

RELATIONSHIP BETWEEN EMOTIONAL INTELLIGENCE, STUDY ORIENTATION IN MATHS AND MATHS ACHIEVEMENT OF MIDDLE ADOLESCENT BOYS AND GIRLS

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ABSTRACT

Poor scholastic achievement in mathematics is a worldwide concern. Emotional intelligence can be linked to children's academic success – yet no study has focused on the role those facets of emotional intelligence and dimensions of study orientation play in maths achievement. Altogether 435 learners in Grades 9 and 11 took part in a quantitative study that involved the completion of two standardised questionnaires: an EI questionnaire, the *Bar-On EQ-i: YVTM*, and the *Study Orientation Questionnaire in Mathematics (SOM)*. Maths achievement was measured by using the learners' final end-of-year maths mark. We found that there the combinations of EI facets and SOM dimensions that were potential predictors of maths achievement differed for boys and girls

Field of Research: mathematics achievement; gender, middle adolescent; emotional intelligence; study orientation in mathematics; mathematics anxiety; Bar-On *EQ-i:YVTM*; *Study Orientation Questionnaire in Mathematics (SOM)*; information processing; metacognition; intelligence.

1. Introduction

Maths achievement at school is one of the best predictors of success at tertiary level. Globally there is not a big difference in the maths achievement of boys and girls, however from nation to nation, the size of gender differences varied a great deal.

Furthermore, there is a statistically significant correlation between mathematics achievement and aspects of study orientation in mathematics. Study orientation includes study habits, problem-solving behaviour, maths anxiety and attitude towards maths. Numerous studies have focused on the role that affect and study orientation in maths play in adolescents' maths achievement and mastering of certain maths concepts. Affect influences decision making and achievement, and a more positive attitude leads to increase in effort and determination (Damasio, 1994; Goleman, 1995; McLeod, 1992; Picard, 1997; Van der Walt, 2008). Learners' emotions, attitudes towards maths and study habits, their experience of the teaching of maths, the classroom atmosphere and their family life, all play a significant role in their maths achievement (Maree, 1997).

Many studies refer to the role of affect in maths achievement (van der Walt, 2008) and a study by Ogundokun and Adeyemo (2010) refers to the relationship between the intrapersonal aspect of emotional intelligence and maths achievement. No other study refers specifically to the role of emotional intelligence, study orientation in maths and

the mathematics achievement of the middle adolescent. It is however generally agreed that emotional stressors can prevent a child from reaching his/her full academic potential and that emotional and social skills can be taught through practice and therapeutic intervention. If, therefore, adequate attention is given to a child's emotions in the classroom, it can enhance his/her personal growth and academic achievement. Children whose emotional needs are met and dealt with at home are better able to cope with the academic demands of the classroom (Cilliers, 2004). These children tend to have fewer behavioural problems and do better in languages and maths than their peers with the same cognitive abilities but who are emotionally neglected (Goleman, 1995) – and yet no study has focused on the role that emotional intelligence plays in maths achievement. This study reports on gender differences in the combinations of facets of emotional intelligence and dimensions of study orientation in mathematics as potential predictors of the middle adolescent's maths achievement.

Emotional intelligence can be linked to children's readiness for life and school, as well as to their academic success.

2. Emotional Intelligence

Emotional intelligence involves an array of non-cognitive abilities, competencies and skills that influence one's ability to cope with environmental demands and pressures. The BarOn EQ-i:YV™ consists of five components which can be subdivided in the following sub-sections: Intrapersonal skills – *control of own emotions, assertiveness, self-respect, self-actualisation and independence*; Interpersonal skills – *empathy, social responsibility, interpersonal relationships*; Adaptability – *reality testing, flexibility and problem-solving*; Stress management – *stress tolerance, impulse control*; General mood – *optimism, happiness*. Emotional intelligence can be developed through practice and therapeutic intervention.

3. Adolescence

Most researchers define adolescence as the bridging period between childhood and adulthood. However, for the purpose of this study adolescence is divided into three phases – early, middle and late adolescence. This study focused on the middle adolescent (15 to 17 years old).

4. Study Orientation In Maths

Study orientation in maths refers to study habits in maths, problem-solving behaviour, maths anxiety, study attitude towards maths and information processing.

