frontiers in Applied Mathematics and Statistics

ORIGINAL RESEARCH
published: 23 April 2021
doi: 10.3389/fams.2021.614408

Perceived Causes of Students' Poor Performance in Mathematics: A Case Study at Ba and Tavua Secondary Schools

Samlesh Chand[1], Kaylash Chaudhary[2], Avinesh Prasad[2] and Vishal Chand[2]*

[1]Ministry of Education, Heritage and Arts, Suva, Fiji, [2]School of Information Technology, Engineering, Mathematics and Physics, The University of the South Pacific, Suva, Fiji

Poor achievement in mathematics is an issue of great concern for many countries across the globe. Fiji is one of the countries in the South Pacific experiencing the same trends, pressures, and concerns. This study aims to seek the views of stakeholders (students, teachers, heads of departments, and school heads) with regards to the causes of poor achievement in mathematics at the senior grades of secondary schools in the districts of Ba and Tavua, Fiji. A descriptive design using both quantitative and qualitative approaches were utilized whereby data were collected from 201 upper secondary school respondents comprising 171 students, 16 mathematics teachers, 7 department heads, and 7 school heads from seven randomly selected schools in the districts of Ba and Tavua. The study found that the students had a negative attitude toward mathematics. It was also found that an ineffective mathematics curriculum in secondary schools was the reason behind poor performance in the subject. Moreover, many of the primary school teachers lacked potential and competence to teach mathematics at primary school levels, and this largely contributed toward the lack of interest amongst students, hence translating into poor achievement at both upper and lower secondary levels. On the other hand, however, it was gathered that secondary school teachers were rather positive, good quality, performing, and fully qualified as far as the teaching of mathematics and delivery of the subject matter was concerned. Review and amendments to the year 12 and 13 mathematics curriculum, use of technologies to teach mathematics, improving the quality of primary school mathematics teachers, reducing the emphasis on exams, introducing internal assessments, projects, and field work in the mathematics curriculum were a few of the significant recommendations made from this study.

Keywords: low academic achievement, teacher quality, curriculum, mathematics in schools, teacher attitude

OPEN ACCESS

Edited by:
Shriram Raghunathan, VIT University, India

Reviewed by:
Parmjit Singh Aperapar Singh, Universiti Teknologi MARA Puncak Alam, Malaysia
Victor Wu, Virginia Commonwealth University, United States

****Correspondence:***
Samlesh Chand
samleshc@yahoo.com

Specialty section:
This article was submitted to Mathematics of Computation and Data Science, a section of the journal Frontiers in Applied Mathematics and Statistics

Received: *06 October 2020*
Accepted: *04 February 2021*
Published: *23 April 2021*

Citation:
Chand S, Chaudhary K, Prasad A and Chand V (2021) Perceived Causes of Students' Poor Performance in Mathematics: A Case Study at Ba and Tavua Secondary Schools. Front. Appl. Math. Stat. 7:614408. doi: 10.3389/fams.2021.614408

INTRODUCTION

Globally, mathematics is regarded as one of the most important subjects in the school curriculum [1]. It is the foundation of scientific and technological knowledge that contributes significantly toward the socioeconomic development of a nation [1–6].

Mathematics plays a vital role in everyday life of so many people [7, 8]. According to [2], mathematics is one subject that affects all aspects of human life at different levels. A study by [9] claimed that both education and human life do not effectively function without the knowledge of mathematics. In formal education, mathematics forms the basis of many of the sciences such as physics, chemistry, biology, engineering, and IT disciplines as well as the nonscience disciplines such as accounting, economics, geography, and even physical education, music, and art [1, 4, 6, 7, 10–15]. It is one of the most important subjects in the school curriculum, which acts as a bridge for all knowledge [3]. Studies by [16, 17] stressed that mathematics is the bedrock and a tool for the scientific, technological, and economic advancement of any country. It is a common belief of educationists that no one can make progress in any field without having the basic knowledge of mathematics [18]. According to [1, 8], mathematics is the foundation of science and technology without which a nation will not prosper and achieve economic independence. That is why mathematics is one of the leading core subjects in the secondary schools' curriculum.

