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CHALLENGES INHIBITING THE PARTICIPATION OF GIRLS IN STEM EDUCATION: A CASE OF 5 A-LEVEL SCHOOLS IN GWANDA CENTRAL IN ZIMBABWE.

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ABSTRACT*:* *Student engagement in educational experiences is a desired dream of every community, while persistent participation in STEM education, especially by the girl child is a milestone for future prospects. Laws and policies have been crafted to harness every possibility that ensures that girls access and succeed in education and training, like, if not better than their male counterparts. This study investigates challenges that coalesce to impede girls from taking up science subjects in 5 A-level schools in Gwanda central. The study employed a qualitative case study design. A purposive sample of 25 science subjects teachers, 5 heads of schools and 50 students was used. Focus Group Discussion (FDG) was conducted with the selected teachers and students while interviews were conducted with the heads of schools to obtain information for discursive analysis and interpretation. The findings of the study were that lack of science centres and low self confidence among girls fostered low uptake of STEM education path. Recommendations were that orientation of girls towards heavy sciences should be progressively introduced from lower grades, membership of students to International Olympia should be seriously considered, while sponsorship of girls at science-biased learning institutions has to be normative.*
KEYWORDS*: girl child, STEM Education, science centres, participation of girls*

INTRODUCTION AND BACKGROUND TO THE STUDY

In Zimbabwe and other developing countries, a notable gender gap exists between the number of high school girls and boys who are enrolled and participate in Science, Technology, Engineering and Mathematics education. The situation finds most female students lagging behind their male counterparts in terms of retention, performance and graduation rates in science education. This scenario has an influence in future involvement of female students in placements that are skewed towards science and technology. This ultimately limits the chances of girls to take up opportunities in science related positions.
The performance of girls in science education appears to suffer considerably from expectations and influences of society (Boilock, 2010). This prevails despite the fact that women constitute more than half of the workforce in most modern communities (Adya & Kaiser, 2005). While it can be expected that their majority status should translate into increased options

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for them to pursue diverse qualifications of their interests, cultural stereotypes still prove to have a telling effect on the compatibility of science education to the performance of girls. The patriarchal nature of communities tends to stifle the rights of the girl child towards education in general, and science competencies in particular.

African contexts teach the binary of human roles. These identify certain types of achievements that are considered to belong to the male domains, and so not to be taken up by girls who are treated to be incapable to operate in those areas (McGreedy & Dierking, 2013). Masculine jobs which were traditionally out of reach to women included those in mathematics, science and technology. In some communities a female who demonstrated interest and achieved in roles that demanded physical stamina and scientific acumen were considered either heretic or atypical African. Philips (2007), however, argue that achievement in science and technology fields should not be used as the benchmark for success and that women should not be portrayed as passive and insecure acceptors of roles.

Once stereotypes are established they become engraved to influence the participation and performance of individuals academically. The gendered experiences that babies encounter at early stages of their lives tend to influence their developmental courses. Mothers tend to have more science talk with boys than with girls (Tenenbaum, Snow, Roach & Kurland, 2005). This encourages boys to pursue science, mathematics or technology related careers later on in life (Packard & Nguyen, 2003). Girls on the contrary, are exposed to roles that border household chores and biased towards social and soft sciences. The experiences and expectations that parents nurture on their children do play a positive role in shaping future course choices for the child depending on gender (Adya & Klaiser, 2003). In addition, the educational attainments of parents also come handy in contributing to the subject uptake of children. According to Simpkins, Davis-Keom & Eccles (2006), educated parents tend to expect boys to take science courses but allow girls more freedom to choose whether or not to take science courses. In this regard, parents with less education tend to demonstrate limited educational aspiration for their children, and no science interest in particular. The implication is that girls may find themselves pursuing a science related course by default and do not have stern parental pressure to engage in a science oriented field, while children of uneducated parents stumble onto science participation.

