

# SOCIAL INFLUENCES ON THE STUDYING OF MATHEMATICS BY BLACK SOUTH AFRICAN LEARNERS

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## **Abstract**

*This study sought to explore how social factors influence learner's Mathematical development. The respondents were selected according to a mixed method approach, where the dominate approach was quantitative method. The study was undertaken in was one science college in East London. Data analysis was with the aid of both descriptive and inferential statistics. Independent variables for this study were grouped into: (i) characteristics of mathematics achievement (MA) and (ii) characteristics of MA members. Results revealed that the social variables significantly predicted learners' mathematics achievement. These were status of parent, duration of parental ship, parents' attendance at school meetings. Other significant predictors included financial and material contributions to learners from parents.*

**Key words:** education, mathematics, social influence, South Africa.

## **Introduction**

The field of mathematics education can be described as having two faces; one turning towards theory (learning) and the other towards practice. There are therefore two sets of discourses involved. Evidence of this phenomenon can be seen from one of the findings of a research study showing that more than three-quarters of research articles in three major international forums for mathematics education community are addressed jointly to teachers and learners and to the society at large (Moyo, 2005; Malcolm, Knowles, Stears, & Gopal, 2004; Jeffrey, 2003; Fitz Simons, 2005; Adler & Reed, 2003). This finding notably identifies that the communities of school Mathematics that is the social setting has a fairly small intersection in membership. The relevance of education and for that matter mathematics education, to the South African aspiration, has constantly been debated over the years. The time has come for all policy makers on educational matters to make rational decisions based on available data derived from studies on the ground. In this context, this paper seeks to focus on the influence of social setting on learning of mathematics at the secondary school level in the East London municipality. As part of a composite study conducted to explore how social influences determine

and shape the mathematics learner, this paper attempts to address events surrounding the new democratic South African environment.

### **The Perception of Mathematics among Black Community Members and the Development of Mathematics Education in South Africa**

The frequent interactions of the authors of this article with students have made them aware of two scenarios which motivated them to undertake this study. Over the years they have observed that most black learners are disheartened when confronted with mathematical problems. The apparent reason being that the subject is boring, too abstract and far removed from reality. As a result learners invariably resort to undisputed discontinuation of mathematics and its allied subjects. Some of these learners become disengaged (detached), which some authors (Goba, 2004; Malcolm, Kowlas, Stears & Gopa, 2004; Reddy, 2004; Jeffrey, 2003; Stears, Malcolm & Knowles, 2003) argue, may not be much a reflection of learning irresponsibility, but rather avoidance of an intolerably painful and frustrating situation for them from dimensions other than teaching and learning. Thus against the backdrop of increasing demand and integration of mathematics into our social structure, and subsequent awareness that mathematics is even an integral entity of every setting, it is imperative to study these topical issues from the social dimension. In the direction of the ever increasing demand for mathematics, there seems to be few strategies in South Africa to, at least incorporate and inculcate an appreciable level of mathematics to all school going learners. Since 2006, however, there has been a bold step in the right direction with a dramatic change in the South African school curriculum. The studying of mathematics has now become compulsory for all school learners up to matriculation level. The move is commendable, because, the overall mathematics performance of South African students is reprehensible. In 2005, for example, the Centre for Development and Enterprise released a survey of mathematics which found South Africa students achieve poorly in the subject (Vithal, Adler & Keitel, 2005; Kent, Hoyles, Noss & Guile, 2004; Adler & Reed, 2003; Jaworski, 1994). It placed a huge obstacle in the way of achieving almost all government's ambitions to open up vast new areas of opportunity for black South Africans. In view of the fact that almost every aspect of modern life relates to mathematics, many educationists and curriculum planners might be more excited to learn that all school leavers would have learnt some mathematics by the time they matriculate.

