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DEVELOPING A STUDY ORIENTATION QUESTIONNAIRE IN MATHEMATICS FOR PRIMARY SCHOOL STUDENTS [1,2]

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Summary.—The Study Orientation Questionnaire in Mathematics (Primary) is being developed as a diagnostic measure for South African teachers and counsellors to help primary school students improve their orientation towards the study of mathematics. In this study, participants were primary school students in the North-West Province of South Africa. During the standardisation in 2007, 1,013 students (538 boys: *M* age = 12.61; *SD* = 1.53; 555 girls: *M* age = 11.98; *SD* = 1.35; 10 missing values) were assessed. Factor analysis yielded three factors. Analysis also showed satisfactory reliability coefficients and item-factor correlations. Step-wise linear regression indicated that three factors (Mathematics anxiety, Study attitude in mathematics, and Study habits in mathematics) contributed significantly ($R^2 = .194$) to predicting achievement in mathematics as measured by the Basic Mathematics Questionnaire (Primary).

This research is part of an ongoing attempt (Maree, 1999; Maree & Steyn, 2004) to improve students' achievement in mathematics and teachers' effectiveness in teaching mathematics. While much has been written about inadequate achievement in mathematics at school and at university in South Africa (Howie, 2001; Horne, 2007),[3] relatively little has been written about achievement in mathematics in the early years of schooling in South Africa or possible solutions to the problem. However, importance of achieving in mathematics during the early years for a solid base for future achievements is now realised (Reeves, 2006) and South African researchers have recently started to focus on ways in which this challenge could be addressed (Horne, 2007; Fleisch, 2008).

Inadequate achievement in mathematics manifests itself internationally (Maree, Pretorius, & Eiselen, 2003). However, the state of mathematics learning and teaching in South Africa appears to be particularly unsatisfactory. South African students in Grade 8 achieved the worst of all 46 par-

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[3]Bernstein, A. (2004) Number crunch for SA. Finance. Accessed 8 July, 2007, at http://www.finance24.com/Finance/Economy/0,,1518-1525_1617659,00.html.

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ticipating countries in the Trends in Mathematics and Science Study.[4] South African mathematics students had significantly lower achievement in this study than students in all other countries (Howie, 2001). Seemingly, the introduction of an outcomes-based approach in South Africa in 1997 has not yet yielded desired results.

In South Africa, as elsewhere, mathematics remains a gateway subject to higher education, since adequate achievement in mathematics is a prerequisite for enrollment in scientific fields. Students have high demands made on them from an early age to process a great deal of information, master content, and to apply their knowledge and skills in everyday situations. As a result, South African training institutions are being challenged to assess whether they train students sufficiently in employable skills to learn effectively and to accept responsibility for the learning process (Schollar, 2004). The use of assessments that could help teachers to monitor their own teaching is needed (Pierce, Stacey, & Barkatsas, 2007). Because the natural sciences currently are the focal point in education in South Africa, research on tests in this subject matter and mathematics in particular is of special importance (Republic of South Africa Department of Education, 1995).

Importance of Adequate Orientation to Mathematics on Achievement

Snow and Farr (1987) asserted that learning in mathematics could best be understood by a view of the whole person which integrates cognitive, conative (the will to achieve), and affective aspects. During the past 15 years, the research focus in mathematics has shifted to examination of influence of social, cognitive, conative, and affective facets on achievement in mathematics (Pierce, *et al.*, 2007).[5] Students who are aware of their own learning processes and understand the way they manage their thought processes and skills (Brown, 1987) manage all these facets to achieve outcomes and monitor their own progress.[5]

There is sufficient empirical evidence that an adequate orientation to mathematics is related to high achievement, as Du Toit (1981), Reynolds and Wahlberg (1992), and Van Aardt and Van Wyk (1994) have shown that adequate orientation towards the study of mathematics is a significant factor in success at school and through the university. Reynolds and Wahlberg (1992) emphasized that there was close interaction between the different aspects of students' orientation to mathematics. Several other researchers found statistically significant associations between aspects of mathematics achievement and study orientation in mathematics, including anxiety, motivation, attitudes, the use of effective (meta-cognitive) learning strategies in mathematics, effec-

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[4]TIMSS. (2003) Trends in International Mathematics and Science Study. Accessed 22 Jan., 2005 at http://nces.ed.gov/timss/TIMSS03Tables.asp.

