

# SCHOOL FACTORS THAT INFLUENCE FEMALE LEARNERS' DEVELOPMENT OF A NEGATIVE SELF-CONCEPT IN MATHEMATICS: THE CASE OF A RURAL HIGH SCHOOL IN CENTRAL ZAMBIA

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## ABSTRACT

The study was aimed at ascertaining school factors, which influence the development of negative mathematics self-concept in female learners. The study used a case study approach. A sample comprising 7 grade 11 female learners with low mathematics self-concept from *Kalale* (pseudonym) Girls' Secondary School, situated in a rural area of central Zambia, was purposively selected. The Rosenberg self-concept scale was used to identify learners with low mathematics self-concept. In-depth face-to-face interviews and a focus group discussion were conducted with the participants. Data were analysed using the Interpretative Phenomenological Analysis (IPA) method. Findings revealed that there were six school factors that influenced the female learners to have a negative self-concept in mathematics. These factors are: bad personality attitudes of mathematics teachers; lack of support from teachers; teachers' mathematics related gender stereotypes; few female mathematics teachers;

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lack of adequate and consistent guidance and counselling programs in the school; and poor organisation of the mathematics club in the school.

**Keywords:** interpretative phenomenological analysis (IPA); mathematics self-concept; school factors

An abundance of research has found that there exists a strong relationship between a student's mathematics self-concept and achievement levels (Chiu & Klassen, 2010; Hamachek, 1995; Hodgson & Reiss, 2013; Kiamanesh & Kheirieh, 2001; Marsh, 1992; Mujtaba & Reiss, 2013; Munsaka, 2001; Wilkins, 2004). Thus, positive mathematics self-concept means high achievement in mathematics. Consequently, low or negative mathematics self-concept has been found to be one of the contributing factors to the poor performance of girls in mathematics (Mujtaba, Hodgson & Reiss, 2013; Munsaka, 2001; Suliman, 2004). What is not clear however, is how this low mathematics self-concept among girls is developed.

*Kalale* Girls' Secondary School, a school in the rural area of central Zambia has its school management together with the teaching staff working tirelessly to make sure the school produces quality grade 12 results, among other things. Though the school has succeeded in producing outstanding quality results in what is commonly referred to as feminine subjects such as Food and Nutrition, Home Management, English language and Social Sciences, results in masculine subjects, mainly Mathematics, Science and Biology, have continued to be poor. Various strategic interventions have been employed, including high level analytical skills, Evidence Based Planning (EBP), tried and tested pedagogies and teacher motivation (Chituka, 2013) to try and reverse the situation in mathematics and other related subjects. Although there has been remarkable change in mathematics after the interventions, performance in the subject has continued to be lower than in the feminine subjects mentioned above. It appears that poor quality results particularly in mathematics at *Kalale* are influenced by girls' low mathematics self-concept. Though factors that influence positive mathematics self-concept have generally been established quantitatively, for instance, by Mujtaba, Hodgson and Reiss (2013), no in-depth, qualitative study has been conducted. Since the environment in which the child is raised is vital to its development and indeed the development of the self-concept, this study sought to establish an in-depth understanding of school factors which might have reinforced the development of low mathematics self-concept in selected grade 11 female learners at *Kalale* Girls' Secondary School in *Mbale* area (pseudonyms) of central Zambia.

Gunderson, Ramirez, Levine and Beilock, (2012) in their study showed that teachers' own mathematics anxieties, stereotypes, beliefs and behaviours can influence children's mathematics attitudes and thus development of positive or negative mathematics self-concept. Other studies (e.g. Fennema, Peterson, Carpenter, & Lubinski, 1990), yielded similar findings. Teachers' attitudes toward the subject

matter have also been found to influence their instructional techniques (Fennema et al., 1990; Pajares, 1992 in Gunderson et al., 2012; Relich, 1996).