5. Maths Achievement

Maths achievement refers to the percentage mark obtained in the final end-of-year maths assessment.

6. Role of affect in Maths achievement

Research supports the view that 'affect' influences decision making and achievement (Van der Walt, 2008).

7. Emotional Intelligence as concept and facet in the life of the adolescent

Adolescents experience emotional change as a result of their physical, cognitive, personality and social development. Adolescents, whose emotional needs are acknowledged and handled by their parents, tend to be healthier and happier than their peers who are emotionally neglected. They are also more popular, have fewer behavioural problems and tend to do better in languages and maths (Goleman, 1995). According to Rivers, Elbertson, Chisholm and Salovey (2009), these youths have more positive relationships, are less likely to engage in risk-taking behaviours such as using drugs and alcohol, experience fewer debilitating emotional symptoms (e.g. stress, anxiety and depression) and perform better academically. Teachers, moreover, perceive emotionally skilled youths as socially more competent and non-aggressive; as less hyperactive, depressed or anxious; and as relatively popular, pro-social, and self-confident.

8. Emotional Intelligence and academic success

Emotional stressors can prevent a child from reaching his/her full academic potential. Emotional intelligence plays a role in a child's school readiness and academic success and in the adult's success in the workplace as well as marital relationships (Bharwaney, 2007; Cilliers, 2004; Louw & Louw, 2007).

9. Role of study orientation in maths and maths achievement

Study orientation in maths is related to mastering new concepts in the maths curriculum (Maree, Molepo, Owen & Ehlers, 2005). Learners who do not have a positive attitude towards work, do not realise the importance of honest hard work in maths, and do not realise that every concept in maths is a prerequisite for new information and thus will not be able to achieve in mathematics (Maree, 1997). Both memory and anxiety were found to affect math performance directly (Prevatt, Welles, Li & Proctor, 2010). Additionally, anxiety served as a moderator of the relationship between memory and math for most (but not all) measures of math achievement.

By changing the learner's study orientation in mathematics from negative to (more) positive is likely to improve his/her achievement in maths (Maree, Pretorius & Eiselen, 2003). Wang (2010) states that a student's self-confidence in learning mathematics, which overlaps with self-efficacy, expectancy and self-concept, was the most important requirement among other student variables to affect eight-graders' mathematics achievement.

10. The role of metacognition and maths achievement

Metacognition is a strong predictor of problem-solving skills in mathematics (Uwazurike, 2010; Kramarski & Mevarech, 2003). Students who reported using memorisation strategies often scored lower in all subjects, whereas students reporting greater use of metacognitive strategies often scored higher in mathematics (Chiu, Chow & McBride-Chang, 2007).

