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Perceptions and Interests of Urban High Density Secondary School Students on Applications of Mathematics to Work-related Situations in Zimbabwe

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ABSTRACT The study investigated urban high density students' interests, perceptions and situations that the learners would prefer to be exposed to and handle in relation to learning mathematics. A questionnaire was administered to 450 randomly selected students from 5 high density secondary schools in Harare, Zimbabwe. The main findings from the study show that students in these schools expressed a high preference for mathematics that would provide them with access to studies at universities and technical colleges, mathematics that is relevant to professionals such as engineers, lawyers, and accountants, and mathematics in modern gadgetry such as SMS and ATM devices, computer games, and play stations. The students expressed low preference for mathematics related to lottery and gambling, craft and decorations by indigenous women, pop music, and designing of clothes and shoes. Such observations sensitize planners to a curriculum sense balancing that taps from the current interests of learners, prospective employers, and other curriculum stake holders.

INTRODUCTION

Over the years in Zimbabwe, as elsewhere, there have been calls for mathematics curriculum to be more meaningful and relevant to students' everyday life and the world of work, that is, industry and commerce. Several researchers have analysed and documented the mathematics practices of adults as well as children, which take place outside the school settings (Carraher et al. 1987; Saxe 1991; Kernan 2007). Despite efforts to address this issue, there is a wide perception within the mathematics education community that a lot still remains to be done. Leng (2009) noted in this respect that many students see mathematics largely as an irrelevant subject. The Millennium Maths Project (2008) identifies the need to help students of all ages and abilities understand the vital contributions mathematics can make through its applications to everyday life and work related situations. Real-life situations or contexts are extra-mathematical situations and defined as 'textual descriptions of situations assumed to be comprehensible to the reader, within which mathematical questions can be contextualized' (Verschaffel et al. 2000: ii). Thus, real-life problems or contexts refer to those day-to-day situations or contexts typically located outside of mathematics as opposed to the intra-mathematical environment.

Research indicates that students learn mathematics better when they find it relevant to their prior experiences (Heibert 2003; Visnovska and Cobb 2009), and their prior experience in learning mathematics affects their role in the classroom (Yackel and Cobb 1996). Other studies show that the perceptions of students about the learning of mathematics affect their classroom practices and performances (Even and Tirosh 2008; Saritas and Akdemir 2013).

Considerable resources and efforts are directed towards encouraging young people to appreciate the relevance of mathematics to work related situations, thus it is important to be aware of their current understanding of and perceptions on the issue. However, research in this area is still scant. Cross (2009) noted that most researches on perceptions and interests about the relevance of mathematics were inconclusive. That situation has not changed much since. Traditionally mathematics has been viewed as a discipline where success is limited to a minority as opposed to a majority of students. There have been conscious efforts by mathematics educators to change this view of mathematics to an orientation that focuses on making mathematics accessible and enjoyable for all students. Reform efforts address topics such as the need for relevance through providing real life applications, collection and organization of real data, and applied problem solving, as opposed to rote memorization of procedures. That is to say, the relevance of mathematics outside the confines of the classroom lessons can be brought about through showing the use of mathematics in the real world. In Zimbabwe, government, business, and higher institutions of learning have noted that there are disjunctions/disconnections between what is learned at school level and in higher institutions and what is needed in the work place (Nziramasanga 1999). In the Nziramasanga Report, the Commission recommended the introduction of a more competency based learning approach which is better linked to industrial needs. The ministry of Education had to provide a solution that would work practically rather than continuing with an overly academic outdated set, which contributed less to skills. Hence a new kind of mathematics literacy that will equip students with real life skills that connects and serves them better in these diverse situations is needed.