Personnels require mathematical skills in various disciplines, workplace, and sectors. Even things like the hydrogen bomb, missiles, space crafts, and satellites would not have been possible without the knowledge of mathematics [19]. Mathematics has its application in a wide range of informal settings, including vegetable selling, sewing, fishing, construction work, shopping, purchasing, carpet laying, video games, cabs and buses, farming, entertainment, sports, and everyday family activities [20, 21]. Ultimately, the survival of any human being in this competitive world is almost impossible without the knowledge and skill in mathematics.

Despite the highly decorated and recognized importance of mathematics and the fact that it is the prerequisite for most of the subjects, poor achievement and lack of interest in mathematics (and STEM) among students remains as an issue of concern in schools, colleges, and universities in developed and developing countries alike [22–25]. Mathematics continues to be one of the most challenging subjects in schools as perceived by students [7, 26–28]. There is a general impression that its very nature complicates mathematics. Because of this impression, majority of students have a phobia for this subject [9, 29–31]. Besides, mathematics students of the 21st century enter mathematics classrooms with a serious lack of fluency and reliability in numerical and algebraic manipulation and simplification, problem-solving, and negative attitude [28, 32, 33].

It is quite evident that students with good mathematical skills can think analytically and have better reasoning abilities. That is why mathematics is used as an essential entry requirement for most of the courses at the higher education institutes, especially for courses relating to science, technology, and engineering disciplines [22]. Reference [34] claimed that the number of students enrolling in higher level mathematics courses had declined significantly. Due to this, there was an increase in mathematically underprepared students enrolling in undergraduate courses leading to curtailed enrollments and low pass rates in higher education (HE) institutes. Fiji with three major higher education institutions, namely, The University of the South Pacific, The Fiji National University, and The University of Fiji face the same challenge of decline in the quantity and quality of applicants enrolling for Science, Technology, Engineering, and Mathematics (STEM) courses due to low pass rates in mathematics at years 12 and 13 national examinations [22, 25, 28, 35]. Many Fijian students fail to meet the basic entry requirements for HE institutions in STEM courses that require either a pass or a higher cutoff mark in mathematics [36]. The domino effect of this over the years has forced HE institutes to remove the high cutoff marks for specific disciplines in order to avoid losing on students [37].

TABLE 1 | Performance in years 12 and 13 mathematics national examinations.

FY13CE	2015	2016	2017	2018	2019
% Pass	45	36	43	37	16
FY12CE	2015	2016	2017	2018	2019
% Pass	38	17	36	31	11

Source: Ministry of Education, Heritage and Arts

The Fijian government and its academic stakeholders have long been investing profoundly in the education sector. The government over the past few years has been providing initiatives such as transport assistance (bus fare and boat fare subsidies), free textbooks, and grants to uplift the standard of education in Fiji [11, 38]. Despite such massive investments in education and the important role that mathematics plays in society, there has been a continuous trend of poor achievement in mathematics, especially at the years 12 and 13 grades of secondary schools in Fiji. The national examination results of FY12CE and FY13CE is demonstrated in **Table 1**.

Studies by [16, 39, 40] claimed that the continual trend of poor achievement in mathematics is a function of cross-factors related to students, teachers, and schools. It is evident from several studies that student, teacher, and curriculum factors seem to have a significant effect on mathematics achievement [1, 16, 33, 41, 42].

