). This measure is aimed at providing information on the proficiencies in mathematics, language usage, ability in verbal and non-verbal reasoning, spatial perception and mechanical insight of learners (Claassen et al., 2000).

Method

Design

A non-experimental correlational design was used to evaluate the inter-correlations between measures and the predictive validity of the LPCAT and DAT-R results for predicting aggregate academic performance. The use of end-of-year academic performance as the criterion measure indicated a predictive validity correlational design.

Participants

The population (N=262) consisted of 162 girls (61.8%) and 100 boys (38.2%). All were pupils in their second year of secondary school at the school where the assessments took place. Because of logistical factors and absenteeism, not all pupils completed all the assessments. The realised sample for the LPCAT (n=239) consisted of 149 girls (62.3%) and 90 boys (37.7%). For the DAT-R, assessments were conducted on different days and the realised samples per sub-test differ. The sample sizes for the DAT-R sub-tests are 251 for the Verbal Reasoning sub-test (155 female, 61.8% and 96 male, 38.2%), 223 for Comparisons (136 female, 61% and 87 male, 39%) and 250 for Spatial Perception (153 female, 61.2% and 97 male, 38.8%). The samples are sufficiently large and proportional in terms of gender to be considered representative of the overall year group as indicated above – although not representative of the gender groups in the broader population.

Assessments

The assessments included for the vocational assessment were the LPCAT (De Beer, 2005) for learning potential, the Differential Aptitude Test - Form R (DAT-R) (Claassen et al., 2000) for aptitude (Verbal Reasoning, Comparisons and Spatial Perception), the Rotter Internal-External scale (Rotter, 1989) for locus of control or motivation and the Career Preference Computerised Adaptive Test (CPCAT) for career-related preferences (De Beer, Marais, Maree & Skrzypczak, 2008). For the present article, the focus was on cognitive assessment results. Consequently the selected results for the LPCAT and DAT-R are reported in this article.

Internal consistency coefficient alpha reliability values for the LPCAT range between 0.926 and 0.978 (De Beer, 2005) while predictive validity values, using academic marks as criterion scores at a junior secondary level, range between 0.44 and 0.54 for first year secondary school and between 0.55 and 0.66 for second year secondary school students (De Beer, 2005, 2006). For the DAT- R Kuder-Richardson Formula 20 (K-R 20) internal consistency reliability values for a second year secondary school group reported by Claassen

et al. (2000) for the selected sub-tests used in this study were 0.63 for Verbal Reasoning, 0.84 for Comparison and 0.91 for Spatial Perception . Although the value for Verbal Reasoning was low, it should be kept in mind that these sub-test results are not used in isolation or by themselves - rather they are generally combined with other sub-test and assessment results for decision making. DAT-R data for this sample were not captured at item level, which precluded calculation of reliability values for this group.

For the LPCAT, pre-test, post-test, composite and difference scores were obtained per individual. For the DAT-R, raw and stanine scores for the three sub-tests that were administered were obtained, and raw scores were used in the correlation and regression analyses. A short description for each of the three sub-tests of the DAT-R that were administered are provided below (Claassen et al., 2000):

- *Verbal Reasoning*: This sub-test is aimed at determining the ability to comprehend verbal ideas and then to process them in a logical manner.
- *Comparison*: This sub-test measures the speed and accuracy of perception of differences and similarities between visual configurations – including both numerical and verbal material.
- *Spatial Perception* : This sub-test measures two-dimensional spatial ability – based on the ability to visualise the final results of a rotation or movement of an object in a two-dimensional space.

(Note: Although the mathematics sub-test of the DAT-R would have added very useful information, its sub-test time of 42 minutes, considered in the light of practical and logistical limitations of having only one lesson period at a time available for assessments, precluded its inclusion in this project.)

Procedure

The students were assessed during vocational guidance lesson times over a period of three weeks in order to avoid disruption of the normal academic school lesson times. Although the entire second year secondary school year group was targeted for the assessments, normal absenteeism and other practical and logistical limitations resulted in some learners missing certain test sessions which resulted in missing data for some individuals. All assessments were administered by psychologists. Academic results were obtained from the school at the end of the academic year.