It is generally accepted that schools should graduate learners who are mathematically literate. Mathematical literacy is variously defined but there is a great deal of overlap across the variations. A widely accepted definition is that given by Wedege (2010) and the Organisation for Economic Co-operation and Development (OECD 2006: 22) that states that "mathematical literacy is the capacity to identify, understand and engage in mathematics and make well founded judgments about the role that mathematics plays in an individual's current and future life with peers and relatives and life as a constructive, concerned, and reflective citizen." The essential purposes of the mathematical literacy requirement are that, as the learner progresses with confidence through the levels, the learner will grow in: a confident, insightful use of mathematics in the management of the needs of everyday living to become a self-managing person, an understanding of mathematical applications that provides insight into the learner`s present and future occupational experiences and so develop into a contributing worker. Thus mathematical literacy can be placed within the realm of applications and modeling. Modeling focuses on the direction: reality à mathematics; and application focuses on the opposite direction: mathematics à reality. Reality is considered here as essentially the extra-mathematical. The essential outcome for mathematical literacy is captured as "to make well founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life." The outcome of mathematical literacy pivots around students' interests and is futuristic. The curriculum in Zimbabwe has been largely influenced by curriculum designers, learning resource developers, and test constructors through their selection of instructional contexts (Nziramasanga 1999).

Students' perceptions and interests are important in the sense that they serve as feedback to policy makers, curriculum designers, syllabi implementers, and educators on issues that need to be addressed, reviewed, and improved. The link between mathematics education provisions and students' interests in and perceptions of mathematics has not yet been fairly established. Mathematics education has been accepted as an investment while the human resource has been accepted as a critical factor in any economic development initiative. What seems to be still problematic is the designing and delivering of the type of mathematics education that is most relevant to the needs and interests of the students. At the moment, however, the indication is that there is a mismatch between what mathematics education develops in learners and the needs of the world of work.

Mulat and Arcavi (2009) also studied the perceptions of high achieving students about what fosters "their mathematics and academic trajectory" (p.77). In their study 'perception' referred to the students' understanding of the factors that enable or constrain learning and achievement of mathematics. Gebremichael (2011) used the term 'perception" to describe certain beliefs relating to personal competences and beliefs relating to classroom norms. It is also used to describe the emergence of attitudes (Pepin 2011). In this study the term perception refers to the meaning the students attach to the relevance of their mathematical experiences to work-related situations. Interests refer to the feelings of a person whose attention, concern, or curiosity is particularly engaged by something (Opt'Eynde et al. 2002).

The aim of this study is to report a characterisation of Zimbabwe high density students' perceptions and interests of the relevance of mathematics with respect to their learning goals as well as about the relevance of mathematics to the society and their real life situation, which we believe exposes the perception in a peculiar context and help to improve the learning of mathematics in Zimbabwe.

Problem Statement and Significance of the Study

Mathematics education in the past decades has focused on making the learner the target of the school academic enterprise and sees him or her as creating his or her own knowledge by interacting with the environment and solving problems through the embedding of real-life situations or contexts (Freebody 2007). However there is still a growing tendency by stakeholders to choose contexts which they deem appropriate and interesting and in turn which may not arouse the desire and interest of the learner to participate in mathematics.

Mathematics educators hold the view that understanding students' perceptions and interests of mathematical applications to the real world is an important step towards understanding how to attract school students to learn mathematics. This understanding would help educators to know what factors influence students' learning of mathematics and how to motivate them to learning successfully and with enjoyment. Further investigation of workplace mathematics is needed as it would demonstrate "the unique forms of mathematics developed in workplaces and their synergies with formal school mathematics" (Zevenbergen 2000: 185).

Research Objectives

- To investigate the perceptions of students towards some mathematical topics in relation to their applications to work related situations;
- To examine the interests of students towards some mathematical topics in relation to their applications to real life situations and,
- To make recommendations to the stakeholders to make effective linkages and synergies of the school mathematics and future workplace ethics in the mathematics syllabus based on research findings.

Research Questions

1. What are high density students' perceptions and interests of the relevance of mathematics and how are they characterized?

Significance of the Study

This line of research gives some insight into how people conceptualise the role of mathematics in their work. More recent research in workplace mathematics has attempted to uncover the mathematical practices of specific groups (for example, nurses, automobile workers, carpet layers) and identify and establish abstractions that underlie these practices. Such studies assume significance because they give rise to the recognition of different forms of mathematics such as academic mathematics, everyday mathematics, folk mathematics, and ethno-mathematics. The use of real-life contexts in school mathematics has the potential to facilitate better conceptual understanding and those contexts can serve as a bridge between mathematics regarded as an abstract discipline and mathematics as a human activity which has relevance in people's lives and a tool for the solution of their problems.