Owing to the issue of social comparison versus individualized orientations in teaching and learning; Rheinberg (1980) in Relich (1996) distinguished teachers who preferred a social reference standard from teachers who preferred an individual reference standard. The typical reference standard a teacher adopts is also called teachers' frame of reference (TFR). Teachers using a social reference standard compare the results of one student with the results of other students, whereas teachers using an individual reference standard evaluate a student's result taking his or her prior achievement into account. The central characteristic of an individual frame of reference when assessing student's accomplishments is the emphasis on the intra-individual improvement of an individual student. Such an approach is believed to counteract the negative effect of social comparisons for low achieving students and, therefore, enhance students' self-concept.

Other studies (Deku, Amponsah & Opoku, 2013; Rehman, 2001) have investigated the influence of teachers' classroom practices on the self-concept of primary school pupils. Results indicated that teacher classroom practices have a moderate relationship with the self-concept of children.

Additionally, inequalities have been found to exist in the classroom. For instance, Fennema and Peterson, as cited in Deku, Amponsah and Opoku (2013) and Dickman (1993), have indicated that discriminatory teacher behaviour does not begin in the college classroom, but rather with the advent of schooling as early as preschool. Specifically, activities chosen for classes appeal to boys' interests and the presentation formats selected are those with which boys excel or they are encouraged more than are girls. Furthermore, boys have been found to receive more teacher reactions of praise, criticism and remediation (Sadker & Sadker as cited in Deku, Amponsah & Opoku, 2013). Likewise, it has been reported by Baker (1986) in Rehman (2001) that in secondary school science classrooms, more precise teacher comments were rendered to males than to females in terms of both scholarship and conduct.

The absence of female teachers in mathematics related subjects is also another aspect which makes girls view mathematics as a subject for boys and eventually develop a negative self-concept. In Lee and Sriraman (2012)'s study, one of the girls studied, Kim, stated that most of the teachers she had met from the centre of gifted education as well as the private institute were men, she pointed out, "I liked mathematics, but I don't think mathematics is suitable for women for all ages because there are only few female mathematicians. I looked up on a website of mathematics faculty, but professors are mostly men" (Lee & Sriraman, 2012, p. 10).

Apart from the absence of female teachers in mathematics related fields, overcrowdness of classes can contribute to loss of interest in mathematics especially among girls. Teaching can be stressfull especially when teaching mathematics.

Corcoran et al., (1998) in Hakalo (2014) found that overcrowding and heavy teacher workloads created stressful working conditions for teachers and led to higher teacher absenteeism. Furthermore, crowded classroom conditions not only make it difficult for girls to concentrate on their lessons, but inevitably limit the amount of time teachers can spend on innovative teaching methods such as cooperative learning and group work. This in the end leads to the girls having a low mathematics self-concept.

Similarly, student materials are very important in improving the performance of pupils in any given subject. Relich (1996) notes that a student/textbook ratio of 1:1 or 1:2, improves syllabus coverage, while a ratio of 1:3 and above slows down syllabus coverage, leading to poor performance. John and Blatchford (2007) in Hakalo (2014) hold that through reading mathematics books, girls will develop their mental faculty that will help them handle the subject.

## PURPOSE OF THE STUDY

The purpose of this study was to ascertain school factors that reinforce the development of negative mathematics self-concept in female learners.

## METHOD

Qualitative case study design was utilized in the study. The qualitative approach was most suitable for this study because of the need to develop deeper insights and understanding of the factors influencing negative mathematics self-concept among female learners. Willig (2001, p. 150) points out that qualitative research, “provides the researcher with an opportunity to study meanings. It allows the researcher to tap into the perspectives and interpretations of participants. In this way, it facilitates the generation of genuinely novel insights and new understandings.”