### **The Value of Mathematics in Today's World**

Mathematics is only one of many subjects which are included in the school curriculum, yet there is greater pressure for children to succeed in mathematics than, for example, in history or geography, even though it is generally accepted that these subjects should also form part of the curriculum. This suggests the importance of mathematics in today's world. The perceptions of the usefulness of mathematics arise from the fact that mathematics provides a means of communication, which is powerful, concise and unambiguous. Even though, many of those who consider mathematics to be useful would probably not express the reason in these terms. The authors believe that the fact that mathematics can be used as a powerful means of communication provides the principal reason for its teaching to all children. Mathematics can be used to present information in many ways, not only by means of figures and letters, but also via the use of tables, charts and diagrams as well as graphs and geometrical or technical drawings augured Ashlock (2001). Furthermore, the figures and other symbols, which are used in mathematics, can be manipulated and combined in systematic ways so that it is often possible to deduce further information from the situation to which mathematics relates. A second important rea-

son for teaching mathematics must be its importance and usefulness in many other fields. It is fundamental to the study of the physical sciences and of engineering of all kinds. Mathematics is increasingly being used in medicine and the biological sciences, geography and economics, business and management studies, engineering and the construction fields. It is essential to the operations of industry and commerce in both office and workshop. It is often suggested that mathematics should be studied in order to develop powers of logical thinking, accuracy and spatial awareness. The study of mathematics can certainly contribute to these ends, but the extent to which it does so, depends on the way in which mathematics is taught, maintains Ashlock (2001). The 2003 Trends in International Mathematics and Science Study (TIMSS) conducted by (Reddy, 2005b; Mullis, Martin, Gonzalez, Chrostowski, 2004) in 46 countries, showed that South Africa was the class dance in mathematics. When the centre used its 1998-99 trends survey results to compare South Africa with 10 developing countries, South Africa's grade eight pupils were the worst performers in mathematics. The centre's research report on senior certificate results shows that about 5% of all matriculation candidates pass higher-grade mathematics, and about 22% pass the subject on standard grade. There is the need to ensure that more than 30% of matriculants take mathematics and succeed. The challenge now is for the Department of Education to ensure that those currently getting an A-grade on the higher grade still excel, and those with a low grade still pass. Coupled with the above issues raised, it was estimated in the year 2000 that almost a fifth of South Africa's secondary schools did not offer matriculation mathematics. It is imperative that everyone does 'some' mathematics. The department of education has the responsibility to ensure that those learners who learn mathematics have opportunities to develop the habits of mathematically literate people, in addition to the habits developed by pure science (Rasool, 2005; Mbeki, 2005a; Mbeki, 2005b; Department of Education, 2005a; Department of Education, 2005b). The country's poor mathematics performance and the economy's increasing demand for people with mathematical skills, indicate that more learners in schools must be encouraged to accept mathematics as a social product, something a modern society and its members cannot do without.

### **Mathematics Education: a Social Phenomenon in South Africa**

If we take up the suggestion that the individual and the social environment, rather than existing as separate but related entities, are part of a single system, then the problems of human agency and the status of discourse are somewhat ameliorated. Individuals, the social practices in which they engage, the social structure within which they live and the discourses, which frame their thoughts and experience become aspects of a single phenomenon. The indication here is that mathematics discourses are neither simply a product nor side effect of social structure and are part of it, and at the same time serve to structure human identity and personal experiences. In this regard mathematical discourse can be seen as a valid focus of social and personal change in this perspective (Sethole, 2004). Meanwhile, Moyo (2005) in reporting Kgobe's 2000 research indicates that there is insufficient data showing much evidence of collective transformative action in South Africa. In addition, research indicates very clearly that social class plays a major role in determining the type of schools and for that matter Mathematics learning (Fitz, 2005; Bishop, Clements, Keitel, Kilpatrick & Leung, 2003; Vithal, 2003). Thus social origins greatly affect the success, which pupils enjoy. Within this framework, the research sought to explore the possibilities of social influence, for mathematics learner and how black communities can make a difference. In view of the above discussion, there are two main research questions asked, thus:

### *Research Questions*

- How do social factors influence learners success in mathematics?
- How does social structure improve the achievement of learners mathematical skills?

### **Methodology of Research**

The study was undertaken in was one science college in East London. The school has a high but relatively homogenous population density of between 30 – 40 persons per class, ranging from grade 8 -12. The school is also equipped with young, educated teachers, who are largely homogeneous in socio-psychological characteristics. Requisite information was collected from respondents with the aid of a structured and validated Interview Schedule, consisting of closed ended questions, based on the objectives of the study. Data analysis was with the aid of both descriptive and inferential statistics. Independent variables for this study were grouped into: (i) characteristics of mathematics achievement (MA) and (ii) characteristics of MA members. The dependent variable was level of social capital of parents (guardians), which was measured in terms of seven elements, viz; duration of parental ship, attendance at school meetings, financial and material contributions to learners from parents, recruitment of fresh membership in schools of learners, participation in MA projects. An individual's total level of social capital of parents (SCP) score was obtained by the summation of respondent's responses to different questions raised on the aforementioned elements and to which different weights had been assigned. Respondents were thereafter categorised into; high, average and low levels of SCP. The interviews were recorded and the recorded versions were transcribed verbatim. In this transcription, the researchers subjected the entire process to categorising the themes that were prominent in the transcribed version. The tools used in analysing included means, frequency and regression analysis.

