LECTURERS' PERCEPTION ABOUT THE LEARNERS' ATTITUDE AND ACHIEVEMENTS LEVELS IN MATHEMATICS

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ABSTRACT–A decline in learner participation and achievement particularly in the senior certificate mathematics examination of South African schooling system has heightened the need to do an introspection of their attitude towards mathematics. To measure the students' attitude in mathematics, we have adopted the questionnaire developed by Tapia (1996), and to measure student achievement goals, we adopted a questionnaire developed by Elliot and McGregor (2001). We have administered these questionnaires to 177 first year university students pursuing a mathematics disciplined study. Students were required to indicate their responses to both questionnaires, indicating their degree of satisfaction or dissatisfaction to the items of the questionnaire. The data was subjected to factor analysis, using the statistical software SPSS program. In the first questionnaire, four factors were identified and they were: (1) self-confidence, (2) sense of security, (3) efficacy of mathematics, and (4) motivation. The internal reliability for each of these factors were evaluated by calculating the Cronbach Alpha. In the case of achievement goals, only three factors were identified, and they being: (1) Mastery of subject content, (2) Apprehensiveness towards subject and (3) Competitive achievement. The results indicate that the identified factors influence the formation of the students' attitude and achievement levels in mathematics.

Key words: Attitude, achievement, efficacy, apprehensiveness, security and motivation.

INTRODUCTION

Underachievement in the gateway subject mathematics has become a global concern over the years (Pisa, 2003; Mohamed & Waheed, 2011). Of particular interest, this subject is being taught by more people around the world than any other subject (Orton, Orton & Frobisher, 2004; Mohamed & Waheed, 2011). Researchers have pondered on factors that could influence learner participation, performance and achievement in this subject. Of the many factors that may be considered, attitude towards mathematics is deemed to be a crucial factor. According to Marzano (2001) and Sundre, Barry, Gynnild & Ostgard (2012), attitude determines the "extent to which learning occurs and how learning occurs". Having a positive or negative attitude towards mathematics may impact in one's ability to function optimally (Anderson et al., 2007; Sundre et al., 2012). It is well known that mathematics has the reputation of being an unpopular subject at school. From a South African perspective, there has been a steady decline in the mathematics performance at the senior secondary level, and more so since the inception of the Curriculum Assessment Policy Statements (CAPS) curriculum. For learners in South Africa, research has indicated that about 54% of them have a high positive attitude towards mathematics, yet their achievement in internationally benchmarked tests is much lower than the international average (Khatoon & Mahmood, 2010; Bayaga & Wadesango, 2014).

These learners once registered at tertiary institutions of higher learning face a mammoth challenge in coping with the pace of curriculum instruction and teaching, the consequence of which is a high attrition and a high failure rate in the subject. There are many factors that could contribute to this situation, ranging from the lack of basic competencies to background factors (schooling, financial, etc.). At tertiary level, improving teaching strategies coupled with interventions might be a plausible solution to this predicament instead of changing their background culture. The aim of this research was to identify some of the factors that were influencing the students' attitude towards mathematics at high school and if they had changed after a semester of improvisations at tertiary level. There have been several studies in literature that points towards a strong correlation between the attitude towards mathematics and scholastic achievement (Venkateshwar & Beena, 2016). In this respect, a further extension to this research was to look at the factors that could influence learner achievement in mathematics. With this scope in mind, we aim to get a holistic picture of the influence of the various factors (both attitude and achievement) that could contribute to underperformance in mathematics as well as and the goals that these learners set in achieving better results.