Analysis

Descriptive statistics provide summative information on the different assessment results available for the sample. Correlational analysis indicates the relationships between variables and multiple regression

analysis was used to investigate the predictive validity of the cognitive variables for predicting aggregate academic performance. The latter was obtained by aggregating the final end-of-year academic results for English, Life Orientation and Mathematics. These three subjects were chosen because they represent verbal, memory and numerical content. Furthermore, these subjects are considered essential building blocks in terms of academic and personal development towards optimising performance. An aggregate of the three final marks for the three subjects was used as the criterion to represent general academic performance.

Descriptive analysis

Descriptive results are a summary of scores (usually involving means and standard deviations), thereby providing an indication of the general performance level of the participants on the different measures.

Correlational analysis

Correlations indicate the direction and strength of the relationship between variables. They are generally interpreted in terms of statistical significance but it has been recommended (Cohen, 1992; Henson & Smith, 2000) that correlations should also be interpreted in terms of practical significance or effect size. In this regard, the magnitude of the correlation is used to indicate practical effect. Generally correlations with an effect size in the region of .1 are considered to indicate small effect, those in the region of .3 medium effect and those close to or larger than .5 large effect (Cohen, 1992; Henson & Smith, 2000).

Regression analysis

Regression analysis is used to evaluate the predictive validity of one (simple regression) or more (multiple regression) independent variable(s) in predicting a dependent variable (Field, 2005). The results are interpreted in terms of the overall model as well as the contribution of the different independent variables. The Enter method of regression analysis simultaneously considers all independent variables in terms of their independent and joint predictive power with regard to the dependent variable (Field, 2005). Because of high collinearity between the three learning potential scores (pre-test, post-test and composite), the one that showed the highest correlation with the dependent variable (i.e. the post-test) was the only one entered in the regression analysis.

Results

Descriptive results

These results provide a summary of performance by indicating means and standard deviations of different scores. The descriptive results for the total group are presented in Table 1.

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For LPCAT results, scores can be compared to typical performance levels for specific educational level groups (see Table 2).

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The mean scores on the LPCAT indicate a mid- to senior secondary level for the pre-test and post-test scores respectively. This indicates that, with regard to their non-verbal figural reasoning and learning potential, the current sample performed slightly above the expected level, given their academic level at the time of the assessment. With regard to the projected future or potential level of performance, it was at a senior secondary level. The general stanine interpretation for the DAT-R scores are very good (9), good (8), above average (7), high average (6), average (5), low average (4), below average (3), poor (2) and very poor (1) compared to the relevant norm group. Interpreting the DAT-R sub-tests results in comparison to a second year secondary school level norm group, the mean score for Verbal Reasoning (M=7) was above average, for Comparisons (M=5.68) it was between average and high average, while for Spatial Perception (M=6.46) it was between high average and above average (see earlier descriptions above).

Distribution of scores

While the descriptive results provide a way of summarising group results, additional information becomes available by viewing the distribution of scores. The distribution of LPCAT results (see Figure 2) indicates that the majority of students performed above the expected level (see Table 2), considering their academic

level at the time of assessment. At an individual level, feedback on the current and projected level of general non-verbal reasoning as reflected in the LPCAT results can help students to aim for appropriate future levels of training and development and to optimise the level of learning potential shown, that is, aiming to achieve academic success at or possibly even beyond the levels of potential shown.

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Figure 2 about here

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The DAT-R scores are norm-based and the distribution of the stanine results on the three selected sub-tests indicate that a considerable number of students performed at "above average" to "very good" levels on the respective sub-tests (see Figure 3 and earlier stanine category descriptions). At an individual level, the results can be used to guide and advise students in terms of their subject choices and vocational decisions.

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The distribution of the academic results of the students in the three selected subjects and in terms of the average scores of the three subjects are depicted in Figure 4.

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The highest mean results were shown for Life Orientation (M=53.88%), followed by English (M=52.57%) and Mathematics (M=48.22%). The distribution of Mathematics results showed an extreme peak around 40.

Correlational results

The inter-correlations between the different scores obtained are presented in Table 3.