Theoretical Framework

To support the relevant literature, the social cultural theory with specific reference to the cultural historical activity theory was used in this study. Socio-cultural theory looks at the important contributions that society makes to individual development. This theory stresses the interaction between developing people and the culture in which they live Vygotsky (1978). According to this theory, parents, teachers/educators, caregivers, peers and the culture at large are responsible for the development of higher order functions of the child (Cobb 2007). Socio-cultural theory also focuses on how cultural beliefs, attitudes and interests impact on how instruction and learning take place. As one dimension of the theory, Lerman (2006) also propounded the cultural historical activity theory (CHAT) whose basic tenet is that knowledge appropriation is a social process mediated by cultural tools such as language with human activity as the unit of analysis. He (Lerman) focused on how we develop understandings of the real world, draw meanings from that understanding, create learning from those meanings and are motivated to respond to that learning. Therefore the students' perceptions and interest are mediated by all these elements. It is in such a theory that such behaviours could be interpreted (Roth and Lee 2009).

Literature Review

Research in mathematics education has shown students' growing negative attitudes towards school mathematics. Sullivan (2011) noted that some 14 year old students could not describe what mathematics is and comment on its value, relevance, and future use. According to Valero (2002), many students have a narrow view of what mathematics is, and if that restricted picture is ineffective to them, then there is a tendency to dislike mathematics. Literature indicates that mathematics with real world connections makes learning mathematics more effective (Gainsburg 2008).Other studies show that the perceptions of students about the learning of mathematics are important for success (Even and Tirosh 2008; Mulat and Arcavi 2009). In general some reported research supports the view that students find it difficult to identify mathematics embedded within work-related situations and their synergies with formal school mathematics.

Obara and Sloan (2009), for example, noted that the range of activities where mathematics could be applied mentioned by students was limited and attributed this to the general lack of modeling activities in school mathematics. Dowker ý (2004) posited that in general secondary school students viewed mathematics as a broader domain, while primary school pupils largely identified mathematics with counting and working with number operations. These findings are consistent with the influence of a shift in curriculum emphasis from elementary to secondary mathematics. The researchers also noted that students do not perceive an activity as mathematics if there is no obvious problem or question to solve. Most strikingly, Bowers and Doerr (2001) reported that mathematics is an "upward shifting domain" in that as soon as an activity becomes easy it is seen as common sense rather than mathematics. Williams (2008) noted that mathematical fields have failed to highlight the social value and relevance of the subject material. In particular, the disconnection between subject material and life applicability has been shown to affect the retention of students in mathematical related fields. Gebremichael's (2011) experience as a mathematics teacher has revealed that there are many who consider mathematics as an academic exercise rather than a social activity; he observed that even some teachers are challenged when they encounter real-life problems that could be solved using mathematics.

Literature indicates that mathematics with real world connections makes learning mathematics more effective (Heibert 2003; Gainsburg 2008; Even and Tirosh 2008). Other studies show that the perception of students about the learning of mathematics is important for success (Chung 2009; Even and Tirosh 2008; Mulat and Arcavi 2009). Julie et al. (2011) observed that the use of real-life contexts in school mathematics has the potential to facilitate better conceptual understanding. They noted that context can serve as a bridge between mathematics regarded as an abstract discipline and mathematics as a human activity which has relevance in people's lives. A balanced mathematics curriculum should therefore focus on mathematics content and processes that are important and worth the time and attention of students. Mathematics topics may be important for different reasons, such as their utility in developing other mathematical ideas, in linking different areas of mathematics and in preparing students for further studies, the workforce, and citizenship.

Contemporary Views in Mathematics

To compete successfully in the worldwide economy, today's students must have a high degree of comprehension in mathematics and its applications to other fields (Mullis et al. 2005). In today's view of mathematics learners must master a sophisticated body of knowledge and learn to use powerful new computational and visualization tools. Because these tools have "*mathematicated*' science and technology, virtually all professionals encounter mathematical models in most of what they do. So contrary to common belief, the ubiquity of computers in the workplaces means that today's students need more rather than less mathematics. Unfortunately most citizens and too many teachers still view mathematics as just the computation of correct answers (Wolfram 2010). The mathematics used in the world today is not the same as that used or needed a century ago. Consequently, the mathematics taught in schools today should not be the same as the mathematics taught in the same ways as decades ago.