## Research participants

The sample consisted of a total of seven grade 11 learners with low mathematics self-concept who were purposively selected from *Kalale* Girls' Secondary School, situated in a rural area of central Zambia. To select the seven grade 11 learners with low self-concept in mathematics, all the grade 11 girls at the school were administered with the self-concept scale which was adapted from Rosenberg (1965). The scale is a 10-item Likert scale with items answered on a four point scale; from strongly agree to strongly disagree. The scale ranges from 0-30. Scores between 15 and 25 are within normal range of self-concept, whereas scores below 15 suggest low mathematics self-concept. The sample used in the current study therefore, constituted the seven female learners who obtained a mathematics self concept score of below 15.

Though the school from which the female learners were from is ranked as one of the best girls' schools in Zambia. The community from which these girls come

from have the majority of the local people work on the commercial farms as farm labourers, security personnel, drivers, plumbers and carpenters. Others do secretarial jobs. A number of these people supplement their income with backyard gardens where they grow vegetables for home consumption and sell at roadside market stalls.

## Data collection

Semi-structured individual interviews and a focus group interview were used to collect data. The interviews were used to allow participants to express their opinions and ideas freely in their own words. The focus group discussion was chosen to allow the learners to express themselves freely about how they perceived themselves vis-à-vis mathematics (Esterberg, 2002). Each interview lasted between an hour and one hour thirty minutes. They were all conducted in English.

It was decided to triangulate the data collection methods; semi-structured interviews and focus group discussion, so as to increase the credibility of the findings. Willig (2001) supports the use of triangulation and argues that case studies integrate information from diverse sources to gain an in-depth understanding of the phenomenon under investigation.

All the interviews and a focus group discussion were tape recorded with the use of a digital recorder and field notes were also taken after participants gave written consent to be recorded so as to allow for transcription, and more thorough analysis and interpretation afterwards.

## Data analysis

The data in this study were analysed using the Interpretative Phenomenological Analysis (IPA) approach. IPA, as scholars Willig (2001) and Fade (2004) in Munsaka (2009) state, is a product of the combination of a descriptive approach (phenomenology) and an interpretative approach (hermeneutics). Thus, this technique made it possible to capture the participants' perspectives of their negative mathematics self-concept problem. After transcribing all the interviews, the researchers read the transcripts to familiarize themselves with the important issues in the participants' accounts and thus, came up with emerging key themes regarding the school factors which led to female learners developing a negative self- concept in mathematics.

## Ethical considerations

Ethical issues were particularly critical for this study in that all the participants were grade 11 learners, below the age of 18. Firstly, the researchers submitted the research proposal to the University of Zambia Ethical Committee for approval. Approval was granted by the ethical committee. In addition, a letter of authorization was obtained

from the Ministry of Education headquarters to have access to the secondary school, which the female learners attended. Before the participants were recruited for the study, they were each given a consent form to seek permission from their parents/guardians to participate in the study. Even if all the parents allowed their children to take part in the study, each one of the learners was given an assent form, which gave them the freedom to accept or decline to participate in the study. Both the consent and assent forms explicitly indicated that confidentiality and anonymity would be observed and that the information gathered would only be used for research purposes. Following the signing of the consent and assent forms, and clearance by the school head teacher, the researchers began to collect the data.

## RESULTS AND DISCUSSION

Six themes emerged that showed how the school influenced the development of low self-concept in mathematics among female learners. The emerged themes are as follows: Poor personality qualities of teachers, lack of support for the girls with low mathematics self-concept, teachers' mathematics-related gender stereotypes, few females in the field of mathematics, lack of adequate and consistent guidance and counselling programs in the school and poor organisation of the mathematics club.

### Poor personality qualities of teachers of mathematics

All the seven learners indicated during individual interviews and focus group discussion that teachers were harsh and not considerate to them when they made follow up questions in trying to understand some problems in mathematics. For instance, Participant 1 and Participant 2, respectively, testified about teachers' manifestation of this negative attitude:

*"I don't know how many times I can explain this for you to understand. This thing is very easy..." (Participant 1).*

*"...You must be very dull, how can you fail to get it...?" (Participant 2).*

The learners showed that they had no problems with the actual words uttered but they showed concern over the manner in which the words were uttered – the tones were hostile most of the time. They added that their understanding of a teacher was that they should be caring, interested in the improvement of their pupils, accommodative and cheerful. Contrary to this expectation, the participants observed that teachers of mathematics were harsh on them, especially when they asked questions continuously. These findings are in line with what Rehman (2001) pointed out that teachers' classroom practices that include the entire instructional, curriculum, social and organisational techniques, influence the self-concept development of children in specific areas, including mathematics.