Lack of science self-confidence works against the achievement of the girl child. This goes beyond the study of science to cover mathematics, engineering and technology. Low self-confidence and self-esteem create disinterest in the subject and encourage students to eventually drop-out from participation (Stake, 2006). This lack of self-confidence can arise from endorsing the stereotype of being bad at mathematics and sciences that society usually compels girls to accept. When this attitude is internalized, girls tend to underestimate their abilities, signifying low confidence even in science laboratory

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activities (Klahr, Triona & Williams, 2006). Britner and Pajares (2006) observe that even despite high scores in the subject, girls show higher levels of science related anxiety and physiological stress but lower levels of mastery experiences. Girls appear scared and reluctant to take the initiatives in experimentation and demonstration activities that teachers plan to assist them to grasp the concepts of the lesson.

Female teachers tend to transplant their loss of confidence in the sciences to girls in their classes. Boilock (2010) posits that a highly math-anxious female teacher may push girls to confirm the stereotype that they are not as good as boys in mathematics, which in turn, affects their achievement in the subject. This ultimately spreads to affect other subjects like science, engineering and other related courses with an affinity for mathematical skills. Ideally, however, one would expect female science teachers to push the girl child agenda by stretching them hard academically so that they perform at the level similar to, if not better than that of their male counterparts. The lack of female role models and stigmas around the education of girls contribute to the underrepresentation of females in STEM education (Torres *et al.*, 2014).

A review of the entire scientific culture of education may serve to enhance the participation and achievement of the girl child. The structure, language and epistemologies of science should be friendly to experiences of girls in ways that encourage them to grow and expose their potential (Davis, 2009). Girls prefer a curriculum that relates to practical experiences of their life. This calls for the rebranding of the current science content to one that has undoubted functionality and a clear social applicability, particularly for female group. Girls want connections to science but have a hard time in relating what they do in science classes to the world around them (Buck, 2002). Teaching strategies that suit the learning of girls need to be adopted in the teaching and learning discourses (Ogunkola & Olatoye, 2005).The natural and biological sciences which relate closely with the real world should be provided and used to rate the achievement of girls in the sciences.

Societal progression and global trends have led to paradigm shifts pertaining to quality and equity issues in education. Governments have responded to this call by formulating policies that seek to empower and cultivate skills development in various fields of experience, with a bias towards the sciences. The Zimbabwean Constitution (1980) clearly advocates for access and participation in education regardless of gender, age and geography. The Nziramasanga Commission to Education and Training (1999) was set up to mediate skills development, particularly through vocational programmes. In the same spirit, the National University of Science and Technology sought to develop mathematical skills among boys and girls through the National University of Science and Technology Secondary Education Programme (NUST-SEP). In spite of these efforts, the performance of the girl child in mathematics and sciences has remained a challenge.

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THEORETICAL PERSPECTIVE

This study is underpinned by Bronfenbrenner's ecological systems theory. The theory focuses on the role that the environment plays in the development and growth of the individual. The relations and interactions that ensure combine to shape the physical and cognitive development of human beings. It is the quality and content of the environment which are crucial and tend to increase in complexity with maturation. The development in the knowledge and competencies of individuals is, therefore, determined by the support, guidance and the structure of the society within which they live. In this regard, the education of children, and girls in particular, is ushered in by societal influences, inclusive of the prevailing attitudes, curriculum content, pedagogy and available resources. These can also contribute variously to inhibit their participation in a defined field, like STEM.

Statement of the Problem

The girl child has traditionally been perceived as having subdued participation in areas that require highly specialized technical and cognitive abilities. This has persisted despite overt and covert commitments by universal states to establish a level ground where both boys and girls have equal opportunities to participate and excel (Vassiliou, 2010). The result has been a lack of sustained performance and eventual success in academic practices that girls engage in, particularly in science education. The enrolment of girls in science related fields has not matched the call for them to partake in that area, while their graduation rates also have not served much to fill up the positions that are reserved for them in most sectors of the economy. In view of this, one wonders what actually militates against the participation of girls in STEM education in Gwanda Central High Schools.

Purpose of the Study

The purpose of the study was to explore challenges that limit the participation of the girl child in STEM education, particularly in the 5 secondary schools in Gwanda central. To achieve this purpose, the following objectives were developed:

- To examine the socio-cultural expectations which impose influences on enrolment, retention and completion patterns of girls in secondary schools.
- To explore the contribution of teaching strategies, resources, equipments and services that are availed to enhance the participation of girls in STEM.
- To establish ways to improve the participation and achievement of the girl child in STEM.