A new definition of mathematics education is needed. Arcaro (2009) defined mathematics education as practical literacy that can be put to immediate use in improving basic living standards, for example, the ability to compare loans, unit prices, manipulate household measurements and estimate the effects of inflation. It is, in other words, applied mathematics. The various attempts to characterize mathematics education illustrate the complex nature of mathematics today. It is no longer enough to conceive mathematics education as just arithmetic, algebra, or geometry. Students in this era need to play an active role in their education, acting as full participants in mathematics education. It is time for a new understanding of the role and importance of mathematics education (Ellis 2005). To ensure that tomorrow's leaders are equipped to compete in a global economy they should be able to make connections between mathematics and everyday life and world of work (Ontario Education 2014).

Content versus Teaching Methods

Several factors can influence the potential of mathematics education to motivate and inspire students. Two key issues are: what is taught (content) and how it is taught (teaching methods). By asking about students' interests in the application of mathematics education to work related situations, we only address the what (content) question. However, the value of this question lays in identifying subject matter that appeal to different groups of students. There is great variety in teaching methods or learning activities ranging from traditional talk and chalk to project work, internet search, excursions, experiments, group work discussions, role play, drama, storyline, among others. The methods serve various educational purposes and have different capacities for motivating students and attracting their interests. This study concentrated only on the relation between content and interests.

A study on students' review of the science curriculum by (Anderson 2006) concluded that students preferred a mathematics curriculum involving more contemporary socio-scientific controversial issues as well as more philosophical and ethical matters. In general students showed interest in topics suitable for discussion and deliberations while fact oriented topics had less appeal. Students in Osborne and Collin's (1994) study blamed mathematics education for not giving space for creativity, imagination, discussion, and self-expression. Osborn and Collin also found that girls do not share boy's interests in mathematics related to cars and planes. Both groups of students agreed that some topics were pointless and far away from students' concerns. Sjoberg (2000) explained how attraction for a subject varies with different contexts. He found that the context was superior to the content in influencing student interest in the subject. A mathematics curriculum should focus on mathematics content and processes that are important and worth the time and attention of students. Mathematics topics may be important for different reasons, such as their utility in developing other mathematical ideas, in linking different areas of mathematics and in preparing students for college, the workforce, and citizenship (NCTM 2005). Research has established that individual student interest has a positive effect on learning and academic achievement. Moreover, if the presence of certain features in the classroom that support the development of individual interests, then instructors may be able to fashion classroom discussions, in ways that promote individual interest in their students (Hidi and Harackiewicz 2000). Research has also shown that interest is fostered by providing an individual with a variety of educational opportunities that promote his or her involvement and in which tasks or activities are accompanied by positive feelings. Quality mathematics teaching provides access to learning environments that link student learning to personal, social and work contexts outside the classroom.

METHODOLOGY

A quantitative research approach using the (ROSME) questionnaire was used to solicit data to understand the perceptions and interests of urban high density secondary school students on applications of mathematics to work-related situations in Zimbabwe**.** The study utilised a quantitative approach as noted by Babbie (2013), because quantitative research design allows the researcher to answer questions between measured variables with the purpose of explaining, predicting and controlling certain phenomena.

Research Participants, Data Collection Instrument and Analysis

The target population for the study consisted of 1500 students drawn from all Harare high density areas (mostly low income working class neighbourhoods) secondary schools doing Forms 1, 2, and 3. The sample consisted of 450 students randomly selected from 5 secondary schools located in those kinds of suburbs of Harare. Two hundred and twenty-five (235) female students and 215 male students responded to the Relevance of School Mathematics Education (ROSME) (Julie 2006) questionnaire. Thirty students were randomly selected per grade making a total of 90 students from 3 grade levels per school. Simple random sampling method was used in each of the grade cohorts.