11. Theoretical Framework

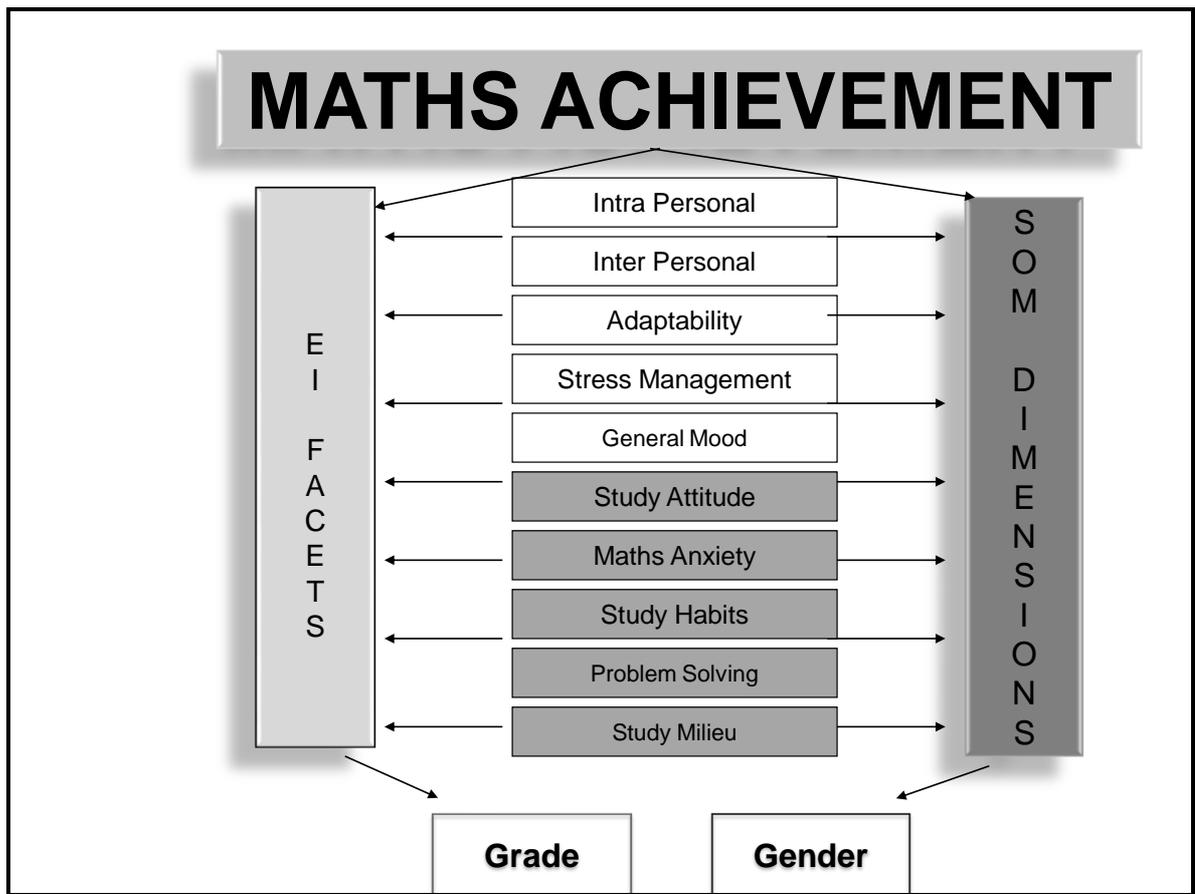


Figure 1: Theoretical framework of this study

The dependent variables used in this survey concerned the Grade 9 and 11 students' maths achievement, factors of the BarOn EQ-i:YV™, as well as the dimensions of the SOM (Study Orientation in Mathematics) questionnaire.

The independent variable was gender and the grade of learners involved in the study (Grades 9 and 11).

12. Methodology

The study reported on in this article was based on a socio-constructivist paradigm. The research design was quantitative.

12.1 Data processing

Pearson's correlation was carried out to measure the strength of the linear relationship between the factors of the BarOn EQ-i:YV™ and the dimensions of the SOM, as well as to establish any correlations between the BarOn EQ-i:YV™, dimensions of the SOM and the respondents' grades and gender.

12.2 Validity

Pearson's correlation was calculated between the fields of the BarOn EQ-i:YVTM and the dimensions of the SOM with regard to the total group, as well as for gender and grade separately.

Regression analysis was carried out on the following dependent variables: maths achievement, factors of the BarOn EQ-i:YVTM and the dimensions of the SOM.

12.3 Sample and data collection method

The quota sampling method was used for the purposes of this study. Altogether 435 (see Table 1) learners in Grades 9 and 11 from the three English-medium high schools in the Mafikeng region took part in the study.

Table 1: Frequencies in terms of school, grade and gender (n=435)

School	School A		School B		School C		TOTAL	
	Boys n	Girls n	Boys n	Girls n	Boys n	Girls n	Boys n	Girls n
Grade 9	36	39	10	50	46	41	92	130
Grade 11	34	33	16	60	36	34	86	127
TOTAL	70	72	26	110	82	75	178	257
Percentage %	49	51	19	81	52	48	41	59
TOTAL	142		136		157		435	
Percentage %	33		31		36			

12.4 Instrumentation

In addition to the BarOn EQ-i:YVTM (Bar-On & Parker, 2000) and SOM (Maree, 1997), we administered an informal questionnaire to obtain the respondents' demographic data. Learners completed all three questionnaires on the same day. The first two questionnaires are standardised measuring instruments that can be accepted as valid and reliable. According to Bharwaney (2007), the advantage of using the Bar-On (EQ-i) is that it is the only available measurement of emotional intelligence that has the validity and norms to allow for its use as a recruitment instrument.