2. REVIEW OF THE LITERATURE

Literature survey (Khatoon & Mahmood, 2010; Bayaga & Wadesango, 2014) indicates that there exists a positive relationship between mathematics attitudes and achievement in mathematics. Thus a positive attitude in mathematics translates to a better performance in the subject. In this respect, we have carefully looked at various constructs of attitude that could potentially have an impact on learner performance. Some of the constructs of attitude are: self-efficacy, self-confidence, motivation and sense of security. Self-confidence (Tapia, 1996) can be considered a good predictor of success in mathematics, while self-efficacy is belief in one's capabilities (Bandura, 1986). Research reveals that success in mathematics is highly influenced by one's motivational levels. However, motivational level never remain static but is ever changing with time. According to Oldfather (1992), a decline in motivation level is experienced once learners enrol for higher level studies in mathematics. It was mentioned by Swafford et al. (2014) that in a positive learning environment, learners will experience a sense of security and this will have a positive effect on their achievement levels in mathematics.

3. METHODS

3.1 Participants

A total of 177 first year university learners from a South African university that enrolled for an engineering mathematics (semesterised module) course participated in this study. This course is a compulsory course for all new learners that enrolled for engineering programs at the university. Prior to the administration of the questionnaire, learners were informed that the study was voluntary and that they would not be disadvantaged in any way in their participation. In this instance all learners participated in this survey. Permission was also sought from the subject lecturer to conduct this survey. This study was conducted towards the end of the first semester during one of their lecture slots and in a lecture room.

3.2 Instrument and Procedure

This study made use of two questionnaires to assess the students' attitude towards mathematics. The first questionnaire, called Attitude Towards Mathematics Instruction (ATMI), is an instrument developed by Tapia (1996), was used to assess the students' attitude towards mathematics. This questionnaire has been extensively used in many studies to measure learners' attitude towards mathematics (for examples, see, Sundre et al., (2012) & Afari (2013)). This instrument which comprised of 40 items, had a 5-point frequency response in the format of Strongly Disagree, Disagree, Neutral, Agree to Strongly Agree. A value was given for each learner response. In this instance, a value of 1 was given to a strongly disagree response, two was given for a disagree response, 3 was given for a neutral response, 4 was given for agree response and 5 was given for a strongly agree response. Of the 40 items in the questionnaire, 12 items were negatively worded. For these items, the scoring was reversed. An example of a positively worded item is: "Mathematics is a very interesting subject" and an example of a negatively worded item is: "Studying mathematics makes me feel nervous". High scores will indicate that the learners have a positive attitude towards mathematics.

The second questionnaire, Achievement Goal Questionnaire (AGQ), developed by Elliot and McGregor (2001), was used to measure learners' achievement levels in mathematics. This questionnaire is also extensively used by many authors to measure learning goals towards mathematics. Learners had to respond to the 16 items of the questionnaire on a 7 point basis, with point 1 standing for "Not at all true for me", all the way to point 7 standing for "Very true for me". Scoring to each of the 16 items in the questionnaire follows a similar pattern as was done in questionnaire one. High scores in this questionnaire would indicate a higher achievement goal level towards mathematics. The significance of incorporating the second questionnaire was to determine whether their attitudes (factors such as: self-confidence, sense of security, efficacy and motivation) towards learning mathematics were aligned to their goals (factors such as: mastery of subject matter, apprehensiveness towards subject and competitive achievement). The learners took about 20 minutes to complete both questionnaires.

Data collected from both questionnaires were subjected to Principal Component Analysis (PCA) using the SPSS software program. Although the sample size of 177 is not totally desirable, but it should be satisfactory in this case because of the high loading on of the items (> 0.80). Loading is an indication of weighting towards a particular item, and it ranges from 0 to 1. A high loading (over 0.80) would indicate a higher preference for that particular factor or item. Further, a low loading (less than 0.30) is a low preference for that factor or item. Although these instruments were validated and reliable from previous studies, our aim was to determine through the factorisation procedure whether similar factors (group of items) would emerge as was done internationally. The reliability of both questionnaires was assessed using the Cronbach Alpha coefficient. PCA was performed on both samples, after it was confirmed that the data was suitable for analysis. PCA was done to extract suitable factors appropriate for this study. This was achieved after oblique rotation of the factors focussing on the oblimin rotation method (delta = 0). In order to extract factors from the data, we are guided by the 3 rules (Cerny & Kaiser, 1977; Kaiser, 1970; Dziuben & Shirkey, 1974):

(1) Kaiser's criterion (eigenvalue > 1)
(2) Inspection of the Scree plot, and
(3) Horn's parallel analysis.