While there are anecdotal pieces of evidence on why we are facing low achievement, there has been a dearth of formal and high-quality research in this area. The present study intends to carry out a thorough investigation on the student, teacher, and curriculum factors by cross-examining the views and perceptions of students, teachers, heads of the mathematics department, and the school heads. The article analyses and discusses the views of the respondents on the factors contributing to students' poor achievement in mathematics, especially at the senior grades of selected secondary schools in the west of Fiji Islands. The findings of this research would provide an empirical insight to the Curriculum Development Unit (CDU), Ministry of Education, Heritage and Arts (MEHA), Higher Education Institutes (HE), and other relevant academic stakeholders to bring about effective reviews and reforms in the education system in order to improve the achievement of students in mathematics at the senior secondary grades. It is anticipated that the recommendations of this study would bring about a positive mental attitude and perception of students toward mathematics. Moreover, the way mathematics is taught in both primary and secondary schools has to be changed.

SECONDARY SCHOOL MATHEMATICS REFORMS IN FIJI

The secondary school mathematics in Fiji has not seen any significant structural changes in the past 3 decades. Whereas almost all areas of the curriculum have changed to fit better with the context of Fiji, it is still an academic system that is driven by examinations [43]. The examination system in mathematics at the secondary level, which currently has external examinations at years 10, 12, and 13, is an entirely written examination in mathematics with no form of internal assessments.

However, for several years, the Overseas School Certificate and the General School Certificate Examinations from the United Kingdom were adopted in the Fijian education system. Then in the 1960s, came the switch to the New Zealand syllabi and examinations—the School Certificate and the University Entrance Examinations. The former was dropped and the latter replaced by local examinations in 1989 [44].

There were no significant changes in the mathematics curriculum for the next 2 decades until internal assessments came into effect. In 2011, Fiji Junior Certificate Examination was abolished, and internal assessment was implemented in all the secondary schools in Fiji [45]. It was anticipated that the reform in the curriculum would allow teachers to adopt a student-centered approach, shifting the focus of instruction from the teacher to the student. The shift from the teacher-centered approach would have allowed a student to be free from the constant pressure and trauma of external examinations. Form six (year 12) and form seven (year 13) examinations remained since they play an important function in the selection of students for further education and employment opportunities.

However, a report presented to the cabinet by the Education Minister in 2015 stated that the raw results for the external examinations showed very low mean marks and percentage pass rates in years 12 and 13 examinations which portrayed a failure in the education system. Mathematics recorded a percentage pass of 7.5%, one of the lowest performing subjects' among all the other subjects in Fiji Year 13 external examination in 2014 [35]. The predicament was seen to be due to the removal of external exams up to year 11, and thus, poorly prepared students passed on from one year to the other without their teachers and parents knowing the true status of the students' level of attainment that year. Removal of scaling was further proposed and passed by the cabinet to reflect a student's true ability as results in mathematics in the past showed exaggerated percentages and averages that did not correctly portray the true stock of knowledge that the student had acquired [46].

In 2015, the honorable minister for education, Dr. Mahendra Reddy, further stressed that the Fijian curriculum was below the standard of some of the countries, whose graduates were more competitive at an equivalent level [47, 48]. Dr. Reddy claimed that the graduates from HE institutes were fraught with lack of soft skills, lack of competency in English proficiencies, unwilling to think outside the box, and had poor research skills [47].

In the year 2018, the repercussions of poor achievement in mathematics were felt when the Ministry of Education, Heritage and Arts identified an immediate shortage of mathematics, physics, biology, chemistry, and industrial arts teachers anticipating the shortage to continue in the foreseeable future [49]. The shortage of teachers in STEM disciplines is attributed to poor achievement in mathematics at senior secondary grades since very few students are able to qualify for such courses. Most of these elite students who qualify and graduate prefer joining the private sector rather than teaching, contemplating better pay scale, and faster promotion chances, the trend shared by other countries in the South Pacific region [22]. To add on, MEHA has gone to the extent of hiring retired industrial arts teachers who wish to rejoin the service as assistant teachers. In few cases, teachers of nonengineering discipline are even appointed by the school administrators to take up the role of teaching engineering subjects at secondary schools due to the shortage of industrial arts teachers in the country. Also, some graduates who do make it to the teaching programs for STEM courses prefer to migrate to neighboring countries after few years of service, for attractive and better salary packages in comparison of what is paid to teachers locally.