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The LPCAT pre-test, post-test and composite scores all indicated statistically highly significant – as well as practically significant in terms of effect size (Henson & Smith, 2000) – positive correlations with the aggregate academic performance of learners. The highest of the LPCAT correlations with the academic performance was for the post-test results (r=.364, p=.000), and as expected (De Beer, 2005, 2010a), high inter-correlations were shown between the pre-test, post-test and composite scores respectively. The three sub-tests of the DAT-R also all indicated statistically highly significant as well as practically significant positive correlations with aggregate academic results. Of the three DAT-R sub-tests, the highest correlation with the aggregate academic results was found for Verbal Reasoning (r=.543, p=.000). The correlations with school aggregate results of the LPCAT scores (pre-test r=.358, p=.000; post-test r=.364, p=.000 and composite r=.358, p=.000) were lower than that of the DAT-R Verbal Reasoning (r=.543, p=.000), slightly lower than that of the DAT-R Spatial Perception (r=.383, p=.000) and of a similar magnitude to that of the DAT-R Comparisons (r=.353, p=.000).

Regression results

To investigate the predictive validity of the different scores for predicting aggregate academic results, the LPCAT post-test, DAT-R Verbal Reasoning, DAT-R Comparison and DAT-R Spatial Perception scores were entered into a multiple regression model using the Enter method (see Table 4). The overall model was statistically highly significant ($p < .001$) in predicting the aggregate academic results ($R^2 = .37$, Adjusted $R^2 = .35$).

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Altogether 37% (35% adjusted) of the variability of academic aggregate performance was predicted by the variables that were entered into the regression. DAT-R Verbal Reasoning contributed highly significantly (p

< .001) and DAT-R Spatial Perception contributed significantly ($p < .05$). For this sample, although also being non-verbal in nature, the correlation of the LPCAT scores (pre-test, post-test and composite scores) with the aggregate academic results were slightly lower (r=.358, r=.364 and r=.358, respectively) than that of the DAT-R Spatial Perception (r=.383). The latter was also a significant predictor in the regression analyses, while the LPCAT post-test score was not. The correlation between the LPCAT post-test and the DAT-R Spatial Perception was statistically highly significant and practically showed high effect (r=.496, p= .000, n=233).

When taken on their own respectively, as a predictor of aggregate academic results, DAT-R Verbal Reasoning accounted for 29.2% of the variance in aggregate academic results ($R^2 = .295$, Adjusted $R^2 = .292$) while for DAT-R Comparisons it was 12.1% ($R^2 = .125$, Adjusted $R^2 = .121$), for DAT-R Spatial Perception it was 14.3% ($R^2 = .146$, Adjusted $R^2 = .143$) and for LPCAT post-test it was 12.9% ($R^2 = .132$, Adjusted $R^2 = .129$).

Discussion

The focus of the present article was on the cognitive (aptitude and learning potential) assessment of second year secondary students from a vocational guidance assessment perspective. The results were used to obtain descriptive results, to investigate the distribution of scores, evaluate the inter-relationships between scores and to consider the predictive validity of the different measures for predicting aggregate academic results in three subjects.

Descriptive results and the distribution of scores are valuable to obtain a summary view of the results of the sample group. Further group-based information in terms of the inter-relationships between variables as well as the regression results for predicting aggregate academic results shed light on the trends and tendencies of relationships between different constructs and measures.

For vocational guidance purposes, individual results and performance levels can be used to guide decision making. DAT-R results reflect performance compared to a second year secondary school norm group. LPCAT learning potential individual results indicate the current and projected future or potential levels of training that the individual is likely to cope with and benefit from. Based on the distribution of learning

potential results for this sample and individual results, students can be encouraged to attain the highest level of academic qualification indicated with due consideration of other vocational assessment results.

The LPCAT and DAT-R results showed statistically highly significant correlations – which were also practically significant in terms of effect sizes indicating between medium and large effect - with the aggregate academic results. These relationships confirm that higher performance on different cognitive assessments is generally associated with higher levels of academic performance. For predicting academic results by means of regression analysis, Verbal Reasoning aptitude was shown to be the best predictor and also the only statistically highly significant predictor of aggregate academic performance ($p < .01$). Spatial Perception aptitude was shown to be a statistically significant predictor ($p < .05$) of aggregate academic results.

It should be kept in mind that the results of learning potential measures are not intended to replace standard assessment results but to be used alongside them to enrich the information that can be made available at an individual level. Using the results at an individual level with students can be valuable in terms of providing vocational guidance for subject choices and future career-related decision making. The results can be used in an integrated way together with other non-cognitive assessment results, as recommended by Claassen et al. (2000).