The Horn's rule is one of the most accurate approaches to estimating the factor items for this study.

4. PURPOSE OF THE STUDY

This study has 2 purposes:

1. To identify items from the questionnaire that are aligned to a particular factor through the Principal Component Factor Analysis method, and
2. To get an insight into the attitudinal change of the learners towards mathematics in the transition between high school and university.

5. RESULTS

5.1 Exploratory factor analysis for the ATMI questionnaire

5.1.1 Student responses to the ATMI questionnaire are represented in Table 1

Table 1 shows Pattern and Structure matrix for the Principal Component Analysis (PCA) with oblimin Rotation to produce a 4 factor solution of the scale item in the ATMI questionnaire (see annexure 1). Some of the headings in the table are abbreviated: F1, F2, F3 and F4 to stand for Factors 1, 2, 3 and 4, respectively, Com. to stand for Communalities and Std. Dev. to stand for Standard Deviation.

Table 1: Student responses to the ATMI questionnaire

Scale items	Pattern Coefficients				Structure Matrix				Com.	Mean	Std. Dev.
	F1	F2	F3	F4	F1	F2	F3	F4			
18	**0.76**	0.00	-0.10	-0.18	**0.77**	0.28	0.28	-0.47	0.60	3.18	1.12
17	**0.69**	0.04	0.07	-0.07	**0.75**	0.32	0.39	-0.42	0.57	3.37	1.21
22	**0.66**	0.05	0.08	0.02	**0.72**	0.32	0.37	-0.34	0.56	2.99	1.11
16	**0.60**	0.26	0.10	0.17	**0.68**	0.47	0.35	-0.23	0.59	3.26	1.28
23	**0.52**	0.09	0.20	-0.13	**0.71**	0.36	0.49	-0.48	0.63	3.32	1.23

26	**0.48**	-0.01	-0.05	-0.13	**0.61**	0.29	0.27	-0.40	0.48	3.54	1.14
19	**0.46**	0.09	0.17	0.06	**0.58**	0.30	0.40	-0.36	0.44	3.57	1.04
24	**0.40**	-0.10	0.09	0.00	**0.49**	-0.15	0.30	-0.26	0.38	3.66	1.28
13	0.12	**0.71**	0.22	0.38	0.38	**0.76**	0.05	-0.38	0.63	3.59	1.25
10	0.19	**0.68**	0.08	0.36	0.36	**0.70**	0.09	-0.15	0.51	3.65	1.22
12	-0.02	**0.65**	-0.19	0.32	0.32	**0.73**	0.12	-0.36	0.64	3.75	1.32
20	0.02	**0.64**	0.11	0.25	0.25	**0.63**	0.23	-0.12	0.51	3.58	1.19
14	-0.07	**0.63**	-0.16	0.32	0.32	**0.75**	0.19	-0.37	0.65	3.95	1.22
21	0.02	**0.63**	-0.04	0.36	0.36	**0.67**	0.38	-0.30	0.55	3.56	1.20
15	0.08	**0.51**	-0.18	0.44	0.44	**0.67**	0.24	-0.42	0.66	3.89	1.19
4	-0.02	0.05	**0.78**	-0.01	0.35	0.20	**0.79**	-0.34	0.63	4.30	1.04
2	-0.00	0.01	**0.73**	0.06	0.28	0.12	**0.70**	-0.23	0.52	4.46	0.88
5	-0.06	0.02	**0.70**	-0.16	0.35	0.20	**0.76**	-0.44	0.64	4.06	1.04
1	0.11	0.07	**0.67**	-0.10	0.45	0.24	**0.76**	-0.42	0.61	4.13	1.13
8	0.14	-0.11	**0.58**	-0.01	0.37	0.07	**0.64**	-0.30	0.53	3.62	1.03
6	0.04	0.02	**0.51**	-0.14	0.33	0.17	**0.59**	-0.38	0.44	3.93	1.15
3	0.18	-0.05	**0.41**	-0.17	0.41	0.13	**0.54**	-0.40	0.46	3.95	0.95
33	0.13	0.09	0.07	**-0.60**	0.50	0.34	0.41	**-0.73**	0.62	3.96	1.24
34	-0.07	-0.03	0.18	**-0.58**	0.24	0.12	0.37	**-0.60**	0.40	3.48	1.05
30	0.24	-0.03	0.02	**-0.57**	0.54	0.26	0.38	**-0.71**	0.59	3.09	1.25
38	0.14	0.17	0.05	**-0.55**	0.42	0.33	0.33	**-0.64**	0.48	3.02	1.23
32	0.06	0.09	0.14	**-0.54**	0.44	0.32	0.43	**-0.68**	0.57	3.28	1.22