Removal of scaling in national exams; preparation of localized and prescribed textbooks; reintroduction of national exams in year 10; introducing standard exams for years 9, 10, and 11; upgrading the quality; and providing detailed solutions of past year national exam papers were few of the reforms that took place over the past 4 years. Still, the result in mathematics at years 12 and 13 grades, the number of students enrolling at universities for STEM programs, and the number of graduates in mathematics, science, and technology continued to decline significantly.

Literature Review

The continuing trend of poor achievement in mathematics in Fiji secondary schools raises concerns to the Fijian government and the stakeholders on whether or not the Fijian education system can supply graduates who possess the essential skills to enable them to cope with the ever-evolving technological society. Several studies have attributed students' low achievement in mathematics to student, teacher, and curriculum factors. For this study, students' attitude and perception toward mathematics, teachers' attitude, and perception toward mathematics, teaching methodologies of mathematics teachers, quality and performance of mathematics teachers, and the effectiveness and relevance of mathematics curriculum were the five factors identified to be influencing students' achievement in mathematics at the senior grades of secondary schools in Fiji. The following review summarizes from the literature the above five factors that contributed to the low achievement of students in mathematics.

Attitude and Perception of Students Toward Mathematics

First, attitude determines the effort a student is likely to put in his or her learning of a subject. It refers to someone's basic liking or disliking of a subject [13, 50]. Several studies have been carried out in many countries to find the factors that influence the students' performance in mathematics. Among these factors, student attitude and perception is one significant factor that has been consistently studied [13, 51–55]. Studies such as [2, 3, 43, 55] attributed challenges to teaching mathematics to the negative attitudes and perception of students as they perceive mathematics as a difficult subject to pass. A recent study by [1] found out that 92.50% of students hated mathematics, whereas 86.25% had unjust fear toward mathematics. The prolonged fear and anxiety of students in mathematics ultimately generates a negative attitude of students that becomes relatively permanent in future [56].

On the contrary, a study by [2] on the three colleges of Ghana found that students had a positive attitude toward mathematics with a willingness to learn. However, they are uncomfortable due to the conditions around them. These conditions do not necessarily mean that a student is always liable for his or her poor achievement. However, to date, while there have been local studies assessing school teachers' preparedness for mathematics [57] and secondary students' attitude in science [25] and ICT [58, 59], there has been no research carried out locally to assess students' attitude and perception toward mathematics. This requires views from students, teachers, heads of departments, and school heads to gain deeper insights into students' lack of interest and low achievement in mathematics at the senior grades of secondary schools in Fiji.

Attitude and Perception of Teachers Teaching Mathematics

Second, the question that arises here is can the students be blamed for the poor attitude toward mathematics? According to [60], teachers' negative beliefs about mathematics have a strong influence on students' attitude and achievement in mathematics. Studies such as [6, 53, 54, 61, 62] have stressed on teachers' attitude in mathematics being the significant determinant of negative attitude among students. The way students perceive teachers' characteristics will affect their attitude toward mathematics [5, 57]. Teachers' personal and professional characteristics play a significant role in students' liking or disliking of mathematics. Studies by [53, 62] show that boring teachers, teachers' lack of commitment, teachers' personality, students' failure to understand the topic, and the poor performance of students in exams relate to teachers' negative attitude. While there is a dearth of relevant studies in Fiji, an international study by [6] has found out that the majority of the mathematics teachers in secondary schools display a positive attitude toward teaching mathematics. However, there are no recorded observations of this issue in Fiji. Therefore, an in-depth and comprehensive formal research needs to be conducted to find the general trend of local teachers' attitude toward teaching mathematics and if this attitude affects their students' attitude toward performance in mathematics.