On a practical level, current and projected future (potential) levels of performance can be compared to the prospective or possible levels of training. Considering a specific level of training, the results will allow the educational psychologist to evaluate whether the individual is currently already at or close to the required level (as indicated by the pre-test results) or whether the individual shows the potential (as indicated by the post-test results) to reach or perform at, or close to, the required level. Alongside other assessment results, this information can be used to guide the individual in terms of career-related choices and decisions, and to utilize available opportunities available for personal development. The focus is, therefore, not only whether the individual will be able to profit from learning, but with what level of training he/she seems likely to be able to cope – or alternatively, to what degree he/she seems able to cope with a particular level of training considered. Assessment information on learning potential can assist educational psychologists to assist individuals to realize their optimal development potential.

Limitations and recommendations

The logistical restrictions of having to work within the normal school lesson time for assessment limited the number of assessments that could be included in this study. Assessment for example of Mathematics aptitude (one of the sub-tests in the DAT-R) would have provided very useful additional information. Within the time available this sub-test could not be included in the test battery. Further research with inclusion of all sub-tests of the DAT-R will add valuable additional comparative information. In terms of the criterion measure used, using more than only three academic subjects' results would improve the quality and general academic representativeness of the criterion measure. Including all academic subjects would strengthen and improve the academic criterion measure.

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Figure 1 Typical assessment areas for career guidance assessment