METHODOLOGY

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The study adopted a case study methodology of the qualitative design. Case studies offer richness and depth of information not usually offered by other methods (Harnock, 2003; Thomas & Nelson, 2001). The population of study comprised of heads of schools, teachers and students in the five Gwanda Central High schools. A convenient-purposive sampling technique was used to select the sample. The sample constituted of twenty five (25) science teachers, five (5) heads of schools and fifty (50) female students. The five schools were selected by virtue of them being conveniently situated in Gwanda town. The participants were chosen owing to their personal experiences in regard to both the cultural stereotypes and the teaching and learning circumstances in schools. Data was collected from teachers and students using focus group discussions (FDGs). Heads of schools were subjected to interviews. The use of multiple methods was done in order to strengthen the validity of the findings and the recommendations. Data was analysed thematically. The responses were coded, with 'T' representing teachers, 'H' for heads of schools and 'S' for students.

FINDINGS OF THE STUDY

The study revealed that there are no peculiar teaching strategies that are biased towards the participation of girls in STEM education. Teachers rely on the traditional teaching strategies that are meant for both girls and boys, inclusive of experimentation, exploration and investigation. The use of project work has to be heightened in all fields of STEM where students are encouraged to be hands-on and to actively participate in knowledge generation and discovery (National Science Foundation, 2013). This can involve the application of artificial intelligence approach or cognitive tutours where individualised and self paced instruction is matched with the needs of the student (NSF, 2013). The groups that are formed for student study should be made up of boys and girls, with leadership in those groups rotated to give girls a chance also to lead as they attend to assigned learning activities. Responses from the FGDs of teachers and students revealed that:

It is difficult to come up with very new teaching strategies that are considered particular to the girl child, especially for the reason that these will not have been subjected to any standard scientific tests. We use the usual teaching methods for teaching the subjects but making sure that the girls are made to play the same roles that their male colleagues take up during the teaching and learning activities (T).

We have not seen any difference between the way teachers teach us in science subjects and what they do when we are learning other subjects. We are usually put into groups at the beginning of each term and those groups are maintained whenever there is work or experiments that we need to do in groups (S).

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The cultural ceiling phenomenon in the society has an impact on the participation of girls in STEM education. Girls are made to believe that they cannot pursue particular studies that seem inappropriate for their gender (Hill, 2015). The masculine image of the sciences escalates their belief. Some parents, siblings and friends exert a huge influence in the choice and performance of girls in science biased subjects. This is cemented in the language that is constantly repeated so as to be internalized by the girl child that they have no intellectual capacity to with stand the vagaries of the field. If not ridiculed, their abilities for enlisting in courses that are considered a preserve for the male domain are questioned.

What I have realised with girls in my class is that they start the subject on a promising note, showing a lot of hope and putting up a lot of effort in their work, their performance appears to diminish with the passage of time. I suppose they will have listened to words of discouragement from their friends, especially those that will be studying subjects that are non STEM (S).

It's not about being discouraged at home or by friends but science subjects are just difficult compared to the Commercials or Arts. You need to spend a lot of time studying, doing experiments and projects for presentations. The other thing is that when you get home, they dont give you time to do your assignments but they will want you to cook and do all the household chores (S).

In the schools under investigation, there were committees that were set up to preside over the selection and placement of students into compartmentalised subject areas. The deputy heads were the common chairpersons of these selection systems which are mainly composed of Heads of Departments (HODs). The areas were constituted as sciences, arts and commercials. Charles and Ward (2007) state that teachers are the best to judge their own practices compared to instances where external practitioners are brought in to influence decisions on matters that are outside their every day practices. The conspicuous absence of the student voice in the allocation of subjects to A-level students is however, worrisome as female students feel hard done by these committees that unilaterally decide in which subject area and the combination thereof the students should belong. Catherine, Christianne and Ross (2010) allege that communities are prone to choosing a male ahead of an identical female counterpart for any societal opening. This harms the chances of girls to be selected to study in STEM fields. Participants expressed that:

I don't totally deny that teachers at times are right in giving us certain subject combinations as they use the symbols that one will have attained as shown in the O-level transcript but at other times people get surprised to be given subjects they have no interest in. They never take into account our expected career paths which we normally discuss with parents (S).