[5]Martinez, M. (1997) Development and validation of an intentional learning orientation questionnaire. Accessed 28 Dec., 2005 at http://mse.byu.edu/projects/elc/meaprojpr.html.

tive time management, concentration, will to achieve in mathematics, parental expectation, and the social, physical, and experienced environment of learning mathematics (Cobb, Wood, Yackel, & Perlwits, 1992; Van Aardt & Van Wyk, 1994; Maree, 1997; Shepard, 2000; Van der Walt, 2007; Fleisch, 2008). Students' orientation to mathematics is assumed to influence their problem-solving abilities and their achievement.

This article describes the development of a questionnaire aimed at evaluating primary school students' study orientation towards mathematics, the Study Orientation Questionnaire in Mathematics (Primary) [SOM(P)]. Language and sex group differences in achievement were analyzed. Because Maree (1999) and Maree and Steyn (2004) reported differences between mean scores of language and sex groups on measures of Study Orientation Questionnaires at secondary school and the university, these relationships were considered in the current study of the primary school learners.

The hypotheses were (a) there would be small, nonsignificant differences in size of effect between the mean scores of language and sex groups on measures of the Study Orientation Questionnaire in Mathematics (Primary) and (b) a combination of subscale scores on the measures of the Study Orientation Questionnaire in Mathematics (Primary) would predict the mathematical achievement of primary school students as measured on the Basic Mathematics Questionnaire (Primary) (Van der Walt, 2007). It was assumed that significant variance in mathematics achievement would be predicted by at least one of the questionnaire's three fields.

Method

Pilot Study

The questionnaire was initially applied to 353 Grade 4 to 7 students (156 English, 98 Afrikaans, and 99 Tswana). Testees were requested to circle the numbers of items and in each to underline phrases and words contained they did not understand. On the basis of the testees' reactions with respect to the items, wording or construction of a number of items was amended.

Sample

A sample of schools, selected based on current data provided by the North-West Education Department, to represent the population of the North-West Province according to socioeconomic status, language, grade, and location (*viz.*, city, town, or township) participated. To ensure representation of each important part of the population, the location was divided into strata or subpopulations. The following strata were taken into consideration: sex (male or female), native language (Afrikaans, English, and Tswana), Grade (4 to 7), and area (four distinct regions in the North-West Province). Participants were 1,103 Grade 4 to 7 students. The results of the 2001 census by age group and the proportion of students in the different language groups, ages 5 to 14 years, appear in Table 1 and were used to calculate weights. Since the majority of the population (88%) in North-West are Tswana speakers, it was not meaningful to use a proportional stratified sample in which the ratio of respondents per language group was the same as in the population. The much smaller number of Afrikaans and English respondents in the sample would have made comparisons on the basis of language impossible, so weighted averages were used for the comparisons of the groups to specify the proportional presentation of language to that of the population. Further, whole classes were regarded as clusters, implying that sex was observed in its population ratio. Fairly even numbers of respondents (between 335 and 398) from the three language groups were included to obtain sufficient data to permit use of factor analysis.

TABLE 1
FREQUENCIES OF STUDENTS' AGE GROUP 5 TO 14 YEARS DURING 2001 CENSUS PER NATIVE LANGUAGE GROUP

	Afrikaans	English	Tswana
Total number	45,442	7,280	554,051
Weights	122.81	18.29	1,653.88

According to the data retrieved from the 2001 census, the calculated weights for the respective language groups Afrikaans, English, and Tswana were 122.8, 18.3, and 1,653.9. Table 2 highlights the following regarding the observed schools: three Afrikaan-speaking schools (A1, A2, and A3) from three different regions (1, 2, and 3) in the North-West Province were included. One was located in a town, another located in a city, and a third was located next to a township or informal settlement. Three English-speaking schools (E1, E2, and E3) from Regions 2 and 3 were included. One was in a city, one in a town, and one in a township. Two Tswana-speaking schools were included (T1 and T2) from Region 2 (both located in townships or informal settlements). A national strike of the teachers union in South Africa affected the data collection, especially in Region 4, in which no schools cooperated. These schools were replaced by schools in Region 2.

TABLE 2
SCHOOLS BY REGION AND LOCATION

Language	North-West Region				Location of School	
	1	2	3	4	City or Town	Township
Afrikaans	A1	A2	A3		A2, A1	A3
English		E2, E3	E1		E3, E2	E1
Tswana		T1, T2				T1, T2

Despite the fact that no particular differences were apparent among the four regions, this strategy might have affected the generalizability of the findings adversely.