Teaching Methods Used by Mathematics Teachers

Third, several studies have attributed poor academic achievement of students to the deficiency in teaching method(s) used by mathematics teachers [1–3, 63–65]. According to [65], teachers employ wrong teaching methods of learning, which results in general hatred for the subject by the students. The author further concluded that if mathematics is to be appreciated by students, teachers must use new pedagogies and technologies that can stimulate students to gain interest in mathematics classes. A recent study by [1] found that 85.63% of students claimed that poor teaching methods of some mathematics teachers scare students from the subject. According to [66, 67], in the current era of education, students are encouraged to discover and build their knowledge through active participation. Teachers should incorporate methods that involve active participation of students, considering students' interest. A local study by [68] justified that due to the exam-oriented system, teachers are too much concerned with finishing the syllabus and drilling the students with the exam questions and answers. He further stressed that teachers are reluctant and sometimes hesitant to use other approaches to the teaching and learning of mathematics as it would take up too much time and are deemed irrelevant to passing exams.

Quality, Performance, and Qualification of Mathematics Teachers

Moreover, great teachers are quality and better performing teachers who tend to inspire people around regardless of any challenges or barriers. Quality, performance, and qualification of mathematics teachers are other important factors that significantly influence the attitude and achievement of mathematics students. It is evident through research that the achievement of students is strongly linked to high-quality and qualified teachers [68]. A recent study by [1] revealed that the majority of the students indicated that their teachers did not have enough potential to teach mathematics. Most of the mathematics teachers do not make the teaching of mathematics practical and exciting due to inadequate training at HE institutions or lack of training for preservice teachers on the 21st-century pedagogies in mathematics, which ultimately leads to negative attitude and poor achievement in mathematics among students. It is, therefore, important that both preservice and in-service training are essential for the quality professional development of the teacher [2]. Studies by [28, 69] have emphasized that technology is essential in teaching and learning mathematics. Some secondary schools in Fiji, such as Nadi Sangam Kuppuswamy Memorial College, Swami Viveka Nanda College, Tilak High School, and Vunimono High School, have already blended ICT entirely in years 12 and 13 of the school curriculum. A recent local study by [70] emphasized that ICT in this modern era allows various innovative and creating assessments to be incorporated in lessons, which were not possible using traditional assessment methods. He further added that the workload of teachers is significantly reduced by the use of ICT, allowing teachers to utilize more time to focus on the key role, that is, to enhance learning among students. Many primary and secondary schools have plans underway to integrate ICT in every classroom [10, 13, 72]; however, investing in such initiatives still proves to be an expensive affair for many schools in Fiji. Another local study conducted by [10] shows that together with the implementation of ICT in the teaching and learning curriculum, students need to have relevant skills such as computer competencies and computer self-efficacies in order to successfully and effectively utilize these tools for their learning processes. Additionally, students also need to have relevant digital literacy skills in order to survive and thrive in this digital world [71, 72]; hence, the teachers as mentors of the students need to have relevant digital literacy skills themselves.

Also, teachers play a very crucial role in integrating ICT in the school curriculum, and without proper training, knowledge, and competency of teachers, ICT may fail to deliver its expected outcome in education. Use of ICT, mobiles, laptops, podcasts, videos, Internets, and other assistive technologies improve the way mathematics is taught and enhance students' understanding of the basic concepts more rapidly and effectively. However, a study by [73] found that mathematics teachers are not fully utilizing these facilities in their classroom teaching. According to [9], most of the mathematics teachers do not even make the teaching of mathematics practical and exciting. They are not competent enough to teach mathematics dynamically, which leads to negative attitude among pupils implying improper guidance by the teachers as well. A study by [74] concluded that the lack of competent mathematics teachers leads to the failure of students in mathematics in Nigerian secondary schools. Teacher's language and background knowledge of the content contributes significantly toward academic achievements [75]. A study by [72, 76] shows that linguistic and conceptual comprehension is a matter of concern. Mathematics teachers need to give a clear explanation to students about mathematical concepts where both language and a basic understanding of the concept is required to ensure each student understands rather than left confused. A study by [77] proved that teachers' clarity, communication skills, content knowledge, and assessment procedures significantly impact students' achievement in mathematics. To add on, studies such as [1, 74, 78, 79] have attributed students' low achievement in mathematics to lack of qualified mathematics teachers teaching at secondary schools. To address such issues in the South Pacific, a new cohort-taught pedagogical model known as the Science Teachers Accelerated Program (STAP) was introduced by The University of the South Pacific (USP) for those in-service science teachers outside the vicinity of USP campuses have to upskill and upgrade their qualifications through cohort teaching [22]. The program has mixed delivery modes and leverages heavily on ICT tools and technologies, including tablets and virtual classrooms [23], which have proven to be statistically significantly effective and productive in terms of quality and qualification of science teachers teaching at secondary schools in the South Pacific.