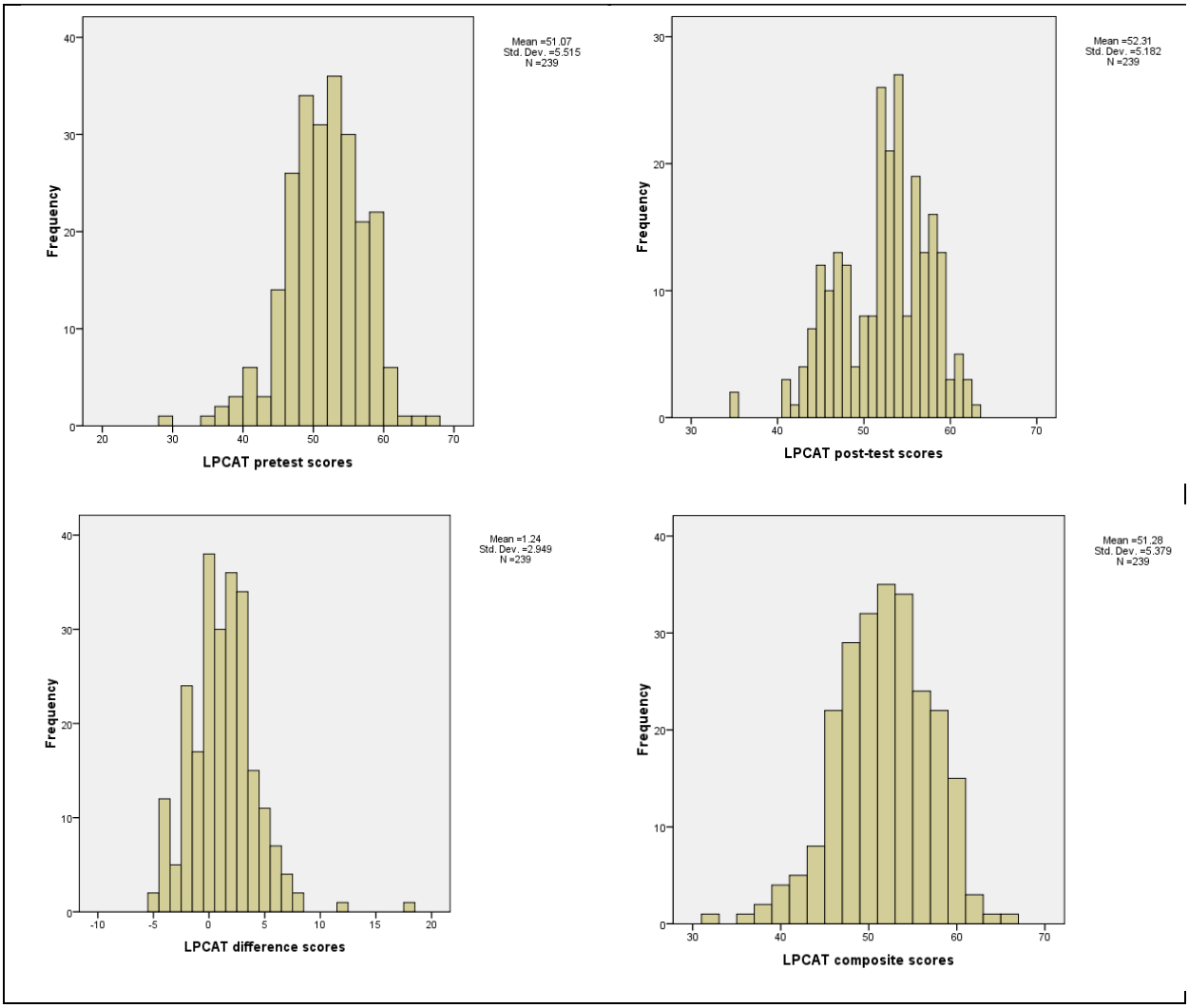

Figure 2 Distribution of LPCAT scores

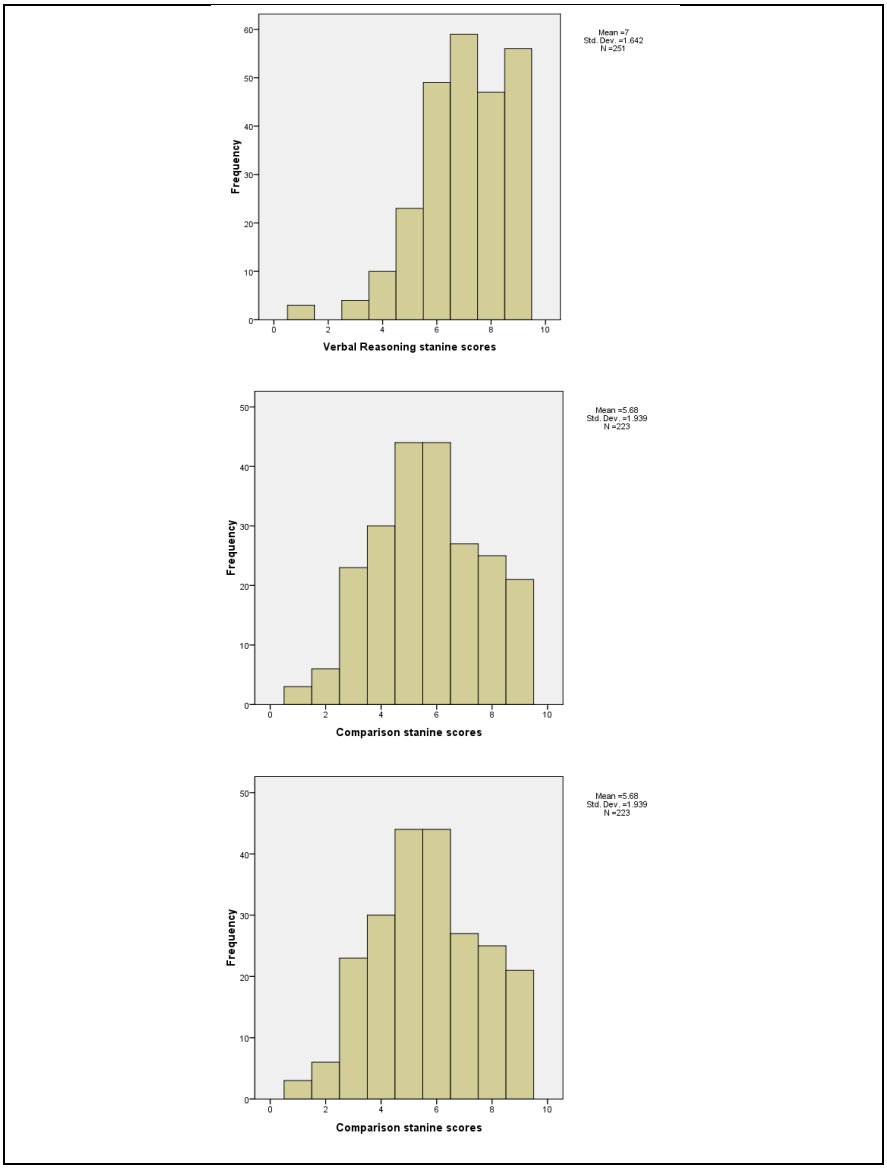

Figure 3 Distribution of DAT-R scores

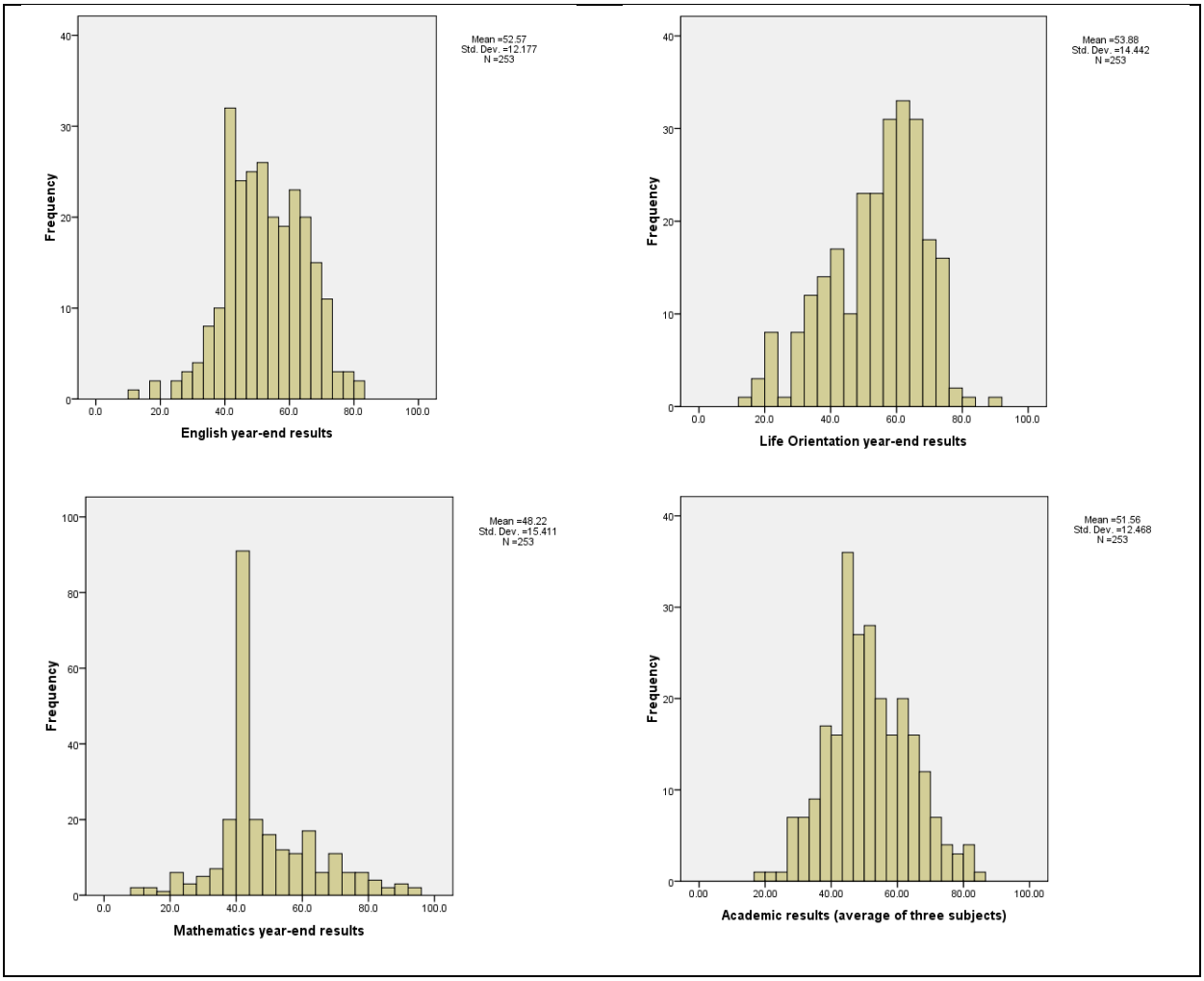

Figure 4 Distribution of academic subject and average academic scores

Measure (max score)	Maximum possible score	N	Minimum	Maximum	M	SD
LPCAT pre-test	80	239	29	66	51.07	5.515
LPCAT post-test	80	239	35	63	52.31	5.182
LPCAT difference score		239	-5	18	1.24	2.949
LPCAT composite score	80	239	32	66	51.28	5.379
DAT-R Verbal Reasoning (raw)	30	251	5	29	19.96	4.469
DAT-R Verbal Reasoning (stanine)	9	251	1	9	7	1.652
DAT-R Comparisons (raw)	30	223	6	30	24.54	4.704
DAT-R Comparisons (stanine)	9	223	1	9	5.68	1.939
DAT-R Spatial Perception (raw)	30	250	0	30	20.08	8.536
DAT-R Spatial Perception (stanine)	9	250	1	9	6.46	2.130
English year-end mark	100	253	11.3	81.0	52.57	12.177
Life Orientation year-end mark	100	253	15.3	89	53.88	14.44
Mathematics year-end-mark	100	253	8.0	95	48.22	15.411
Aggregate academic score	300	253	51.8	250.1	154.67	37.403