The ROSME instrument, specifically constructed to assess issues and contexts learners would prefer to learn about in mathematics was used to investigate the students' interests and perceptions. The data collection instrument consisted of 62 closed questions which were centred on the stem statement "*What I would like to learn about in mathematics*." The question is an inventory of possible context-cued topics to learn about, each with a 4-point likert scale from "*not at all interested*" [1] to "*very interested*" [4]. Three additional questions were open ended and asking the students to write three issues that they are very interested in learning about the use of mathematics in these issues and explain their desires in these issues. The final item required the students to make a sketch diagram of a mathematician working. This was meant to obtain a sense of the pupils' conceptions and images of a career mathematician.

Before administering the questionnaire for the main study, a pilot study was carried out in order to check and improve the validity of the instrument. The instrument was altered and reworded as necessary in order to suit the cultural context and language of the learners. Descriptive statistics in the form of Kendal's W test for k-related samples were calculated using SPSS version 22 to analyse the data.

RESULTS AND DISCUSSION

The closed items were grouped into 13 categories consisting of 11 extra-mathematical clusters and 2 non-mathematical clusters. Identification of the 11 clusters was facilitated by module writers and learning materials developed by the Consortium for Mathematics and its Applications to ensure compliance with the possible mathematical treatment of clusters. Students' interests in mathematical topics were ranked according to their responses on preferences. Clusters on politics and youth culture were identified as the non-mathematical clusters. The 62 closed items were ranked using the Kendall's W test for k-related samples and the item with the highest rank was found to be C23 (Mathematics that will help me to do mathematics at universities and technical colleges) with a rank of 46.3 (Table 1).

Table 1: Kendall's rank order: The most preferred items

Code	*Description*	*Mean ranking*
C23	Mathematics that will help me to do mathematics at universities and technical colleges	46.32
C11	Mathematics that is relevant to professionals such as engineers, lawyers and accountants	42.87
C15	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	41.27
C46	Mathematics involved in sending of messages by SMS, cell phones and e-mails	40.02
C3	Mathematics involved in making computer games such as play stations and TV games	39.72
C47	Mathematics involved in working out financial plans for profit-making	39.17
C45	Numbers	38.62
C26	The kind of work mathematicians do	37.07
C22	Mathematics to prescribe the amount of medicine a sick person must take	36.9
C21	Mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community	36.53
C27	Geometry	36.05
C16	Mathematics used to calculate the taxes people and companies must pay to the government	35.78
C34	Algebra	35.41
C51	How to predict the sex of a baby	34.9

The overall picture of the results indicates that high density secondary school students assign a high priority to learning mathematics as a discipline. Also related to this was the desire shown by the students to do mathematics relevant to professions such as engineering, law, and accountancy. Mathematics relevant to modern gadgetry such as cell-phones, automated machines (ATMs), computer games, television broadcasts, and play stations was also accorded a high priority. Item C23, dealing with *mathematics that will help me to do mathematics at universities and technikons* is the highest preferred item for learners from high density urban environments. One notes from this that learners from these areas seem to have a strong preference for further studies in mathematics-related subjects at Higher Education Institutions. The reason for this choice may be the fact that learners come from disadvantaged backgrounds and their aspiration for higher education is seen as a means to uplift themselves from their disadvantaged backgrounds.

The item, C11, *mathematics that is relevant to professionals such as engineers, lawyers and accountants*, was ranked number two on the common most preferred list. This may be an indication of the learners' desire to complete their schooling in order to pursue such high-status careers. This is probably an indication of learners' awareness of the importance of mathematics linked to professions that presumably leads to a better lifestyle.

Three of the items (C15, C46 and C3) in the highest ranked items deal with modern day technologies. Learners from high density environments find it interesting, challenging and explorative to work with modern technology such as cell phones and computer games and ATM pin numbers.

The item, C47, *Mathematics involved in working out financial plans for profit-making*, was also ranked among the most preferred items. This may be indication of some family backgrounds, since some get their incomes through small tuck-shops, backyard business, fruits and vegetable vending. However the results shows that the same students expressed low preference for mathematics in activities such as lottery and gambling, craft and decorations by indigenous women, pop music, and designing of clothes and shoes items (Table 2).