Table 3 indicates that for the total of 1,103 students, between 100 and 187 respondents per school participated. The respective percentages of respondents from each native language group (*viz.*, Afrikaans-, English-, and Tswana-speaking) who participated were 33, 36, and 31%. The numbers of boys (538) and girls (555) (10 students did not indicate their sex) were almost equal and the frequency of respondents per grade varied between 267 and 289. Even though students were informed that no time limit was set for the completion of the questionnaire, they were requested to try to do so in 20 to 25 min.

TABLE 3
FREQUENCIES BY LANGUAGE

Language	A1	A2	A3	E1	E2	E3	T1	T2	Total
Number	100	124	146	130	139	129	187	148	1,103

Procedure

Ethical aspects.—Permission was requested and obtained in writing from the Department of Education, the parents, and the students to conduct the research and publish the findings. Assurance was given that no individual would be identified.

Inventories.—The Study Orientation Questionnaire in Mathematics (Primary) was adapted from the Study Orientation Questionnaire in Mathematics (Maree, 1997). Permission was granted by the author and the opinions of 10 Grade 4 to 7 teachers, 20 students, and five experts (university lecturers in mathematics) about the changes requested. The original questionnaire comprises six fields (based on factor analysis), containing 92 statements which relate to how individuals feel or act regarding aspects of their achievement in mathematics. The test was developed by the Human Sciences Research Council of South Africa (Maree, Prinsloo, & Claassen, 1997) between 1994 and 1997 based on responses from 3,013 high school students in South Africa. A student rates each item on a 5-point response format anchored by 0: Rarely and 4: Almost always. Of the items, 46 are stated positively and 46 stated negatively to avoid a "yes" set. Information on preferred answers can be converted to percentile ranks, and a profile can be drawn. As a broad guideline for the interpretation of a profile, the following division is suggested: 70 to 100% (adequate study orientation), 40 to 69% (neutral but can contribute to an adequate or inadequate study orientation), and 0 to 39% (inadequate study orientation). Cronbach alpha for the six fields of the original questionnaire ranged from .70 to .80 and for the questionnaire as a whole from .89 to .95. Several steps (Maree, 1999) were followed to ensure content validity. Whereas Steyn (2003) adapted the questionnaire for use in tertiary environments, Eiselen (2006) built on Steyn's research.

The aim of the current study was to change the items in the original questionnaire to fit the developmental level and reading skills of learners in Grades 4 to 7 in South Africa. For the Study Orientation Questionnaire in Mathematics (Primary), the wording and response categories were changed to three to simplify the questionnaire for primary school students. A number of changes were made to the first five fields of the original version of the Study Orientation Questionnaire in Mathematics (Study attitude, Mathematics anxiety, Study habits, Problem-solving behaviour, and Study environment). Longer statements were shortened and simplified, the number of items was decreased, and statements with regard to the sixth field (Information-processing, which refers to concepts not handled in the primary school) were omitted. The Study Orientation Questionnaire in Mathematics (Primary) comprises 36 statements which concern how individuals feel or act regarding aspects of their achievement in mathematics. The student rates each item on a 3-point response format anchored by 3: Almost never and 1: Almost always. The three fields identified in the Study Orientation Questionnaire in Mathematics (Primary) are Study habits in mathematics, Mathematics anxiety, and Attitude towards mathematics. A description and a sample item of each field are presented in Table 4.

TABLE 4
DESCRIPTION AND SAMPLE ITEM FROM EACH FIELD ASSESSED

Field	Description	Sample Item
1. Habits (11 items)	Help seeking strategies, self-confidence, participation during group work, interest, and involvement in mathematics	I do the sum myself when we work in groups.
2. Anxiety (17 items)	Avoiding doing sums or failure, negative experiences of mathematics class, passive anxiety towards mathematics class and teacher, lack of mathematical confidence, anxiety caused by unfamiliarity and degree of difficulty of a sum	I feel nervous when my teacher talks to me.
3. Attitudes (8 items)	Self-efficacy experiences in mathematics class, a positive attitude towards mathematics, and personal preferences regarding mathematics	I am bored when I do sums.

The Basic Mathematics Questionnaire (Primary) (Van der Walt, 2007) has 15 multiple-choice items (questions) in mathematics based on the Revised National Curriculum Statement (Republic of South Africa Department of Education, 2002). These items are standardised for the Grades 4 to 7 population of South Africa. The test measures the general level of knowledge and understanding of mathematics in Grades 4 to 7 and can be regarded as an achievement test in mathematics for Grades 4 to 7. An attempt was made to compile the test in such a way that its content would be representative of the core syllabus for mathematics: Grades 4 to 7, in so far as it is possible with a limited number of items (15). Items with a discrimination value $> .20$ were used.