### **Results of Research**

The purpose of the study was to identify the educational and social influences on the studying of mathematics by black South African learners. The data were organised and analysed around the study's research questions. The respondents were 38% males and 62% females accounting for parents. About two-third (65%) of the respondents were Black Africans learners and the rest were Non-Black Africans (whites, Indians, coloureds) learners. Over half (59%) of learners were from science and 41% from business (commerce stream) background. About one-third of the teachers' respondents (36%) of the teacher population in the school participated in the interviews schedule. Very few (2%) of the respondents (parents) were foreign national thus a stratum that consisted of mainly Ghanaian parents.

#### *Correlation Relationship between Factors Affecting Social Capital and Level of Social Capital*

The results reveal that 5 of the dependent variables (cf. section 2) involved in the analysis recorded significant and positive correlation coefficients with level of MA. These were: status of respondents in these case parents ( $r = +0.78$ ,  $p = 0.01$ ); duration of parental ship ( $r = +0.27$ ,  $p = 0.001$ ); attendance at school meetings ( $r = +0.27$ ,  $p = 0.001$ ); financial and material contributions to learners from parents ( $r = +0.21$ ,  $p = 0.01$ ); recruitment of fresh membership in schools of learners, participation in MA projects ( $r = +0.21$ ,  $p = 0.01$ ).

### *Status of Respondent*

The revelation that “status of respondent” correlates significantly with MA level may be due to the fact that a parent has a higher stake in ensuring success and eventual sustenance of his or her learner. In essence, it may be implied that a school that distributes executive positions among a majority of its members (parents) will attract a high MA level.

### *Duration of Parental Ship*

This section of results revealed that higher MA levels accrue to individuals with a relatively longer period of parental ship. It may be noted that individuals do not affiliate without expectations of some social, psychological or material reward. That is why Ernest (1991) reported that an individual seeks and retains membership of any group that makes it possible for him/her to actualize his/her expectations. The individual also becomes deeply involved in the group’s operations and activities, in order to sustain such benefits. It may therefore be implied that individuals with relatively long periods of MA affiliation are assumed to be exposed to some form of benefits and are more likely to participate more effectively in group activities and procedures.

### *Attendance at School Meetings*

In this distribution of results it was revealed that attendance of parents at school meetings with multiple group membership have children who participate more actively and improve on their MA activities and operations. Sfarid (2002) argued on the inevitability of multiple group membership, based on the multiplicity of rural especially in the case of Eastern Cape Province needs and which a single organisation cannot solve. This trend is in consonance with Sfarid, Forman & Kieran (2001) finding of “a higher level of MA for individuals already involved in some other voluntary activities”. It may be inferred that individuals with multiple group membership, extend knowledge derived from other associations, into the activities and operations of the local organisation under focus. This attitude is expected to enhance MA effectiveness and subsequent sustainability.

### *Chi-square Analysis for Factors Affecting Level of Social Capital in MA*

A further analysis revealed the association between some factors affecting social capital of parents and level of MA in the school. According to the indexes only two variables significantly predicted the level of SC of students MA activities and operations. These variables are: relationship of MA learners with information source for affiliation ( $\chi^2 = 21.50$ ,  $p < 0.05$ ) and mode of generation of funds by MAs ( $\chi^2 = 39.39$ ,  $p < 0.05$ ). The distribution also depicts a significant association between MA learners relationship with information source for parents SCP. The study revealed that 87.5% respondents claimed to have become more aware and subsequently affiliated with the MA under focus, due to information received from their parents. This maybe that learners intend to learn to be in positions of their parents. It may therefore be inferred that MA learners who affiliated through information derived from friends and/or relations, participate more actively in MA operations and activities. This result concurs with Bandura (1975) assertion that “personal relationship is a triggering factor in the voluntary participation of most people. In essence, most people become deeply involved in social activities because of a social acquaintance that they can trust to provide factual information on the true functional status of a group. In conclusion therefore, individuals involved in recruitment into MAs are advised to focus on their acquaintances, who may be more easily convinced to affiliate, based on interpersonal relationship.