13. Finding & Discussion

13.1 Reliability analysis

The reliability coefficient of the *BarOn EQ-i:YVTM* (North American sample, N=9172) for boys varied from 0,67 to 0,90 across the different age groups and for girls this coefficient varied from 0,65 to 0,90 across the different age groups.

The reliability coefficient of the SOM (N=2055) varied between 0,89 and 0,95.

13.2 Descriptive statistics & analysis

Table 2 illustrates the extent to which a combination of facets of emotional intelligence and study orientation in maths predicts the maths achievement of the Grade 9 group according to gender.

Table 2: Result of the regression analysis with the EI fields and SOM dimensions as independent variable and maths achievement as the dependent variable for the Grade 9 group (male and female)

Gender	Model	R	R ²
Boys	Maths Anxiety (P2)	.480 ^a	.231
	Maths Anxiety (P2); Problem Solving (P4)	.625 ^b	.390
Girls	Study Habits (P3)	.414 ^c	.171
	Study Habits (P3); Maths Anxiety (P2)	.509 ^d	.259
	Study Habits (P3); Maths Anxiety (P2); General Mood	.569 ^e	.323

Grade 9 – boys: R² = .390; *: p < .05; **: p < .01

Grade 9 – girls: R² = .323; *: p < .05; **: p < .01

The final stepwise regression model for both genders in Grade 9 used in the study explained maths achievement significantly (Boys: F=28.501; p < 0.001)(Girls: F=20.064; p < 0.001) and all the predictors were highly meaningful.

The *r-square* (R²) was .390, which means that 39% of the variance in the maths achievement of the Grade 9 boys group can be explained by Maths Anxiety (P2), Problem Solving (P4). For the Grade 9 girls group the *r-square* (R²) was .323, which means that 32.3% of the variance in their maths achievement can be explained by Study Habits (P3), Maths Anxiety (P2) and General Mood (E).

Table 3: Result of the regression analysis with the EI fields and SOM dimensions as independent variable and maths achievement as the dependent variable for the Grade 11 group (male and female)

Gender	Model	R	R ²
Boys	Problem Solving (P4)	.429 ^a	.184
Girls	Information Processing (P6)	.536	.288
	Information Processing (P6); Study Habits (P3)	.563	.317

Grade 11 – boys: R² = .184; *: p < .05; **: p < .01

Grade 11 – girls: R² = .317; *: p < .05; **: p < .01

The final stepwise regression model for both genders in Grade 11 used in the study explained maths achievement significantly (Boys: F=18.375; p < 0.001) (Girls: F = 27.891; p < 0.001) and all the predictors were highly meaningful.

The *r-square* (R^2) was 184, which means that 18.4% of the variance in the maths achievement of the Grade 11 boys group can be explained by Problem Solving (P4). For the Grade 11 girls group the *r-square* (R^2) was .317, which means that 31.7% of the variance in their maths achievement can be explained by Information Processing (P6) and Study Habits (P3).

Table 4: Comparison of the predictors of maths achievement according to gender

	Boys	Girls
Grade 9	Mathematics anxiety (P2) Problem Solving (P4)	Mathematics Anxiety (P2) Study Habits (P3) General Mood (E)
Grade 11	Problem Solving (P4)	Information Processing (P6) Study Habits (P3)

14. Conclusion and Future Recommendation

The results of the study indicated that the genders differ with regards the combination of the facets of emotional intelligence and the dimensions of study orientation that could be considered potential predictors mathematics achievement. The results of this study urges the educational planners at national level to go back to the basics and revisit the curriculum for teacher's training and to include skills development for teachers to facilitate the development of emotional intelligence skills. Due to the different ways in which the adolescent boy and girl cope with daily living, it is the responsibility of educators to structure the learning environment in such a way that both genders could benefit optimally from the learning experience. Emotional intelligence is one of the missing elements that can contribute to the effective functioning of learners in general, as well as to enhance maths achievement. Emotional intelligence can be developed through practice and therapeutic intervention and the findings of this study support the inclusion of emotional intelligence as part of programmes aimed at improving adolescents' maths achievement.

The way to the mathematical brain of a learner is through his/her heart. The key to opening this heart is emotional intelligence skills. Boys and girls have different keys.

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