Table 1 Descriptive statistics for the different results

LPCAT T-score range	LPCAT Stanine score	ABET* / NQF level	Educational levels
20 – 32	1	Abet level 1	Junior primary
33 – 37	2	Abet level 2	Mid-primary
38 – 42	3	Abet level 3	Senior primary
43 – 47	4	Abet 4 / NQF 1	Junior secondary
48 – 52	5	NQF level 1 – 3	Mid- to senior secondary
53 – 54	6	NQF level 4 – 5	Junior Tertiary (Higher Certificate)

55 – 57	6	NQF level 6	Tertiary Diploma/Advanced Certificate
58 – 62	7	NQF level 7	Tertiary 3-year Degree/Advanced Diploma
63 – 68	8	NQF level 8	Honours / 4-year Degree/ Postgraduate Diploma
69 – 80 (65+)	9	NQF level 9	Advanced Degree (Master's)
69 – 80 (65+)	9	NQF level 10	Advanced Degree (Doctorate)

*Abet: Adult Basic Education and Training

Table 2 LPCAT score ranges for interpretation purposes

Variable		1	2	3	4	5	6	7	8
LPCAT pre-test	r	-							
	(p)								
	n								
LPCAT post-test	r	.850**	-						
	(p)	(.000)							
	n	239							
LPCAT difference	r	-.377**	.168**	-					
	(p)	(.000)	(.009)						
	n	239	239						
LPCAT composite	r	.993**	.886**	-.300**	-				