Bolded items indicate high loadings on items

Oblimin rotation is a way generating 2 tables of loadings. The one table is the Pattern Coefficient and the other is the Structure Matrix. The Pattern Matrix provides the loadings for each of the items in the table. An inspection of the data reveals the items (bolded) that have the highest loadings which are then categorized and labelled according to the appropriate factor. In this case, the main loadings on Factor 1 are the items: 18, 17, 22, 16, 23, 26, 19 and 24. Likewise Factors 2, 3 and 4 have been identified according to their loadings. In this scenario, it was easy to identify and label the 4 factor solution of the data. The Structure Matrix provides useful information about the correlation between the various variables and the identified factors. The loadings on the items for the Structure Matrix should correlate reasonably well with the loadings of similar item on the Pattern Matrix, as can be seen in the table above. Data presented for Communalities, gives information about how much variance each item in the table are explained, for example, item 24 ("I have usually enjoyed studying mathematics in school") has the lowest communality value (0.38), and it also has the lowest loading (0.40). Eliminating this item from the questionnaire might improve the total variance explained to a higher value.

The ATMI sample was assessed for suitability by the exploratory factor analysis. There are 2 statistical measures that help in the factorability of the data: the first one is the Bartlett's Test of Sphericity, and the second one was the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy, as shown below (Cerny & Kaiser, 1977; Kaiser, 1970; Dziuben & Shirkey, 1974):

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.904
Bartlett's Test of Sphericity	Approx. Chi-Square	2645.042
	df	406
	sig.	0.000

For our data, it was found that the KMO value was 0.904 (within the acceptable range from 0 to 1) and for the Bartlett's Test of Sphericity to be significant, it should have a value of $p < 0.05$. Our data is highly significant since the value obtained for p was 0.000. Through factor analysis several items from the ATMI questionnaire were eliminated due to low loadings (< 0.40). This resulted in the elimination of the following factors: 36, 11, 7 (cross-loaded on another factor), 37, 39, 40 and 27 (low factor loading, < 0.40), 9 and 35 (due to these having single item factors) and items 28 and 31 (low factor loading). In the final procedure, factor analysis were computed on the remaining 27 items of the original 40 item ATMI questionnaire. Oblimin rotation was done to obtain 4 factors: (1) Principal Component Analysis (PCA) revealed 4 eigenvalues that were above 1 (10.151, 3.012, 1.738 and 1.445) and with corresponding variances (33.43%, 8.84%, 4.414% and 3.277%), respectively. An examination of the Scree plot supported such a solution. Factor analysis has revealed that of the 40 original items from the questionnaire examined, only 27 items were retained and categorised into 4 factors by Oblimin rotation: Self-confidence (made up of items: 18, 17, 22, 16, 23, 26, 19 and 24), (2) Sense of insecurity (made up of items: 13, 10, 12, 20, 14, 21, and 15), (3) Efficacy in mathematics (made up of items: 4, 2, 5,1, 8, 6 and 3) and (4) Motivation (made up of item: 33, 34, 30, 38 and 32).

