

Factors affecting students' achievement in mathematics in secondary schools in developing countries: A rapid systematic review

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Abstract. Mathematics is seen by society as the foundation of scientific technological knowledge that is vital in social-economic development of a nation. In fact, studies suggest that mathematics as a subject affects all aspects of human life at different levels. This paper is a rapid systematic review of factors affecting students' achievement in mathematics. We searched literature on student achievement in mathematics. We used ERIC database and supplemented with Google Scholar and random Google search. Twenty six articles met the final selection criteria and were reviewed. The teaching methods, teachers' attitude, students' attitude towards mathematics were noted as key factors in almost all articles reviewed. There seemed to be consistency too that parents can exert a positive influence on their children's mathematical performance, classroom environment, students' previous mathematics achievement and gender related factors. Student achievement at secondary level determines whether they will opt to or qualify to study statistics at university. From this review, it is imperative that these factors be addressed early in the students' career so as to have more student enrollment for statistics at tertiary institutions.

Keywords: Mathematics teaching methods, teachers' attitude, students' attitude, student achievement in mathematics

1. Introduction

Mathematics as a subject affects all aspects of human life at different levels [1]. Studies have suggested that, Mathematics is a science of magnitude and number that is very useful virtually in all subject areas [2]. This is because all fields of studies are dependent on it for problem solving and prediction of outcomes. Competency in mathematics learning is vital to any individual and nation in domestic and business deals, scientific discoveries, technological breakthrough, problem-solving and decision making in different situations in life [3,4].

The teaching of statistics in many schools in sub Saharan Africa is done as a component of the mathematics curriculum [5]. Many African countries like Benin, Nigeria Kenya and Lesotho [5,6] practice this. Unfortunately, students' achievement in this important subject is usually not good at secondary levels of education in sub Saharan Africa [1]. The conceptions, attitudes, and expectations of students regarding Mathematics and Mathematics teaching have been considered to be very significant factors underlying their school experience and achievement [2,7,8].

In many cases, students have been found to approach Mathematics as procedural and rule-oriented [9]. This prevents them from experiencing the richness of Mathematics and the many approaches that could be used to develop competence in the subject [4,9,10]. A number of studies have explored the concept of factors affecting

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students' performance in mathematics with divergent views and findings. This study is a rapid systematic review of different studies to establish factors affecting students' achievement in Mathematics in secondary schools in developing countries.

2. Methods

The PICO (Population, Intervention, Comparison, Outcome) framework was used to develop research questions to guide the scoping process. Since these were observational and mainly cross sectional studies, we further adjusted the PICO to PICO (Population, Interest, Context) framework to structure review questions on achievement in mathematics, student grades, factors affecting performance in mathematics and determinant of students' performance in mathematics and statistics mathematics achievement among others. We used the ERIC database as the main source of articles. ERIC (Education Resources Information Center) is an authoritative database of indexed and full-text education literature and resources. It is an online digital library of education research and information. ERIC is sponsored by the Institute of Education Sciences of the United States Department of Education. We supplemented with google scholar and random google search.

Studies conducted in sub Saharan Africa and beyond, published in peer reviewed journals were included in the search. The initial search generated 15,353 articles related to our study conducted between year 2000 and 2019. We further refined the subject by themes and generated 1,748 articles on mathematics achievement, 1,611 articles on mathematics education, and 1,581 articles on mathematics teaching methods, 1,116 on teachers' attitude and 1,701 on student attitude. We further filtered the articles and generated 886 articles. Finally twenty six articles met the criteria and were reviewed. Review was based on topics of academic achievement in mathematics including; student attitude, teachers attitude, gender factors and other factors.

3. Results

The results show that there many variations in factors that determine student performance in mathematics. From the systematic rapid synthesis, there are various factors identified by different scholars to affect the students' achievement in mathematics. There were general factors that seemed to be mentioned in all the stud-

ies that fitted the selection criteria. Some studies have demonstrated a strong and significant relationship between Mathematics attitude and Mathematics achievement [11]. Other studies regard attitude towards Mathematics as just a like or dislike for Mathematics while others attitude towards Mathematics is just a positive or negative emotional disposition towards Mathematics [2,9,10]. The students' attitude, teachers' attitude, teaching methods, classroom environment, were noted as key factors in almost all articles reviewed [12–14]. There seemed to be consistency too that parents can exert a positive influence on their children's mathematical performance [1,4,7,14,15]. Other factor were students' previous mathematics achievement, age especially for adolescents, gender stereotypes, classroom environment among others [16].

3.1. Students' attitude

The students' attitude is seen to affect their performance in mathematics in different studies. In a comparative studies have found that there is a direct link between students' attitudes towards Mathematics and student outcomes [2,9,10]. In the study of elementary school pupils, there was a positive correlation between student attitude and student performance [11]. More studies support this [9,14]. Students have been found to approach Mathematics as procedural and rule-oriented. This is said to prevent them from experiencing the richness of Mathematics and the many approaches that could be used to develop competence in the subject [2,9,10].

3.2. Teachers' attitude

From this qualitative synthesis, the teachers' attitude is strongly mentioned to influence student achievement in mathematics. The learner draws from the teacher's disposition to form his own attitude which may affect her learning outcomes [17]. The learner draws from the teacher's disposition to form his own attitude which may affect her learning outcomes [13,14,18]. Positive teacher attitude towards Mathematics was significantly related to high achievement in pupils [19–21]. Also studies that specifically focused on teachers' attitude and students' achievement in mathematics found out that teachers' attitude contributed to students' academic performance and behavior [3,10,12]. Teachers' beliefs about Mathematics such as the usefulness of Mathematics, the way Mathematics should be learned, the difficulty or ease of Mathematics, as well as gender ability and beliefs also affect their attitude towards the subject and impact on students' performance [14,18].

3.3. Teaching methods

The teaching methods, are key in enabling the learner understand underlying and key concepts [13,14,21,22]. Teaching Method can best be defined as the type of principal & methods used for Instruction. There are many types of teaching methods, depending on what information or skill the teacher is trying to convey. The methods used in teaching may vary from one country to another, depending on the information or skills being taught [21,23]. A variety of strategies & method are used to ensure that all students have equal opportunities to learn. If the teaching method is not favoring understanding the students will achieve less as compared to the other.

3.4. Gender factors

There are gender disparities that also affect achievement in mathematics. Studies revealed the belief that boys do better in Mathematics than girls. This belief tends to affect the attitude of girls towards Mathematics [24]. In comparative studies, comparing girls to boys, girls lacked confidence, had debilitating causal attributional patterns, perceived Mathematics as a male domain and were anxious about Mathematics [3,23]. Girls were found to have lower self-confidence in Mathematics than boys [1,4].

3.5. Parental influence

Parents serve as a role model and a guide in encouraging their children to pursue high educational goals and desires by establishing the educational resources on hand in the home and holding particular attitudes and values towards their children's learning [25]. Parental influence of child performance in mathematics is paramount [26]. Parents can exert a positive influence on their children's mathematical performance [7,13,14]. In Uganda, Nsubuga observed that the role of parents, particularly through Parent-Teacher Association (PTA), was instrumental to students' learning achievement [7].

4. Conclusion

The study was carried out to provide a systematic review and synthesis of the factors affecting students' achievement in Mathematics and statistics in secondary schools and its influence on studying statistics at University. Basing on our findings, factors such as, stu-

dents' attitude, teachers' attitude, teaching methods, classroom environment, gender stereotypes and parental factors have been widely found to influence student achievement in mathematics. From this review, it is imperative that these factors be addressed early in the students' career so as to have more student enrollment for mathematics and better achievement in the subject.

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