Results from cluster analysis suggested that students prefer the mathematics education and training cluster which grossed a mean of 39.91 for the 6 cluster items (Table 3).

The technology and communication cluster was also given a high preference. Those phenomena that have to do with secret coding, electronic processes and personal and financial concerns enjoy highest priority. This is indicative of the great impact on youth of modern high-technology driven everyday life activities. The availability of multi-function technological communication devices, such as cell phones, secret codes are integral to their daily lives, in terms of

Table 2: Kendall's rank order: The least preferred items

Code	*Description*	*Mean ranking*
C59	Mathematics to describe movement of big groups of people in situations such as emigration and refugees fleeing from their countries.	21.53
C56	Mathematics to describe facts about diminishing rainforest and growing deserts	21.05
C8	How to estimate and project crop production	20.88
C41	Mathematics involved in making pension and retirement schemes	19.85
C10	Mathematics political parties use for election purposes	18.71
C1	Mathematics linked to designer clothes and shoes	17.88
C31	Mathematics used to calculate the number of seats for parliament given to political parties after elections	16.57
C36	Mathematics involved in working out the best arrangement for planting seeds	16.34
C28	Mathematics involved in packing goods to use space efficiently	16.17
C17	Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	15.97
C13	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops	15.68
C14	Mathematics needed to work out the amount of fertilizer needed to grow a certain crop	15.33
C37	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	15.03
C43	Mathematics linked to decorations such as the house decorations made by Ndebele women	14.65
C2	Mathematics of a lottery and gambling	14.21

Table 3: Cluster analysis

Cluster	Number of items	Exemplar indicator item	Mean ranking
Technology and Communication	6	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	39.91
Health	4	Mathematics involved in determining the state of health of a person	38.89
Mathematicians' Practices	5	How mathematicians make theirdiscoveries	38.01
Agriculture	4	Mathematics involved in working out the best arrangement for planting seed	37.67
Physical Science	3	Mathematics involved in making complex structures such as bridges	36.72
Mathematics	5	Mathematics that will help me do mathematics at universities and technikons	36.12
General	7	Mathematics involved in assigning people to tasks when a set of different tasks must be completed	36.00
Transport and Delivery	3	Mathematics involved in the sending of messages by SMS cell phones and emails	35.86
Life Science	3	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	35.33
Crime	4	Mathematics involved in setting up a crime barometer for my area	34.67
Sport	2	Mathematics involved in crowd control at a sport meeting	34.35
Youth Culture	4	Mathematics linked to music from the United States, Britain and other such countries	34.07
Politics	3	Mathematics used to calculate the number of seats for parliament given to political parties after elections	33.98

learning, communicating and getting around. A notable feature of the cluster analysis results was the high preference given to the health cluster.

The strong interest in the health cluster can be ascribed to the knowledge learners have developed about health hazards and their implications in their lives. Because of their low socioeconomic background, urban high density suburbs have a higher mortality rate than their low density counterparts due to preventable causes such as tuberculosis, violence, Human Immunodeficiency Virus/ Acquired immune Deficiency Syndrome (HIV/AIDS). There are also campaigns related to these issues that are conducted regularly through the media targeting these neighbourhoods. In the researchers' opinions, awareness of undesirable and fatal consequences of such issues excites students to need to know more about them. The least preferred items include mathematics for lotteries and gambling and mathematics linked to crafts and decorations made by indigenous artisans. These are often viewed as vices to be stamped out of society and those issues linked to culture are generally regarded by youth as traditional and backward. From the perspective of learners the ethno-mathematical approaches underlying mathematical analysis of cultural artifacts and indigenous mathematical knowledge systems do not appear to entice their interests. Needless to say it would be interesting to find out why that is the case.

Despite aggressive advertising and popularization of contributions of the lottery and casinos to social development, the students indicated low preference for dealing with mathematics related to that. This seeming disinterest may be due to the belief that one has to have luck to win, and also that in Zimbabwe the minimum age for gambling is 18 years (and participants of this study ranged in age from 13 to 17 years).