An inspection of the Pattern Coefficients and Structure Matrix reveals a good discrimination between the various factors. In respect to the Pattern Coefficients, there appears to be high loadings for the various items within a factors: item 18, loading at 0.76 for Factor 1, item 13, loading at 0.71 for Factor 2, item 4, loading at 0.74 for Factor 3 and item 33, loading at 0.73 for Factor 4. On the other hand, the lowest loading for the corresponding items within the various factors are: item 24, loading at 0.40 for factor 1, item 15, loading at 0.51 for factor 2, item 3, loading at 0.41 for Factor 3 and item 32, loadings at -0.54 for Factor 4. An inspection of the Structure matrix components, reveals a good discrimination for the various item within the factors. Likewise, we have high loadings for the various items: item 18, loading at 0.77 for Factor 1, item 13, loading at 0.76 for Factor 2, item 4, loading at 0.79 for Factor 3 and item 33, loading at -0.73 for Factor 4. Correspondingly, the lowest loadings for the various items within the factors of the Structure matrix are: item 24, loading at 0.49 for Factor 1, item 24, loading at 0.63 for Factor 2, item 3, loading at 0.54 for Factor 3 and item 34, loading at 0.60 for Factor 4.

5.1.2 Reliability of the data

In order to determine the reliability of the data, the Cronbach Alpha was determined for each of the above factors and is indicated in Table 3 below.

Table 3: Cronbach Alpha for each of the Factors in Table 1

Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
0.868	0.880	0.863	0.824

In this study, the Cronbach Alpha reliability ranged from 0.868 to 0.824, respectively for each of the factors F1 to F4 and considered to be in the acceptable range.

5.2. Exploratory factor analysis for the AGQ questionnaire

5.2.1 Student responses to the AGQ questionnaire is represented in Table 3

Table 4: Pattern and Structure matrix for the Principal Component Analysis (PCA) with oblimin Rotation to produce a 4-factor solution of the scale item in the AGQ questionnaire

Scale items	**Pattern Coefficients**				**Structure Matrix**				**Com.**	**Mean**	**Std. Dev.**
	F1	**F2**	**F3**	**F4**	**F1**	**F2**	**F3**	**F4**			
7	**0.82**	0.06	-0.01	-0.14	**0.88**	0.04	-0.39	-0.42	0.69	6.45	1.30
10	**0.73**	0.05	0.02	0.01	**0.72**	0.06	-0.30	-0.24	0.50	6.26	1.41
3	**0.72**	0.04	-0.06	0.03	**0.73**	0.06	-0.37	-0.22	0.51	6.25	1.30
16	**0.64**	0.15	-0.17	0.07	**0.68**	-0.11	-0.41	-0.21	0.46	6.20	1.52
14	0.05	**0.80**	0.03	0.00	0.00	**0.80**	-0.03	0.19	0.46.	3.82	2.14
11	-0.10	**0.75**	-0.11	0.01	0.01	**0.75**	-0.24	0.64	0.43	4.33	1.98
5	0.07	**0.60**	0.19	-0.01	-0.01	**0.62**	-0.05	0.29	0.34	4.16	2.13

12	0.06	0.10	**-0.76**	-0.20	0.46	0.17	**-0.83**	-0.28	0.66	5.58	1.84
1	0.07	-0.06	**-0.75**	-0.05	0.41	0.05	**0.78**	-0.16	0.59	5.52	1.81
2	-0.04	-0.08	**-0.63**	0.14	0.18	0.04	**-0.59**	0.07	0.39	5.66	2.04
15	0.10	0.07	**-0.54**	0.00	0.33	0.15	**-0.59**	-0.08	0.43	5.64	1.91
6	0.24	0.17	**-0.48**	-0.21	0.53	0.20	**0.63**	-0.31	0.55	5.86	1.55
4	0.04	0.03	0.07	**0.73**	-0.25	0.17	0.13	**0.73**	0.28	2.06	1.68
9	-0.27	0.21	-0.18	**0.45**	-0.36	0.32	-0.04	**0.57**	0.35	1.85	1.76