	(p)	(.000)	(.000)	(.000)					
	n	239	239	239					
DAT-R Verbal	r	.492**	.546**	.041	.505**	-			
Reasoning	(p)	(.000)	(.000)	(.536)	(.000)				
	n	232	232	232	232				
DAT-R Comparisons	r	.338**	.338**	-.042	.344**	.456**	-		
	(p)	(.000)	(.000)	(.545)	(.000)	(.000)			
	n	207	207	207	207	219			
DAT-R 2D reasoning	r	.422**	.496**	.080	.436**	.398**	.321**	-	
	(p)	(.000)	(.000)	(.226)	(.000)	(.000)	(.000)		
	n	233	233	233	233	245	219		
School aggregate	r	.358**	.364**	-.033	.358**	.543**	.353**	.383**	-
Score	(p)	(.000)	(.000)	(.621)	(.000)	(.000)	(.000)	(.000)	
	n	233	233	233	233	247	218	244	

Table 3 Inter-correlations between the different measures

** $p < .01$

Variable	B	SEB	Beta	t	p
LPCAT post-test score	.312	.520	.044	.600	.549
DAT-R Verbal Reasoning	3.545	.616	.424	5.758	.000**
DAT-R Comparison	.964	.523	.121	1.844	.067
DAT-R Spatial Perception	.689	.298	.158	2.316	.022*

[R^2 = .37. Adjusted R^2 = .35; ** p < .01; * p < .05]

Table 4 Summary of standard multiple regression analysis using the Enter Method for predicting aggregate academic results