Effectiveness and Relevance of Mathematics Curriculum

Finally, a study by [80] described the curriculum in developing countries as too compact and exam-oriented. For teachers and stakeholders, the exam results of the schools are of great concern to them. Thus, due to the exam-oriented system, teachers are too much concerned with finishing the syllabus and drilling students with the exam questions and answers [68]. In the same view, [81] claimed that curriculum and assessment in Fijian schools do not serve the actual purpose effectively and efficiently. Examinations are not able to assess the attitude of students, leaving an important facet of life underdeveloped and probably the reason for not attaining quality. He further claimed that the gap in the curriculum content and the forms of assessment to achieve the outcomes has labeled the Fijian education system hapless. The Education Commission Report 2000 even reflected that the exam-oriented curriculum does not allow for outcome-based teaching and learning to progress. In many developing countries, several studies and researches have been carried out on curriculum and examinations influencing students' interest and achievements in mathematics [7, 81–84]. Local studies by [85, 86] recommended that the Ministry of Education should review the curriculum to make it relevant and flexible to the diverse needs of different regions and background of the students. Reference [5] emphasized that the curriculum that currently exists focuses primarily on impoverished ideas about student learning or are based on no model of learning at all. It is quite evident that the mathematics content and assessments at years 11, 12, and 13 are dominated by arithmetic and is broad, non-contextualized, and irrelevant to real life when compared to years 9 and 10.

The majority of the local research works from the literature were conducted in primary schools, which focused on limited factors affecting performance in mathematics. At the same time, there are several factors responsible for students' poor achievement in mathematics. Therefore, the study intends to contribute to the existing literature investigating the above five factors contributing to poor achievement in mathematics at the senior grades of secondary schools in the Western Division of Viti Levu, Fiji.

RESEARCH OBJECTIVES

Aim

The aim of this study was to examine and assess the factors that contribute to students' poor achievement in mathematics at the senior grade (years 12 and 13) of secondary schools.

Objective

The study sought to:

a) assess students' attitude and perception toward mathematics at senior grades of Tavua and Ba secondary schools
b) assess student perception on teachers' attitude toward teaching mathematics at Tavua and Ba secondary schools
c) evaluate the qualification of mathematics teachers of Tavua and Ba secondary schools
d) identify teaching methods used by mathematics teachers of Tavua and Ba secondary schools
e) student and teacher perception on the effectiveness of the current mathematics curriculum at the senior secondary grades.

Research Questions

Specifically, this study aims to answer the following research questions:

a) What is the students' attitude and perception toward mathematics at senior secondary grades?
b) What is the student perception on teachers' attitude toward teaching mathematics at senior secondary grades?

c) What are the teaching methods used by mathematics teachers at senior secondary grades?
d) What are the qualifications of mathematics teachers in Tavua and Ba schools?
e) What is the student and teacher perception on the current mathematics curriculum at the senior secondary grades effective?