Bolded items indicate high loadings on items

Likewise the AGQ questionnaire was subjected to factor analysis. The factorability and significance of the data was justified in terms of its KMO and Bartlett's Test of Sphericity values, indicated below:

Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)		0.787
Bartlett's Test of Sphericity	Approx. Chi-Square	928.209
	df	91
	sig.	0.000

These values indicate that the KMO value (0.787) is within the acceptable range (between 0 and 1) and the data is highly significant (0.000). A few item from the questionnaire were eliminated due to low loadings (< 0.40) from the factorisation procedure. The 2 items from the 16 item questionnaire that were eliminated were: item 13 (due to low MSA: "I want to get through this course by doing the least amount of work as possible") and item 8 (due to low communality and low loading on the factor: "The fear of performing poorly in this course is what motivates me"). A principal Component Analysis (PCA) revealed 4 factors that had eigenvalues above 1, and they were 4.421 (Factor 1), 2.398 (Factor 2), 1.488 (Factor 3 and 1.061 (factor 4). The corresponding variances are: 28.59%, 13.78%, 7.369 and 4.218%, respectively, for each of the Factors 1 to 4. The 4th factor had to be further eliminated due to the fact it only contained 2 items, and the remaining factors were: (1) Mastery of Subject Content (made up of items: 7, 10, 3 and 16), (2) Apprehensiveness towards Subject (made up of items: 4, 11 and 5) and (3) Competitive Achievement (made up of items: 12, 1, 2, 15 and 6). From the data obtained Communality, values of 0.28 and 0.35 for the Factors 4 (" I really don't want to work hard in this course") and 9 ("I want to do as little work as possible in this course"), respectively are too low and are not ideal for analysis. Further, items with low communality scores of 0.34 (item 5) and 0.39 (item 2) could have been further eliminated before factorability, but are retained for the purpose of discussions (limitations of items).

An inspection of Pattern and Structured Matrix items reveal a reasonable discrimination amongst the various factors. The high loadings for the various items in both the Pattern and Structured Matrix are: item 7, loadings of (0.82 and 0.88) for Factor 1, item14 with loadings of (0.80 and 0.80) for Factor 2, item 12 with loadings of (-0.76 and -0.83) for Factor 3 and item 4 with loadings of (0.73 and 0.73) for Factor 4. The corresponding low loadings for the various item within the factors are: item 16 with loadings of (0.64 and 0.68) for Factor 1, item 5 with loadings of (0.60 and 0.62) for Factor 2, item 6 with loadings of (-0.48 and 0.63) for Factor 3 and item 9 with loadings of (0.45 and 0.57) for Factor 4. Item 6 ("It is important for me to do well compared to other students") has a particularly low loading (0.48) in the Pattern Coefficients compared to its corresponding higher loading (0.63) in the Structured Matrix.

5.2.2 Reliability of the data

In order to determine the reliability of the data, the Cronbach Alpha was determined for each of the above factors and is indicated in Table 4 below.

Table 6: Cronbach Alpha for each of the Factors in Table 4

Factor 1	Factor 2	Factor 3	Factor 4
0.835	0.763	0.816	0.619

In this study, the Cronbach Alpha reliability ranged from 0.868 to 0.619, respectively for each of the factors F1 to F4. As mentioned above, factor 4 was eliminated from the discussions due to it having a low loading as well as it having a low communality value. On the other hand, the Cronbach Alpha reliability for the other factors are satisfactory.

6. DISCUSSION OF RESULTS

The results reveal that, of the 4 factors highlighted, factor 3 (Efficacy of Mathematics) and in particular, item 2 ("I want to develop my mathematical skills") within this subscale has the highest mean score (4.46), as well as the highest loading in both the Pattern Coefficient (0.73) and Structured Matrix (0.70) scores. This suggests that their fundamental competencies may be shallow or that their knowledge and skills maybe inflated and thus their focus is towards a development of proper skills that could lead them to success in their engineering mathematics course. Item 4 ("Mathematics helps develops the mind and teaches a person to think"), which also has a high mean score (4.30) within this subscale, reinforces the fact that engineers need to have a sound mathematical mind for real world applications.