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We trust the decisions of teachers that are assigned to allocate A-subjects to students because some of them will have taught the students in previous classes and are also guided by the grades that they will have got at O-level. Of course they can make mistakes here and there, as you know there is no system that is 100% perfect (H).

The facilities and equipments for use in the teaching and learning of science related subjects were indicated to be an impediment to student achievement. All the schools of study had laboratory buildings which were mainly suitable for O-level but later recast to serve A-level classes. The essential chemicals for experimentation were either in short supply or past their shelf life which denied students typical conditions for mastering concepts. It is a universal desire that schools, and workrooms for scientific and technical skills be state-of-the art to advance the development of knowledge. Such provision will particularly inspire the girl child to flourish academically through studying in a friendly and less frustrating environment. Hill (2015) advances that initiatives should be planted to develop the interest of girls to persevere and achieve in STEM careers. The limited resources that are a feature in most schools have an effect of constricting chances for student activity and practice. This resonates well with the female disposition that primates the distribution of resources to the broader family ahead of individual interest. It is therefore this learning in a competitive space for resources which hampers the achievement of the girl child in the science related fields.

The problem to do with equipments and chemicals is a perennial one. Teachers are faced with situations where they have to put aside certain experiments or to improvise as a stop gap measure to ensure that at least students perform some activities despite of the shortages. In some instances students have to conduct experiments in very large groups, making it impossible for each one of them to be hands-on, and this is usually so for girls (T).

It must be understood that as heads, we are doing our utmost best to procure enough resources for use by our science teachers and students. Science materials are expensive and remember that all the departments compete for the scarce financial resource that we receive from students in fees. We buy some chemicals on the foreign market. The good part is that we liaise with other schools so that students are transported there to use equipments that we don't have here (H).

Participants unveiled the existence of programmes and services that are designed to inform and influence the career choices of students. These were largely not only STEM and girl child oriented. Student access to a wide array of advisement helps to build an early profile towards a specific career path and to break ties with cultural stereotypes and biases, particularly for the

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girl child. This stems from the understanding that it is culture and not biology which causes females to lag behind men in science and technology (Kane & Mertz, 2012). The ideal programmes are those that seek to encourage the participation of girls in STEM fields through availing information about existent courses and career prospects (NSF, 2013). Guidance and counseling services, exhibitions and other forms of edutainment can be utilised to increase entrance and completion of the girl child in science-based subjects.

We always make sure that our students attend Careers Day exhibitions our local polytechnic college organises each year and impressive students are given the opportunity to go to the Trade Fair as strategies to expose them to a wide range of available career choices. There are no specific programmes to encourage and prepare girls for STEM (H).

The school takes Upper 6s and some form 4s to the college (Joshua Nkomo Polytechnic) for a careers day. Teachers also keep reminding ourselves about the careers and programmes that we want to do after completing our A-levels. This time its unlike in form 4, where there is a Guidance and Counseling lesson focusing on life issues, including jobs (S).

The absence of science centres from which students can access crucial field knowledge was revealed as impeding the success of girls in STEM. The foundation for lasting behaviours is best laid down when children are exposed to expected experiences at the early stages of their lives. This implies that STEM education should start at the earliest possible stage of the academic road of the individual. The presence of accessible research centres in the community can help to plant a culture of research quite early in the population. A scene of this nature will even make it easier for students who take up STEM fields to engage in practical research at the stroke of enrolment into those areas at schools. Hill (2015) states that students must be provided with early research opportunities to excel in science and technology. Research and education should be integrated across all STEM fields (NSF, 2013). Participation in research further reinforces mastery of learning concepts through involvement in school competitions and conferences.

There are no research centres around here or research projects that may be relevant to us students. It may be good practice for us to participate in school competitions of a science nature but we have never been told about such competitions (S).

The study exposed a dearth of regulatory measures aimed at supporting the girl child towards STEM education. The drive for girls to persist and excel in science and technology rests on the universalisation of primary and secondary education as enshrined in the 1980 constitution, as amended in 2013. The National Gender Policy 2013-2017, among other pieces of instruments works to open up the provision of education to all sectors of the population regardless of colour, race and gender.