Methodology

This study is a descriptive study in which a cross-sectional survey research design was adopted. The data for the research were collected by the use of questionnaires, interviews, and student focus group discussion. The target population was 201 respondents which comprised 171 students, 16 mathematics teachers, 7 department heads, and 7 school heads from seven randomly selected secondary schools in the districts of Tavua and Ba. Random Sampling technique was used to select the seven secondary schools from a population of 14 secondary schools within the districts of Ba and Tavua. The sample, therefore, represented 50% of the population of Ba and Tavua secondary schools. The mathematics teachers, heads of departments, and the school heads were a part of the sample, who answered the questionnaires and also took part in the individual interviews as per the schedule. The stratified random sampling technique was then used for the selection of students from years 12 and 13 by obtaining a list containing recent overall academic results of each student in order to group them with varied abilities. This was done to ensure that the views of all the students with different abilities are equally represented. Furthermore, the purposive sampling method was used to select the students for the focus group discussion. Students within the Ba community were identified by the principal researcher, who were very inquisitive about the study's objective and were outspoken to give personal and true opinions for the study. All the respondents were assured of confidentiality and their identity anonymity to protect the privacy of each respondent and to get the required information, which are the true opinions of each respondent. The appointments with the school heads were made and the consent of each respondent was also taken prior to the field research.

Research Tool Development and Pilot Study

There were four sets of questionnaires designed for each group of respondents (students, teachers, heads of departments, and school heads). The questionnaires were almost the same except for the content being rephrased to suit the opinion of the different groups of respondents. The questionnaire utilized the Likert scale to collect quantitative data for the research along with a section for suggestions and recommendations to curb the issue of poor achievement in mathematics. Three sets of interview questions were then designed. This was only for the mathematics teachers, heads of departments, and school heads. The students were not considered to be interviewed due to time constraints and a busy schedule for students after the reopening of schools post–COVID-19 lockdown in the country. Students were rather selected for the focus group discussion that was held at one of the libraries in the Ba town. The interviews and the focus group discussion only collected the qualitative data for the research. Pilot testing of these tools was also done in the two secondary schools in the district of Ba and Lautoka, which were not part of the sample. This was done to establish the clarity, meaning, and comprehensibility of each item in the tools. After the pilot study, the research tools along with the responses were discussed among the co-researchers for further review and amendment for its reliability and validity. A Cronbach alpha test using Statistical Package for the Social Sciences (SPSS) was carried out. The alpha value of 0.86 indicated that the questionnaire was valid and reliable for the study.

Demographic Characteristics of the Respondents

From the target population of 201 respondents, 181 respondents comprising of 151 years 12 and 13 students, 16 mathematics teachers, 7 heads of mathematics department, and 7 school heads answered the questionnaire. The same 16 mathematics teachers, 7 heads of the mathematics department, and 6 school heads from the 181 respondents group were the respondents who were also interviewed. The remaining 20 respondents from the target population were the years 12 and 13 students from the four secondary schools in the Ba district. They volunteered to be part of the student focus group discussion. From the 13 secondary schools in the districts of Tavua and Ba, 7 schools were randomly chosen to be the sample of this study. Data on **Table 2** indicate the gender distribution of the participants in the study.

RESULTS AND DISCUSSION

a) Research question 1: What is the attitude and perception of students toward mathematics at senior secondary grades?

Students, teachers, heads of the mathematics department, and the school heads selected for the study were asked to give opinions on years 12 and 13 students' attitude and perception toward mathematics. Each of the students selected expressed views on their own attitude and perception toward mathematics while the teachers, heads of mathematics department, and the school heads expressed their opinion on students' attitude and perception toward the subject. The responses obtained are presented in **Table 3** and **Table 4**, as shown below.

Table 3 shows that majority of the students perceived mathematics as a difficult subject. Students' responses for each item showed that more than 50% of the students had a fear of mathematics as a subject and preferred learning other subjects, with the majority not wishing to continue with mathematics at the university level.

Table 4 shows responses from the 30 educators. More than 50% of the educators also perceived that students found mathematics a difficult subject and mostly failed because they had mathematics phobia. Looking at the educators' responses, more than 50% believed that students lacked mathematics basics

TABLE 2 | Gender of respondents.