This study found a decrease in the confidence (Factor 1) and motivational levels (Factor 4) of learners engaged in engineering mathematics (average mean scores of 3.36 for both Factors). This implies that learners have found the transition from high school to university very demanding and are struggling to cope with the pace of lecturer instruction. Their learning strategies maybe not sufficient to cope with the voluminous curriculum demand of university mathematics. These mean scores could only improve once they have reached a certain level of maturity in their knowledge, skills and applications through "discipline and self-regulated learning" (Zimmerman & Schunk, 2001). Item 22 ("I learn mathematics easily"), which has the lowest mean score (2.99) further justifies the fact that learners are struggling to cope with the cognitive demands posed by university mathematics. In this respect, universities are making huge investments in the form of interventions to bridge the gaps between school and university education with the hope of influencing the learning outcomes (Sundre et al., 2012).

The mean scores for the other Factors, such as Sense of Insecurity (Factor 2) and Efficacy in Mathematics (Factor 3) are reasonably high (3.71 and 4.06, respectively). This stems from the fact that the learner's insecurity levels which were high at high school has now spilled over into their higher education studies in mathematics. In contrast, the efficacy factor is a driving force for the learners to do well in mathematics.

The Mastery of the subject matter is considered a priority by the learners (average mean score of 6.29). Such a high score for this factor is a reflection of their commitment to attain excellence in the subject matter. Also, item 7 ("I want to learn as much as possible in this course"), which has the highest mean score (6.45) of all items between the various factors, is a reassurance of their willingness to achieve their best through hard work. On the other hand, their apprehension towards their understanding of mathematics is an area of concern (average mean score of 4.10) and systemically can be traced back to their underperformance and learning deficit gaps in their early years of study. Further, item 5 ("I'm afraid that I may not understand the content of this course as thoroughly as I'd like"), within this factor reflects the learners' shallow learning of the subject matter. It can be deduced from their responses to this item in the questionnaire, that their foundational knowledge in mathematics is poor which leads to underperformance and apprehension towards mathematics.

The mean score for the Competitive Achievement factor is relatively high (average mean score of 5.59). The importance of this goal is that learners are trying their best to compete and achieve higher than their peers in all aspects of achievement. This means that they will stop at nothing and go the extra mile to improve their understanding of mathematics.

Our antecedent results in mathematics, has shed some light into the nature of these goals, particularly in terms of their need for achievement and the fear of failure (Elliot and Marayama, 2008). From literature (Conroy, 2001; Elliot & McGregor, 2001), it is found that the goal, Mastery- avoidance, is linked to fear of failure in the subject. It can be mentioned that success in the Mastery of the Subject Content goal can be regarded as a precursor to achievement in mathematics. All other goals are regarded as a consequence of this primary goal. Another consequence of the successes in the Mastery of Subject Content goal is positivity showed towards mathematics, and failure in such a goal could lead to a negative perception in the subject. Failure in this goal is closely tied to the lack of mastery in the subject, and this could account for their apprehension towards mathematics. It must also be mentioned that success in the Mastery of Subject Matter goal fosters a competitive spirit for learning in the subject.

7. CONCLUSION

This research mirrors the study undertaken by Reinlander and Wallace (2011) that despite the fact learners are less prepared for tertiary studies, they displayed increased levels of resilience to uplift themselves from such a plight. Evidence of such is reflected in their attitude change over a period of a semester. A profile of their attitudes (self-confidence, efficacy and motivation) is definitely on an upward trajectory. While the aspect of self-efficacy is good predictor of success, negative views that prevailed during their high school years appears to have transcended from a low efficacy belief to one of positivity. Their apprehension towards the subject maybe justified by the fact that their fear of doing well may escalate despite all their endeavours and this may bring about a false sense of security. A follow-up research should be done to find a correlation between increased levels of efficacy and marks attained at a tertiary level in mathematics.