## Lack of support for the learners with low mathematics self-concept

During interviews and focus group discussion, all the seven learners showed that most topics learnt in mathematics did not make a lot of sense to them. For example, participant 1 pointed out *“For topics like trigonometry, matrices, and equations, I don't know how they are applied in real life. I do not like doing them, they bore me especially that the teacher does not consider us.”* Participant 1's statement was echoed by the other participants that mathematics was a subject unrelated to everyday life and considered studying it as waste of time. It appears teachers did not give full support to the female learners in terms of information on the applicability of what the girls were learning.

The learners did not hide their disappointment with their teachers who did not give them individualized attention during learning time. They regarded themselves as being treated unfairly, making them feel cut off from the teacher and the rest of the class. Participant 3 expressed her disappointment as follows, *“...he teaches us as a group and not concerned about our individual needs...It is not nice...The teacher speaks to himself”*. Participant 3 thus indicates that teachers were not really interested in how each learner was fairing. The statements show that teachers employ the teacher-centred method and only engage the bright learners whenever they felt the need to engage the class's participation. In the next excerpt, Participant 4 expands more on the issue of engaging the bright students, *“teachers have a tendency of comparing us with the good girls. They are not considerate of us who are slow learners. Besides, they point only at particular girls who perform well for answers.”*

The above quotes from the interviews with the learners indicate that teachers have a tendency of not being fair; making comparisons between pupils in a class in unhealthy ways and without courtesy. These vices not only put off the girls from participating in class but also contributed in building their low self-concept in mathematics. Participant 3 elaborated on this point, *“...teachers do not give us chance to improve...Yes other people are better than us in mathematics, but they should not make it obvious that we can't be better than them.”* Participant 3, who actually unlike all the other participants, has been performing very well in all the other subjects, seems to indicate that if teachers were more courteous in the way they handled them, they would not be reinforcing a negative self-concept in mathematics and they would be encouraged to try their best to improve.

These findings are in line with what Rheinberg (1980, as cited in Relich (1996) tried to clarify. He tried to distinguish teachers who prefer a social reference standard from teachers who prefer an individual reference standard. Teachers using a social reference standard compare the results of one student with the results of other students, whereas teachers using an individual reference standard evaluate a student's result taking his or her prior achievement into account. The central characteristic of an individual frame of reference when assessing students' accomplishments is

the emphasis on the intra-individual improvement of an individual student. Such an approach is believed to counteract the negative effect of social comparisons for low achieving students and therefore enhances students' self-concept.

Generally, in consonant with these findings, Rosenthal (1973, cited in Deku, Amponsah and Opoku, 2013) claims that boys are given more feedback as to the quality of their work, more chances to generate correct answers and more encouragement to persist on problems that they initially get wrong. Girls, on the other hand, have their incorrect answers attributed to poor ability and are not encouraged to continue working to get the correct answer. These views are similar with Namafe (2014), who points out that lecturers and indeed teachers must ensure that the levels of students' motivation are maintained. He continues to state that, "if the levels of motivation are therefore maintained by what goes on in the teaching and learning process, the performance of students may be improved regardless of how challenging the course is" (Namafe, 2014, p. 185). Thus, if pupils are supported and encouraged by teachers, difficulties those most female learners face in mathematics would be minimized and their mathematics self-concept would be boosted.