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There is need to craft principles that are specific on the thrust to provide and ensure girls participate and succeed in STEM education. Participants indicated that:

There are no known policies that support the provision of stem education for the girl child. The available regulations are adaptations of the 1980 declarations and the millennium development goals which are not biased towards a specific gender bracket (T).

DISCUSSION

A multitude of variables play out in curtailing the performance and achievement of the girl child in education. This is particularly acute in STEM. The cultural stereotype and bias no doubt assume a gate keeping role in censuring the participation of girls in the science and technology field (Modi, Schoenberg & Salmond, 2012; McGreedy & Dierking, 2013). It is common belief from tradition that social roles are defined by gender, making it anomalous for an individual of a set gender to partake in activities parceled out as belonging to a particular group of people. In this conviction, girls are not expected to participate in areas that are understood as for boys and vice versa. This attitude entails even in the choice of subjects to be studied at school and the subsequent careers in the social-political and economic space. Girls are expected to do subjects that are considered soft as in the form of arts and social sciences while subjects with economic crunch, in the form of hard sciences and technology, are considered the preserve for boys. It is at times at the pre-formal and elementary stages that girls are deemed to perform at par with boys in sciences and then lose this feat as they enter into the intermediate stage of education (McGreedy & Dierking, 2013). The internalisation and entrenchment of gender related social roles should be seen as variously impacting the participation and outcomes of the girl child in STEM education.

Torres, Pena, Camacho and Siva (2014) argue that the participation of parental and the community in general is the major driver for improvement in STEM in conjunction with scholarships to make education a reality. The support and encouragement that the significant others contribute to the learning of girls make STEM fields real and feasible (Modi, Schoenberg & Salmond, 2012). These contribute significantly in the learning of girls who naturally thrive in their engagement through receiving assurances from parents, friends, relatives and teachers. This propels girls to engage in STEM in a committed and focused manner (Anderson-Butcher, Newsome & Ferrari, 2003). The place of the community in the learning of children may be apparent in cases where they either assist in forging partnerships between the school and the business sector or facilitate the establishment of informal science centres where students participate after school. These facilities would

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then provide experiences that help to build capabilities and proficiencies in science (Afterschool Alliance, 2011). Exposure of young girls to learn science and participate both in school and out-of-school STEM activities helps to improve their representation at all levels of human development (Falk & Dierking, 2010; Peterson, 2013). This participation also enhances confidence, positive attitudes and builds knowledge and skills in science fields (Chun & Harris, 2011). The learning of skill in STEM should be early in the education path of the learner so that they have a good start at the university (Torres, Pena, Camacho & Silva, 2014) with clearly cut career decisions (Tai, Lin, Maltese & Fan, 2006).

Many schools lack an emphasis on science (Torres *et al.*, 2014). Science focused schools are those whose overall package inclusive of infrastructure, curricula and the kind of staff employed resonates with the spirit of performance in science education. The existence of specialised buildings and equipment therein sets the tone for the degree of seriousness with which the selected curriculum is implemented. The aptitudes of students in STEM have to be supported by state-of-the-art equipments whose operation matches the universal standard set in the structuring of a particular content in STEM. Many schools however, fall short in providing the desired climate for success in STEM. Torres *et al.*, (2014) state that the lack of adequate facilities, labs, and textbooks to teach critical math and science courses hinders learner achievement. It is therefore, important for stakeholders to partner and develop the available infrastructure to provide students and the community with the resources needed to maximize STEM education and opportunities (Torres *et al.*, 2014). Liaison with captains of industry, church organisations, student alumni and non-governmental organisations can offset shortages in the teaching and learning of STEM. Highly qualified and effective teachers are a boon in the delivery of STEM experience to girls (Torres *et al.*, 2014). These should be teachers with a rich grasp of the subject knowledge and pedagogies that are attuned to the learning of girls. Assigning of students to teachers who did not major in the field of instruction or unqualified to serve in the profession is a danger to learner participation and attainment.