Research strategy.—The Nunnally and Bernstein (1994) strategy for the design of multiple-choice tests was implemented. The preliminary questionnaire was administered during 2007.

Results

Bartlett's sphericity test was used (SPSS, 2005) to determine if significant correlations existed between items (Hair, Anderson, Tatham, & Black, 1998). The result ($p < .001$) confirmed that correlations between items were large enough to conduct meaningful factor analysis. Sampling adequacy ($N = 1{,}103$) was measured by the Kaiser-Meyer-Olkin test (Field, 2005). This yielded a value of .88, suggesting a compact factor structure (Field, 2005), i.e., mutual correlations will form between items to form factors.

To facilitate internal structure congruence, factor analysis (exploratory analysis; Bhalla & Lin, 1987) was used because the Study Orientation Questionnaire in Mathematics (Primary) was administered to young children for the first time. To circumvent some of the most typical problems attached to the use of factor analysis on items of an ordinal test (e.g., insufficient correlation between items, low factor loadings, and unique variance relative to shared variance), items were grouped into 17 "parcels" of two or three items with similar meaning. According to De Bruin (2004), item parcels are more reliable than individual items because parcel variables can take on more values than individual items and provide a greater possibility of linear relations among parcels or factors (Comrey, 1988; Little, Cunningham, Shahar, & Widaman, 2002). Exploratory factor analysis was subsequently used on the 17 parcels which collectively comprise the Study Orientation Questionnaire in Mathematics (Primary) to assess the underlying factor structure.

To assess the equivalence of constructs for different native languages, Tucker's ϕ (Van de Vijver & Leung, 1997; Chan, Ho, Leung, Cha, & Yung, 1999) was used (coefficients larger than .8 indicate good similarity of factors). Tucker's ϕ coefficients for parcels as elements of the three factors of

TABLE 5
Tucker's ϕ Coefficients For Three Factors of the SOM(P)

Language	SOM(P) Factor		
	1 (17 Items)	2 (8 Items)	3 (11 Items)
Tswana	.81	.89	.76
English	.83	.74	.93
Afrikaans*	1.00	1.00	1.00

*Reference group.

the Study Orientation Questionnaire in Mathematics (Primary) indicated different factor structures for the three language groups. Subsequent analyses indicated that the removal of Parcel 6 improved the congruency of the analysis substantially, and new coefficients are given in Table 5.

Results of exploratory factor analysis (Extraction method: principal component analysis; rotation: *promax* with Kaiser normalization) appear in Table 6. Factor loadings smaller than .3 were omitted.

TABLE 6
Pattern Matrix of Factor Analysis on Parcels and Item Communalities (Parcel 6 Deleted)

Parcel	Factor 1	Factor 2	Factor 3	h^2*
1	.75			.58
4	.71			.48
3	.70			.46
2	.70			.45
8	.63			.44
7	.55			.32
12	–.47			.35
17		.77		.57
14		.68		.43
13		.67		.51
5		.40		.20
16			.76	.52
15			.58	.44
9			.53	.33
11			.49	.38
10			.36	.24

*Crossloadings and loadings < .3 were omitted.

Intercorrelations between factors and Cronbach coefficients α for Grades 4 to 7 appear in Table 7. In this table are moderate relations between the three factors. Reliability coefficients vary from .56 to .80 and can be regarded as satisfactory for the purpose of this study. Even though reliabilities of Attitude towards the study of mathematics and Study habits in mathematics are < .7 (Nunnally & Bernstein, 1994), this probably reflects that these students are still very young. Factor scores were calculated as the mean of all

TABLE 7
Correlations Between Factors

Factor	1	2	3
1. Mathematics anxiety	.80		
2. Attitude towards study of mathematics	–.30	.63	
3. Study habits in mathematics	–.17	.35	.56

Note.—Cronbach coefficients α for Grades 4 to 7 appear as the diagonal.

questions contributing to a factor, so missing values are automatically replaced with the mean for other questions in the factor so that the factor score can be interpreted on the original scale of measurement. Means, medians, ranges, lower and upper quartiles, skewness and kurtosis for Grade 4 to 7 students for the Study Orientation Questionnaire in Mathematics (Primary) are provided in Table 8. This table shows Mathematics anxiety had the highest means and median. Mean responses fall between Sometimes and Almost never, edging in the direction of Sometimes. That the means and medians of variables do not differ markedly as well as the small values of skewness and kurtosis indicate a normal distribution of the data.