ANNEXURE 1

ATTITUDE TOWARDS MATHEMATICS INVENTORY (ATMI)

This inventory consists of statements about your attitude towards mathematics. There are no correct or incorrect responses. Enter one of the letters that best describes your feelings.

Please use these responses: A - Strongly Disagree
B – Disagree
C – Neutral
D – Agree
E – Strongly Agree

1	Mathematics is a very worthwhile and necessary subject.	
2	I want to develop my mathematical skills.	
3	I get a great deal of satisfaction out of solving a mathematics problem.	
4	Mathematics helps develop the mind and teaches a person to think.	
5	Mathematics is important in everyday life.	
6	Mathematics is one of the most important subjects for people to study.	
7	High school math courses would be very helpful no matter what I decide to study.	
8	I can think of many ways that I use math outside of school.	
9	Mathematics is one of my most dreaded subjects.	
10	My mind goes blank and I am unable to think clearly when working with mathematics.	
11	Studying mathematics makes me feel nervous.	
12	Mathematics makes me feel uncomfortable.	
13	I am always under a terrible strain in a math class.	
14	When I hear the word mathematics, I have a feeling of dislike.	
15	It makes me nervous to even think about having to do a mathematics problem.	
16	Mathematics does not scare me at all.	
17	I have a lot of self-confidence when it comes to mathematics.	
18	I am able to solve mathematics problems without too much difficulty.	
19	I expect to do fairly well in any math class I take.	
20	I am always confused in my mathematics class.	
21	I feel a sense of insecurity when attempting mathematics.	
22	I learn mathematics easily.	
23	I am confident that I could learn advanced mathematics.	
24	I have usually enjoyed studying mathematics in school.	
25	Mathematics is dull and boring.	
26	I like to solve new problems in mathematics.	
27	I would prefer to do an assignment in math than to write an essay.	
28	I would like to avoid using mathematics in college.	
29	I really like mathematics.	
30	I am happier in a math class than in any other class.	
31	Mathematics is a very interesting subject.	
32	I am willing to take more than the required amount of mathematics.	
33	I plan to take as much mathematics as I can during my education.	
34	The challenge of math appeals to me.	
35	I think studying advanced mathematics is useful.	
36	I believe studying math helps me with problem solving in other areas.	
37	I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in math.	
38	I am comfortable answering questions in math class.	
39	A strong math background could help me in my professional life.	
40	I believe I am good at solving math problems.	

ANNEXURE 2

ACHIEVEMENT GOALS QUESTIONNAIRE (AGQ)

This inventory consists of statements about your attitudes towards learning and performance in the class. Please indicate how true each statement is of you. If you think the statement is true of you, mark a 7 on the last column of the inventory. If the statement is not at all true of you, give a mark of 1 on the last column of the inventory. If the statement is more or less true of you, find a number between 1 and 7 that best describes you. There are no right or wrong answers.

1	2	3	4	5	6	7
Not at all true of me						Very true of me

Complete the table below accordingly

1	My goal in this course is to get better grades than most of the other students.	
2	I just want to avoid doing poorly compared to other students in this course.	
3	Completely mastering the material in this course is important to me	
4	I really don't want to work hard in this course.	
5	I'm afraid that I may not understand the content of this course as thoroughly as I'd like.	
6	It is important for me to do well compared to other students.	
7	I want to learn as much as possible in this course.	
8	The fear of performing poorly in this course is what motivates me.	
9	I want to do as little work as possible in this course.	
10	The most important thing for me in this course is to understand the content as thoroughly as possible.	
11	I worry that I may not learn all that I possibly could in this course.	
12	I want to do better than other students in this course.	
13	I want to get through this course by doing the least amount of work possible.	
14	I am definitely concerned that I may not learn all that I can in this course.	
15	My goal in this course is to avoid performing poorly compared to other students.	
16	I look forward to working really hard in this course.	

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