Practices that promote a favourable learning environment for girls in science and mathematics fields are those which involve collaboration and experiential learning, with an emphasis on practical applications of the acquired subject matter (Campbell *et al.*, 2002; Koch, 2002). The teaching of science should be more holistic and reflect a social context (Wenglinsky, 2000). The locus of control orientation suggest that girls attribute success to effort or luck unlike boys who believe that success comes from their own personal ability. As such girls do well under conditions that involve collaborative interaction and active learning (Kramer, 2000). This occurs even in their use of technology and computers (Kramer, 2000). Learning strategies that are hands-on and explorative raise the self-confidence and interest of the girl child in STEM courses (McGreedy & Dierking, 2013). They should participate in workshops, science expos, conferences, school science competitions and out of school class activities to develop and enhance their STEM skills (Breakwell & Beardsell, 2007) .Girls however, perform best when placed

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in girls only groups where they are not ignored, dwarfed and resource usage not dominated by boys (Volman & van Eck, 2001). Boaler (2014) surmise that girls are by nature deep thinkers, inquisitive and prone to make connections between the content of study and situations in the wide world. This tends to curtail their performance in STEM fields which favour procedural teaching with an emphasis on speed, a feature that lends advantage to boys. It is therefore, imperative that teachers understand how girls learn and adopt suitable strategies in order to dispel myths surrounding the performance of girls in STEM.

Lack of female role models and stigmas around women in STEM occupations contribute to underrepresentation of females in STEM education (Torres *et al.*, 2014). The importance of role models both at school and out of school social groups cannot be overemphasized (Liston, Peterson & Ragan, 2008). Girls need to be introduced to women in STEM careers as a strategy to inspire them and to encourage the formation of connections that will cement their interest in science and technology (Modi, Schoenberg & Salmond, 2012). This helps them to see the real-life application of their studies (Torres *et al.*, 2014). The presence of female teachers in STEM provides a real and immediate source of inspiration for girls to persevere in science fields. The power of traditional prejudice, which ascribes males for STEM has caused female science teachers to retain math anxiety which is subsequently transferred to the girls they teach (Boilock, 2010). Providing effective role models and mentors is crucial not only in the learning of girls but throughout their careers in the sciences (Clewell & Darke, 2000; Thom, Polly, Hoey & Perlman, 2001).

RESEARCH IMPLICATIONS

It is hoped that the study would provide the needed impetus for the girl child to work hard to dispel the seemingly engrained cultural myth that achievement in mathematics and science is a preserve for boys. Boys also need to embrace the presence of girls in the science field and to appreciate the fair competition that they inject in the intellectual arena. Teachers have to adopt teaching strategies that are sensitive to the learning needs of both boys and girls and to avoid prejudicing girls when selecting subjects for them to study at A-level. Parents and the community should further be sensitised on the call for girls to take up courses in the science field and to provide them with the necessary support. Heads of schools need to ensure that resources for teaching and learning of science and mathematics are provided and procured on time. Finally, curriculum designers should poses expertise to ensure the right mix is struck in the content of the science and mathematics subjects in a way that encourages both sexes to excel.

CONCLUSIONS

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Girls, like their male counterparts, have the capacity to participate and achieve in STEM education. The cultural stereotypes and biases that tend to hold back the performance of girls in favour of boys can be rendered obsolete through a shift in the mindsets of the girls, preparing them well for a STEM curriculum and creating a conducive learning climate. Teachers should implement teaching strategies that are commensurate with the needs of the girl child. Learning models that cultivate hands-on experience as well as develop interest and confidence of the girl child should be encouraged from a tender age. The application of STEM knowledge requires wider application in order to embrace the various experiences of the students. STEM schools must be endowed with adequate and suitable learning resources and equipment. Machinery and chemicals used must be of high quality to avoid advancing the "stereotype effect" which develops in girls as a consequence of engaging in failed research-based projects. Administration of support programmes and services like career guidance and counseling biased towards the participation of girls in STEM fields must be robust and permeating the entire student population in schools. Field trips, science expos and school science competitions must be infused in the learning process. The dearth of viable policies and legislation skewed towards the achievement of girls in science and technology militates against the desire to redress the underrepresentation of females in this academic arena. There should be continuous advocacy aimed at sensitizing or changing the mindset of communities towards leveraging the competencies of the girl child in STEM.