The Kendall's W and Chi square values obtained for each cluster in the cluster analysis seem to suggest that the students could not see the items as constituting a cluster. They probably saw the items as separate entities. This suggests that they could not see the mathematics inherent in these activities but that they could probably relate career or job activity to an item. This is perhaps one limitation of a cluster analysis approach with this particular data set.

Responses from the open ended questions failed to bring much from the students as most of them tended to refer to items from the closed items and repeat ideas they had already expressed. Here boys tended to have a strong orientation towards the use of mathematics involved in making computer games, television and play stations, and making airplanes and other craft. Their reason for showing this desire was that they wanted to pursue careers in these areas. On the other hand, female students' responses were biased towards nursing and mathematics involved in preparing recipes and other careers typically taken up by women. Responses given by the Form 3s were more meaningful than those given by the Form 1s and 2s. This may be due the educational maturity and language effects.

On the use of mathematics in other subjects, the most common response among the respondents was that mathematics tends to create a barrier that prevents them from understanding those other subjects. The students suggested that mathematics should not overlap into other subjects and that each subject should be taught as a separate entity. This is in contrast with educational research, experience and common sense which tells us that students learn best and make better sense of what they are learning when they can make connections with previous learning or with different areas of learning. However, some argued that mathematics that is applied in other subjects is usually easy to understand since it is just the application of mathematics and not mathematics in its pure form. Mwakapenda (2006) urged that integrating learning areas is a great way to embed mathematics into other curriculum areas. It enables students to apply mathematics skills and understanding to their learning in other areas of the curriculum or to real-world problems of importance to their communities.

Finally, responses to the last item that required the students to draw a sketch diagram of a mathematician working were dominated by pictures of female or male teachers teaching (about 50 percent of the diagrams). Hence it can be said for these students their teachers define mental models of a professional mathematician. The other half of the students drew diagrams depicting scenes that can be associated with architectural, construction, or manufacturing activity. Diagrams of persons constructing bridges and brick walls, and assembling electrical appliances were also noted. According to their diagrams mathematicians use tools such as mathematical theory (teaching), well-defined tools and the latest computer technology to solve economic, scientific, engineering, physics, and business problems. Students' pictures also depicted the two branches of mathematics: theoretical, or pure, mathematics, and applied mathematics. Mathematicians doing applied work use the theories and laws developed by theoretical mathematicians. Applied mathematicians solve specific problems in such fields as physical science, social science, business, computer science, government, biology, and engineering

CONCLUSION

The real-life situations that the learners in these environments prefer most are related to electronic gadgets and personal finance, whilst the items they are least interested in are issues related to gambling and cultural practices. Furthermore, results suggest that students in suburban high density environments are interested in learning mathematics that will enable them to pursue further studies at institutions of higher learning, regardless of the nature of the embedding learning context. The motivations for their interests are dominated by their desire to attain careers based on acquiring tertiary education. A belief held by parents and others in the low socio-economic and material-capital environments is that when a certain level of schooling particularly the secondary school level is attained, then the student must do his/her utmost to move up the socio-economic ladder and move out of those depressive and overcrowded residential neighbourhoods. The value accorded to mathematics as a discipline is that of enabling them to cross that line. Everything else is peripheral.

RECOMMENDATIONS

The research recommends a mathematics curriculum that provides learners access to learning environments that link student learning to personal, social and work contexts outside the classroom. Learning must incorporate relevant syllabus outcomes and embed the work, employment and enterprise and key competencies cross-curriculum content statements into classroom teaching. A work, employment and enterprise content enable students to develop work-related knowledge, skills and understanding through their study of mathematics. It also provides opportunities for students to develop values and attitudes about work, employment and the workplace. Class topics can be linked to relevant career pathways so that students can make the connections between their learning and the 'real world'. For effective linkage of the school mathematics curriculum and future workplace ethics and skills and positive attitudes at school and workplace, the study strongly recommends that all stakeholders of education including industry and employers should be involved in the process of curriculum development. The results can also usefully inform the curriculum designers of assessments on school mathematics about appropriate real-life situations which appeal to learners that can be used in school mathematics.

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