TABLE 8
MEANS, MEDIANS, MINIMUM AND MAXIMUM (RANGE) VALUES, LOWER AND UPPER QUARTILES, SKEWNESS, AND KURTOSIS FOR GRADE 4 TO 7 LEARNERS [SOM(P)] ($N = 1{,}103$)

Factor	*M*	*Mdn*	Range	Quartile		Skewness	Kurtosis
				Lower	Upper		
Mathematics anxiety	2.21	2.18	1.35–3.00	1.94	2.47	0.08	–0.62
Attitude towards study of mathematics	1.50	1.50	1.00–2.75	1.25	1.67	0.76	0.67
Study habits in mathematics	1.50	1.45	1.00–3.00	1.27	1.73	0.80	1.15

All comparisons of language, sex, and grade groups yielded statistically significant differences. These differences were due to the large weighted sample sizes and not to practically significant differences. Cohen *d* was used as the effect size to evaluate whether differences between groups were practically significant (Cohen, 1988; Steyn, 2000). Whereas effect sizes larger than .8 were regarded as practically significant, values of ca. .5 indicate differences visible to a researcher (Cohen, 1988).

Table 9 shows that whereas Afrikaans- and English-speaking students had significantly lower rated anxiety (i.e., higher anxiety scores) than Tswa-

TABLE 9
MEANS, STANDARD DEVIATIONS, AND EFFECT SIZES FOR GRADE 4 TO 7 LEARNERS FOR DIFFERENT LANGUAGE GROUPS ($N = 1{,}103$)

Language	Mathematics Anxiety		Attitude Towards Study of Mathematics		Study Habits in Mathematics	
	M	*SD*	*M*	*SD*	*M*	*SD*
Afrikaans	2.52	.30	1.50	.33	1.43	.23
English	2.45	.29	1.51	.30	1.42	.26
Tswana	2.19	.33	1.49	.31	1.51	.32
	Effect Sizes					
Tswana and English	.80†		.04		.29	
Tswana and Afrikaans	1.02†		.00		.24	
English and Afrikaans	.25		.04		.05	

†Large effect (practically significant; Cohen, 1988).

na-speaking students, no significant differences were noted between the native language groups in terms of Attitude and Study habits in mathematics.

It is evident from Table 10 that Mathematics anxiety (a lower score indicates raised anxiety) decreases from Grade 4 to Grade 7 (older students rated stress lower than the younger students). Mean scores for Attitude and Study habits in mathematics decrease from Grade 4 to Grade 7, suggesting that older students rate themselves as having more adequate study habits and better attitude than the younger children. Grade 4 students in particular rate themselves as having significantly lower scores for study habits and attitude than older students.

TABLE 10
MEANS, STANDARD DEVIATIONS, AND EFFECT SIZES FOR DIFFERENT GRADE GROUPS

Grade	*n*	Mathematics Anxiety		Attitude Towards Study of Mathematics		Study Habits in Mathematics	
		M	*SD*	*M*	*SD*	*M*	*SD*
4	268	2.0	.3	1.6	.4	1.7	.3
5	267	2.1	.3	1.4	.3	1.5	.3
6	279	2.3	.3	1.5	.3	1.5	.3
7	289	2.4	.3	1.5	.3	1.4	.3
		Effect Sizes					
4 and 5		.34		.62*		.58*	
4 and 6		.78†		.52*		.55*	
4 and 7		1.36†		.47*		.70†	
5 and 6		.43		.13		.03	
5 and 7		.89†		.17		.13	
6 and 7		.46*		.06		.16	

*Visible, but not practically significant (Cohen, 1988). †Practically significant.

Data in Table 11 show that, whereas there were no practically significant differences between boys' and girls' Study habits in mathematics, the boys rated themselves as having more favourable Study attitude than girls.