## Teachers' mathematics - related gender stereotypes

The participants indicated that the attitude of some teachers reinforced mathematics gender stereo-typing by passing discouraging remarks. For example, participant 1 and participant 2 said the following respectively:

"My teacher puts me off when he says 'If it were boys they would have understood a long time. You are slow learners you are not like boys who understand at once'" (Participant 1).

"Our teacher sometimes tells us that we are naturally lazy and that mathematics is not for lazy people and that's why we continue to fail unlike boys" (Participant 2).

It is possible that the teachers might have uttered these statements loosely with no ill intentions, but it is such utterances which continue to influence the development of low mathematics self-concept in girls. Participant 1 indicated that the effect of such words on her was negative, "*Somehow interest goes when the teacher compares us with the boys... It's like he is just doing it for the sake of it but deep down in his heart he knows it's difficult and only boys can handle it well.*"

Broadly speaking, teachers communicate to the female learners that mathematics is difficult and it is for boys. In the next excerpt, participant 5 indicates that these stereotypical sentiments about mathematics did not start in grade eleven (where she was at the time of the interviews), but during her primary school days. She recalls,

*"When I was in grade seven, my teacher then told me that drawing and mathematics were subjects for boys and I took it that way. I think it made a lot of sense because it is too hard not only for me but for most of the girls I know."*



Participant 5's observations above can be related to what Dickman (1993) posits that, discriminatory teacher behaviour does not begin in the college classroom but rather with the advent of schooling. Other studies have demonstrated that, from preschool onwards, activities chosen for classes appeal to boys' interests and the presentation formats selected are those with which boys excel or they are encouraged more than are girls (Fennema & Peterson as cited in Deku, Amponsah & Opoku (2013). Similarly, Deku et al., (2013)'s study, which investigated the influence of teachers' classroom practices on the self-concept of primary school pupils with disabilities, found that teacher classroom practices have a moderate relationship with the self-concept of children with disability. This finding indicates that teachers' practices in class are crucial in enhancing the self-concept of children and indeed the mathematics self-concept.

Generally, it can be said that male and female learners come to hold different beliefs about their academic abilities as a result of differential treatment in the classroom. In this case, even if the current study was conducted in a single sex school for female learners, the impact seemed to be felt as teachers always compared between the two sexes in terms of mathematics ability. Teachers should refrain from making utterances that could make learners develop a negative self-concept in mathematics or any other subject, for that matter.

## Few females in the field of mathematics

All the participants indicated in individual interviews and focus group discussion that their idea that mathematics was for men was reinforced when they discovered that there was only one woman as a teacher of mathematics at the school. The following two excerpts from participant 6 and participant 3' statements, respectively typify the responses that were given:

*"The presence of more female teachers of mathematics can impact in a positive way on us as it makes us think women can also do it"*(Participant 6).

*"I wonder sometimes why we do not just leave mathematics to boys because most teachers of mathematics I have known are male. At this school alone, only one out of four teachers is female. I think some things are just meant for boys"* (Participant 3).

These two excerpts seem to suggest that the female learners with low mathematics self-concept had been comforted with the state of affairs at the school.

By and large, the absence of female teachers in mathematics-related subjects is another aspect which makes the female learners view mathematics as a male territory and eventually develop a negative self-concept. In Lee and Sriraman (2012)'s eight-year-long qualitative study of the two Korean gifted girls (Kim and Lee), one of the girls, Kim, stated that most of the teachers of mathematics she had met from the

centre of gifted education as well as the private institute were men. This was how she expressed herself in front of a female interviewer who had excelled in mathematics:

Were you (interviewer) really good at mathematics? Why did you continue to study mathematics? Any females from my family didn't major in mathematics or science, so you look weird to me. And I think you are really cool. But I am getting to like other subjects than mathematics, like the other family members. How can one do well in mathematics continuously? Did you study a lot of mathematics every day? (p.8)

Thus, Kim was surprised that there were women who excelled in mathematics. It seems this was her first time to meet a female who had really excelled in the field of mathematics. In the excerpt below, Kim further showed that mathematics was not for women:

I liked mathematics, but I don't think mathematics is suitable for women of all ages because there are only few female mathematicians. I looked up on a website of mathematics faculty, but professors are mostly men.(p. 10).