RECOMMENDATIONS

The study recommends that schools should staff develop teachers on strategies that improve the participation and success of girls in STEM education. In the recruitment and selection of A-level students for science and technology fields, teachers must involve critical stakeholders and ensure that gender equity and equality issues are addressed. The Ministry of Primary and Secondary education should motivate girls to study STEM from a tender age and to offer educational scholarships to those who enroll in the field. Heads of schools should also source funding to establish vibrant science centres within communities in which schools reside. Robust career guidance programmes and services aimed at inspiring the girl child to study sciences at A-level should be instituted. Communities should design and implement advocacy and sensitization programmes through available media to deal with dysfunctional cultural beliefs on the participation of the girl child in STEM. Finally, policies and regulatory measures should be developed to increase the participation of girls in STEM education.

REFERENCES

ISSN 2055-0170(Print), SSN 2055-0189(Online)

Adya, M., Kaiser, K.M. (2005). Early Determinants of Women in the IT Workforce: A Model of Girls' Career Choices. *Information Technology and People*,18 (3), 230-259.

Afterschool Alliance. (2011). *STEM Learning in Afterschool: An Analysis of Impact and Outcomes*. Washington, DC: Afterschool Alliance.

Kramer, M. S. (2000). Educating Girls in the New Computer Age. Washington, DC: American Association of University Women Educational Foundation.

Anderson-Butcher. D., Newsome, W.S., & Ferrari, T.M. (2003). Participation in Boys and Girls Clubs and Relationships to Youth Outcomes. *Journal of Community Psychology*, 31 (1), 39 – 55.

Boaler, J. (2014). *Changing the Conversation about Girls and STEM*. Stanford University, The White House.

Breakwell, G. M., & Beardsell, S. (2007). Gender, parental and peer influence upon science attitudes and activities. *Public Understanding of Science*, 1 (2), 183-197.

Britner, S. L. & Pajares, F. (2006). Sources of science self- efficacy benefits of middle school students, *Journal of Research in Science Teaching*, 43 (5), 485-499.

Buck, G. A. (2002). Teaching discourses: Science teachers' responses to the voices of adolescent girls. *Faculty Publications*,1 (1), 29- 50.

Campbell, P., Jolly, E., Hoey, L. & Perlman, L. (2002). *Upping the numbers: Using research-based decision making to increase the diversity in the quantitative disciplines.* Newton, MA: Education Development Center, Inc.

Carr, W. (2006). Philosophy, Methodology and Action Research. *Journal of Philosophy of Education*, 40 (4), 421-435.

Catherine, H., Christianne, C. and Ross, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics*. American Association of University Women (AAUW), Accessed on 11 March 2016 at http://www.aauw.org/learn./research/whysofew.cfm/.

Chun, K., & Harris, E. (2011). *STEM out-of-school time programs for girls*. Cambridge, MA: Harvard Family Research Project.

Clewell, B. & Darke, K. (2000). *Summary report on the impact study of the National Science Foundation's Program for Women and Girls.* Washington, DC: The Urban Institute Education Policy Center.

Creswell, J. W. (2005) *Educational Research, Planning, Conducting and Evaluating Quantitative and Qualitative Research*. New Jersey, Pearson Education International..

Falk, J.H., & Dierking, L.D. (2010). The 95% solution: School is not where most Americans learn most of their science literacy. *American Scientist*, 98, 486-493.

Liston, C., Peterson, K., and Ragan, V. (2008). *Evaluating Promising Practices in Informal Science, Technology, Engineering and Mathematics (STEM) Education for Girls*. New York, Girls Scouts of the USA.

ISSN 2055-0170(Print), SSN 2055-0189(Online)

Hannock, B. (2002). *Trend Focus for research and development in Primary health care: An Introduction to Qualitative Research*. University of Nottingham: Division of General practice.

Hendricks, C. (2006). *Improving Schools through Action Research: A Comprehensive Guide for Educators*. Boston: Allyn and Bacon.

Hill, C. (2015). *Solving the Equation*. Washington DC, American Association of Women in Science.

Johnson, B. and Christensen, L. (2008). *Educational Research (3rd ed): Quantitative, Qualitative, and Mixed Approaches*. London: Sage.

Kane, J. M. & Mertz, J. E. (2012). *Debunking Myths about Gender and Mathematics Performance*. Notices of the American Mathematical Society, 59, 10-21.