A medium to large percentage of variance of achievement in mathematics was explained by three Study Orientation Questionnaire in Mathematics (Primary) factors (Cohen, 1988). Data in Table 12 indicate that only Mathe-

TABLE 11
MEANS, STANDARD DEVIATIONS, AND EFFECT SIZES FOR GENDER GROUPS

Factor	Boys ($n=538$)*		Girls ($n=555$)		Effect Size
	M	*SD*	*M*	*SD*	*d*
Mathematics anxiety	2.22	.36	2.21	.32	.01
Attitude towards study of mathematics	1.44	.31	1.55	.30	.33
Study habits in mathematics	1.50	.33	1.50	.28	.00

*10 missing values recorded.

matics anxiety yielded a practically important contribution to the regression (18.3%). Study attitude and Study habits contributed only approximately 1% of the explained variance. This result confirms the predictive validity of the test. Norms (percentile ranks) were calculated separately for Grades 4, 5, 6, and 7.

TABLE 12
STEPWISE REGRESSION ANALYSIS OF STUDY ORIENTATION QUESTIONNAIRE (PRIMARY) ONTO SCORES OF BASIC MATHEMATICS QUESTIONNAIRE (PRIMARY)

	β	*SE* β	B	*SE* B	*Z*	R^2_{Partial}	$R^2_{\text{Cum.}}$
Intercept			−1.26	.032	−38.7		
Mathematics anxiety	.40	.001	3.07	.009	323.7	.18	.18
Study attitude	−.10	.001	−0.86	.011	−77.5	.01	.19
Study habits	.01	.001	.12	.011	10.4	.0001	.19

Note.—$R = 0.44$; $R^2 = 0.194$; Adjusted $R^2 = 0.194$; $p < .0001$.

DISCUSSION

Firstly, it should be noted that this was a limited local study, and the findings reported in this article have limited generalisation.

Lack of improvement in achievement in mathematics in South Africa over the past decade shows that little in South Africa has changed since 1994 (Simkins, Rule, & Bernstein, 2007; Fleisch, 2008). During 1997 to 2000, performance on the final school examinations in mathematics in South Africa suggests only half of the students passed the examinations (Bureau for Institutional Research and Planning, 2001). This trend was continued at the university (Maree, *et al.*, 2003; Van der Walt & Maree, 2007). Such figures are not encouraging for South Africa where increased scientific and technological expertise is needed, so facilitating better achievement in mathematics is desirable.

Having tests which may help students monitor their learning and teachers their effectiveness at instructing seems essential. Whereas the Study Orientation Questionnaire in Mathematics was initially developed as a diagnostic test for teachers and counsellors to help students to improve their orientation towards the study of mathematics and consequently their performance, the Study Orientation Questionnaire in Mathematics (Primary) is being developed as a diagnostic test for teachers and counsellors to help primary school students acquire adequate study orientation in mathematics and improve achievement in mathematics at secondary and tertiary levels. Standardisation of the questionnaire yielded satisfactory results with regard to the specification of aspects such as reliability, validity, and intercorrelations.

Seemingly, respondents in general did not experience significant anxiety about Mathematics. This finding is consistent with the results of Maree and

Crafford's study (2005). Further, respondents' mean responses for both Study attitude and Study habits fall in the region of Almost always or Probably sometimes. This suggests these young respondents have not yet acquired adequate study habits or attitudes towards study of mathematics.

It is evident from Table 9 that there are substantial differences between anxiety scores of students whose native language is Tswana and of students whose native languages are English and Afrikaans. This is probably *inter alia* due to the fact that the former still experience vastly inferior socioeconomic status than their white counterparts (Nelson Mandela Foundation, 2005).

It is clear from Table 11 that sex groups do not differ significantly in rated Mathematics anxiety. These findings are supported by Dane (2005), who found no significant differences between sex groups at Turkish universities. However, present results do not correspond with the findings of Abed and Alkhateeb (2001), who found statistically significant differences between the mean anxiety scores of boys and girls (boys had higher anxiety scores). More research to clarify the possible extent and nature of sex-related mathematics differences seems essential.

As is evident from Table 12, scores on Mathematics anxiety had the largest association with achievement in mathematics. Since a high score in Mathematics anxiety is indicative of the absence of such anxiety, this negative correlation for scores in achievement in mathematics may suggest that a reasonable anxiety, particularly if coupled with ability to focus on work, might identify students who take their studies seriously. This finding is consistent with Maree, *et al.*, (2003) who reported that mathematics anxiety might be a predictor of success at the university. The results seem to support the hypothesis that a reasonable amount of anxiety might influence achievement in mathematics positively (Wigfield & Meece, 1988) and that too much stress is likely to have negative performance influence on mathematics (Skemp, 1986; Fairbanks, 1992). The prognosis for improvement of the current circumstances in which many primary school students underachieve in mathematics is probably good if the factors referred to are corrected.

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