It was pointed out in this Korean study that while the two girls were participating in gifted programs, they perceived gender inequality in the society. In particular, they noticed that whereas there were only few women professors and researchers in fields related to mathematics, there were relatively higher proportions of women in humanities and sociology fields. They believed that it was difficult for them to choose mathematics-related careers because of clear gender inequality in those occupations (Lee & Sriraman, 2012). With this Korean study, it is evident that the absence of role models in mathematics-related fields can have a negative impact on the development of mathematics self-concept.

## Lack of consistent guidance and counselling programs in the school

All the seven participants who participated in the study indicated that the guidance and counselling department was there in the school, except its programs were not only inadequate, but also inconsistent. Participant 7, for instance, observed:

"I know that we have the guidance and counselling department in this school but the problem is that there isn't much to talk about it...programs are not consistent and I think there isn't much being done to help boost our morale for mathematics."

The participants did not only put the blame on the teachers of mathematics in not helping the situation, but also on the careers and guidance teachers. Further, participant 6 had this to say:

"In as much as our mathematics teachers do not really link mathematics to real life, I feel the careers teachers would help if they were effective. They would tell us about different careers and how mathematics is applied in those careers eventually we may start appreciating it."

These findings are in line with what Nherera (1999) recommended that girls should be guided and counselled. He added that they should be encouraged to learn and understand the importance of mathematics at all stages in their education. According to Nherera (1999), guidance and counselling should start at primary school and continue into tertiary education.

## Poor organisation of the mathematics club in the school

Both in interviews and in the focus group discussion, the participants indicated that the mathematics club was not helpful to them as girls with low mathematics self-concept. They argued that the club was purely organised to benefit the so called 'bright girls'. For example, participant 4 claimed, "*The mathematics club in this school is just for the bright girls. Being bright in mathematics is a gateway to joining the club.*"

Participant 7 added, "*Being good at mathematics is an entry requirement to the club. Without it you are not welcome.*"

Further, participant 7 also claimed that the rationale for most clubs in the school was to gain access to outings, "*Most of the clubs in school are organised with the motive of going out on trips*". Participant 5 emotionally stated, "*They do not make both slow and fast learners understand. As if that is not enough, they pick only girls who are good in mathematics to belong to the mathematics club. It is as if we do not exist.*" These sentiments show that learners who performed poorly in mathematics felt left out such that even if they wanted to improve, such practices in the school discouraged them.

Broadly speaking, it seems, in as much as it was important to organise the mathematics club consisting only of the bright girls who would later teach others, the practice was not well received by those who were low performers. The idea behind the formation of the club was clearly misplaced and not beneficial to the learners who are struggling with mathematics. Pupils seem to learn better when they interact with their peers. Segregating the fast learners from the slow learners can breed alienation between peers as the latter feel that they are second class students.

## CONCLUSION

The findings of this study suggest that to better understand female learners' negative mathematics self-concept, one need to explore what goes on in schools where learning is supposed to take place. This study has shown that the study of mathematics self-concept should not only end with mere findings that indicate that female learners have a low or negative mathematics self-concept, instead more in-depth studies need to be conducted in Zambia and elsewhere to come to a deeper and broader

understanding of what makes female learners to generally get outperformed by male learners in mathematics. It is paramount that future research, for instance, consider exploring how individual female learners' experiences outside of school, influence the formation of their mathematics self-concept.

## LIMITATIONS OF THE STUDY

While the current study triangulated the research instruments which were aimed at increasing the credibility of the findings, generalisation of the findings has to be done with caution due to the small qualitative sample size that was used. Small, purposeful samples are typical of most qualitative studies where the aim is to uncover depth and not breadth of findings (Willig, 2001).

## BIOGRAPHICAL NOTES



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