Kessels, U. (2005).Fitting into the stereotype: How gender stereotyped perceptions of prototypic peers relate to linking for school subjects. *European Journal of Psychology of Education*, 20 (3), 309-323.

Koch, J. (2002). *Gender issues in the classroom: The past, the promise and the future.* Paper presented at the annual American Educational Research meeting.

Langen, A. V., Bosker, R. & Dekkers, H. (2006). Exploring Cross national differences in gender gaps in education. *Educational Research and Evaluation*, 12 (2), 155-177.

Lichtman, M. (2014). *Qualitative Research for the Social Sciences*. London, Sage.

McGreedy, D. & Dierking, L. D. (2013). *Cascading Influences: Long-term Impacts of Informal STEM Experiences for Girls*. Philadelphia: The Franklin Institute.

Modi, K., Shoenberg, J. and Salmond, K. (2012). *Generation Stem: What Girls Say about Science, Technology, Engineering and Math*. New York: Girl Scouts of the USA.

National Science Foundation (2013). Inspiring STEM Learning: Education and Human Resources. Wilson Bouulevard: Virginia.

Ogunkola,. B. J. & Olatoye, R. A. (2005). Strategies for Improving Participation of Girls in Secondary School Science in Nigeria: Science Teachers' Options. *Gender and Behaviour*, 3 (1), 453-464.

Packared, B. W. & Nguyen, P. (2003). Science career- related possible selves of adolescent girls: A longitudinal study. *Journal of Career Development*, 29 (4), 251-263.

Peterson, T. K. (Ed.). (2013). Expanding minds and opportunities: Leveraging the power of afterschool and summer learning for student success. Washington, DC: Collaborative Communications Group.

Phipps, A. (2007). Re-inscribing gender binaries: Deconstructing the dominant discourse around women's' equality in science, engineering, and technology. *The Sociological Review*, 55 (4), 768-788.

ISSN 2055-0170(Print), SSN 2055-0189(Online)

Selimbegovic, L. & Chatad, A. (2007).Can we encourage girls' mobility towards science- related careers? Disconfirming stereotype belief through expert influence. *European Journal of Psychology of education*, 22, 275- 290.

Simpkins ,S.D., Davis,-Ken, D. E. & Eccles, J. S.(2006). Math and Science motivation: A longitudinal examination of the linking between choices and beliefs. *Developmental Psychology*, 42 (1), 70-83.

Spencer, S. J., Steele, C. M. & Quinn, D. M. (1999). Stereotype Threat and Women's math Performance. *Journal of Experimental Social Psychology*, 35 (1), 4-28.

Punch, K. F. (2005). *Introduction to Social Research: Qualitative and* Quantitative *Approaches*. London: Sage.

Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). *Planning early for careers in science*. University of Virginia: Charlottesville.

Tenenbawm, H. R., Snow, C.E., Roach, K.A. & Kurland, B. (2005). Talking and reading Science. Longitudinal data on sex differences in mother-child conversations in low income families. *Applied Developmental Psychology*, 26, 1-19

Thom, M. (2001). *Balancing the equation: Where are women and girls in science, engineering and technology?* New York, NY: National Council for Research on Women.

Thomas, J. R. & Nelson, J. K. (2001). *Research Methods in Physical Activity*. 4th Ed. London: Longman

Torres, L., Pena, C., Camacho, K. & Silva, P. (2014). STEM Education: A bridge for Latinos to Opportunity and Success. Washington DC, League of United Latin American Citizens.

Tsabani, A. B., Sethi, R. J., Boy, L & Yarden, A. (2006). *Using questions sent to an Ask-A-Scientist site to identify disinterest in science*. Wiley inter-science: Haifa.

Vassiliou, A. (2010). *Gender Differences in Educational Outcomes: A Study on the Measures Taken and the Current Situation in Europe*. Brussels: Education, Audiovisual and Culture Executive Agency.

Wenglinsky, H. (2000). *How teaching matters; bringing the classroom back into discussions of teacher quality.* Princeton, NJ: Educational Testing Service.

Wilson, E. (2009). *School–based Research: A guide for Education Studies*. London: Sage

Yin, R. (1984). *Case Study Research: Design and Method (1st Ed*). Beverly Hills: Sage.

ISSN 2055-0170(Print), SSN 2055-0189(Online)