*Multiple Regression Analysis for Significant Predictors of Level of MA*

Multiple regression analysis was utilized to determine the percentage contribution of some of the identified significant predictors, to level of social capital. The distribution revealed that only two variables made significant percentage contributions to level of mathematical achievement (MA). These are; status of respondent ( $B = 15.31, p < 0.01$ ) and duration of parental ship ( $B = 1.57, p < 0.05$ ). It may thus be inferred that “status of respondent” and “duration of parental ship” are the two variables, prominent in explaining the variation in level of MA in the school. Altogether, according to the results these two variables have a joint correlation of 0.81. The  $R^2$  value also suggests that these two variables explain approximately 65 percent of the variations in level of MA leaving the other 35% to the remaining factors and other factors not included in the equation. The analysis of variance also revealed that the regression coefficients are real and did not occur by chance. It may therefore be inferred that relatively duration of parental ship, occupying positions of responsibility have learners who participate more actively in the operations and activities of focal MAs. By implication then, MAs will become more effective if efforts are targeted at recruiting learners who have relatively good duration of parental ship.

*Interviews*

According to the prominent guardians’ answers to the questionnaires and the interviews, three classes were defined, depending on the extent of the elementary definition of the research question. The findings were limited to cater for the issue of concern eg. social influences regarding the studying of mathematics among black South Africans.

**Table 1. Categorisation and Summary of themes from interviews conducted.**

Categories	Themes
Acquisition of mathematical skills is aligned to social factors	Participants alluded to the fact that the process of acquiring mathematical skills relates to the social settings of the individual
Social factors regarded as main drivers of learning mathematics of learning mathematics	Interviewees agreed unanimously that the environment, family setup and group relations contribute effective acquisition of mathematics skills
Rating community commitment	Not much community participation-relatively low
Social factors influencing studying mathematics and its development	Participants alluded to the fact the stable family learning resources and community at large contribute to the success of learning
How the factors above influence mathematics and the development of mathematics	These factors affect learning of mathematics generally

**Discussion of Findings**

To learn mathematics in schools is a highly creative and complex endeavour. Mathematics is a body of knowledge, which, although created by human beings, often seems to have a necessity of its own and to offer access to a truth, which many claim to be real and fundamental.

Its beauty, elegance and precision may sometimes appear to be cold or inhuman and yet even learners can gain great pleasure from working and solving problems within its domain. Table 1 above indicates that learning is a highly complex process and has characteristics. These characteristics are both social and individual in nature. Mathematical knowledge may often seem to have a highly personal nature as if we had created it for ourselves.

However, mathematics is usually taught to a large group of learners who are asked to arrive at a common understanding of an accepted body of knowledge. The teacher's creative and demanding role is to mediate between the constructing demands of mathematical knowledge, the individual learner and the social situation to provide a mathematical education, which will meet the needs of the individual learner today and in the future. Indeed the above table indicates that the complex nature of this task requires the exercise of professional judgment and continuous, on the spot, decision making, which may or may not be prescribed from outside the classroom. In referring to constructivism as an epistemology, its value to mathematics education will, in the long run, depend on whether this way of sense making of problem posing and solving contributes to the improvement of mathematics learning and teaching in typical classrooms with characteristic teachers. If it eventually fails to do so it will become irrelevant to mathematics educators. Vithal, et al. (2005) maintain that a central theme of the constructivist approach is an acceptance of the fact that the reality of one individual is different from that of another and that individual construct their own mental representations of situations, events and structures. They extend that knowledge as a result of new experience when they have to use what they already know to interpret the new situation in which they find themselves.

#### *How Social Structure Impacts on Learners*

Reddy (2004) asserts that heroic claims are made for participatory approaches to development of mathematics. Participation of community members is assumed to contribute to enhanced efficiency and effectiveness of investment and to promote processes of mathematics community. The challenge of ensuring the sustainability of development interventions is assumed to be solvable by the proper involvement of beneficiaries in the supply and management of resources, services and facilities. There are even claims that participation constitutes a 'new paradigm' of development (Reddy, 2004).

Vygotsky's theory, lays emphasis on the socio-cultural nature of learning. A key concept within this theory is the *zone of proximal development*, which represents the level of development immediately above the learner's present level. Daniels (1996) asserts that tasks within the zone of proximal development are ones that a learner cannot (yet) do independently, but that can be done with the assistance of adults or peers. This is supported by Bandura (1975). This implies that the value of cooperative learning settings, can interact around tasks and problems within each other's zone of proximal development. In this process, the educator acts as mediator of the learning process by means of scaffolding. Scaffolding refers to support for learning and problem solving in various forms, such as clues, encouragement, breaking down the problem into steps, and providing examples. An important purpose is that it should enhance growth in independence and learners should take increasing responsibility for their own learning. Hence, the process of knowledge acquisition, is not necessarily one whereby individuals make their knowledge their own, independently of other contextual influences, but one in which they can make it their own in a community of others who recognise and share a sense of belonging and knowing within a context (Sethole, 2004). In doing so, individuals evolve (learn) an extensive set of specific common adaptations that organise and define relations among objects, people and situations that they encounter. And such, the construction of knowledge relationships does not occur from a position of cognitive isolation or independence. Rather it occurs from a recognition and response for what such "inputs and forces" have come to mean for the

learners. From the above, it is evident that mechanisms for coordinating must bring together as many resources, and types of expertise as possible to support centres of learning and communities to need the needs of learners. Mathematics cognition designed to contribute on: (1) Individual differences that moderate the development of mathematical proficiency (eg, gender or cultural factors, socio-economic status, personality, cognitive style); (2) Normal development of mathematical proficiency (eg. conceptual understanding, comprehension, reasoning, procedural fluency, and strategic competence).

## Conclusion and Implication

To address the social influences that affect mathematics learning among black students in this case study, numerous diverse issues in schools would have to be better organised and empowered in terms of active and critical participation by parents and learners. This will facilitate a sustained level of mathematics teaching. This study was therefore an attempt to identify the social influences factors that may significantly predict level of mathematics learning among black learners in Eastern Cape Province. Results revealed that the variables significantly predicted MA level of mathematics learning. These were status of respondents in this case parent, duration of parental ship, attendance at school meetings. Other significant predictors included, financial and material contributions to learners from parents, recruitment of fresh membership in schools of learners participation in MA projects. It was also revealed however that, status of respondent and duration of parental ship contributed to the variations in level of MA. It may therefore be concluded that effective MA will occur in mathematics learning that will: engage in a broader distribution of responsibilities the variables listed. The findings of this research have profound implication for broad policy formulations aimed at enhancing and sustaining social participation in mathematics learning. The following recommendations are worthy of consideration, school executives should be pro-active in driving the variables mentioned because they are believed to be more credible and are more committed to ensuring greater MA.

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## Footnotes

### Three bands of education

1. South Africa's National Qualifications Framework (NQF) recognises three broad bands of education: General Education and Training, Further Education and Training, and Higher Education and Training. School life spans 13 years or grades, from grade 0, otherwise known as grade R or "reception year", through to grade 12 or "matric" - the year of matriculation. General Education and Training runs from grade 0 to grade 9. Under the South African Schools Act of 1996, education is compulsory for all South Africans from age 7 (grade 1) to age 15, or the completion of grade 9. General Education and Training also includes Adult Basic Education and Training.

### Levels of education in South Africa

BAND	SCHOOL GRADES	NQF LEVEL	QUALIFICATION
HIGHER		8	Doctor's de
		7	Master's de
			Honours de
			Postgraduate
		6	General first
			Professiona
			degree postgi
			Bachelor's c
		5	First diplc
			Higher certi
Certifica			
FURTHER	12	4	Diploma
	11	3	Certificat
	10	2	
GENERAL	9	1	Grade 9 / Adu Education Training le
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		
R			

The primary function of the Education, Training and Development Practice (ETDP) is to facilitate skills development in the education, training and development (ETD) sector. Education is universally recognised as a critical building block for both individuals and society generally. The education system in South Africa has to provide access to education and opportunities for lifelong learning to all the people of South Africa. Skills Development Act (1998) provides a framework for the development of skills in the workplace. Amongst other things, the

Act makes provision for skills development by means of a levy-grant scheme, and the establishment of 27 sector-specific Sector Education and Training Authorities – or Setas – to administer the scheme's funds, and manage the skills development process. The Setas were established in March 2000 and are responsible for the disbursement of training levies payable by all employers in the country. Setas replace and extend the work of the old industry training boards and are accredited by the South Africa Qualification Authority (SAQA).

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