Respondents	Questionnaire		Interview		Student Focus Group		Total
	M	F	M	F	M	F	
Students	55	96	—	—	12	8	171
Teachers	7	9	7	9	—	—	16
Heads of department	5	2	5	2	—	—	7
School heads	6	1	6	—	—	—	7
Total	73	108	18	12	12	8	201
Percentage	40.3%	59.7%	60%	40%	60%	40%	

TABLE 3 | Students' attitude and perception toward mathematics—student perception.

	Statement	SA (%)	A (%)	U (%)	D (%)	SD (%)
1	I have a dislike for mathematics and do not find the subject interesting	50 (33%)	27 (17.0%)	14 (10.0%)	32 (21.0%)	28 (19.0%)
2	I have phobia (fear) for mathematics	43 (28.5)	28 (18.6%)	28 (18.6%)	27 (17.8%)	25 (16.5%)
3	Mathematics is normally not counted in my best 4 subjects	50 (33.6%)	38 (25.1%)	18 (11.9%)	18 (11.9%)	26 (17.5%)
4	I am unable to logically and critically think when working with mathematics	49 (33.4%)	35 (23.1%)	22 (14.5%)	22 (14.5%)	22 (14.5%)
5	I perceive mathematics as a difficult subject to pass	34 (22.5%)	34 (22.5%)	25 (16.6%)	25 (16.6%)	33 (21.8%)
6	I perceive mathematics having no relevance to real life	34 (22.5%)	34 (22.5%)	25 (16.6%)	25 (16.6%)	33 (21.8%)
7	I lack the foundation (basics) in mathematics	40 (26.5%)	30 (19.8%)	30 (19.8%)	31 (20.6%)	20 (13.3%)
8	I hardly do any of the class activity and homework assigned	33 (21.8%)	40 (26.5%)	20 (13.2%)	21 (13.9%)	37 (24.6%)
9	I perceive mathematics containing only arithmetic (numbers, calculations, and computations) with nothing interesting and relevant	41 (27.2%)	31 (20.5%)	24 (15.9%)	24 (15.9%)	31 (20.5%)
10	I prefer studying other subjects than mathematics	53 (35.1%)	20 (13.2%)	29 (19.2%)	29 (19.2%)	20 (13.3%)
11	I learn mathematics better with technology	34 (22.5%)	44 (29.1%)	19 (12.5%)	19 (12.5%)	16 (10.6%)
12	I hardly study for mathematics exams	31 (20.6%)	46 (30.5%)	25 (16.5%)	25 (16.5%)	20 (13.2%)
13	I fail most of the mathematics exams	47 (31.2%)	24 (15.8%)	22 (14.6%)	22 (14.6%)	36 (23.8%)
14	I do not wish to pursue mathematics, science, engineering, and technology courses in universities	56 (37%)	25 (16.6%)	20 (13.2%)	27 (17.9%)	23 (15.3%)

TABLE 4 | Students' attitude and perception toward mathematics—educators perception.

	Statement	SA (%)	A (%)	U (%)	D (%)	SD (%)
1	Students have a dislike for mathematics and do not find the subject interesting	10 (33.3)	7 (23.3)	6 (20.0)	4 (13.3)	3 (10.0)
2	Students have phobia (fear) for mathematics	4 (13.3)	9 (30.0)	7 (23.3)	8 (26.7)	2 (6.7)
3	Mathematics is normally not counted in best 4 subjects of students	7 (23.3)	11 (36.7)	2 (6.7)	4 (13.3)	6 (20.0)
4	Students are unable to logically and critically think when working with mathematics	11 (36.7)	9 (30.0)	3 (10.0)	4 (13.3)	3 (10.0)
5	Students perceive mathematics as a difficult subject to pass	12 (40.0)	13 (43.3)	0 (0)	3 (10.0)	2 (6.7)
6	Students perceive mathematics having no relevance to real life	6 (20.0)	14 (46.7)	4 (13.3)	3 (10.0)	3 (10.0)
7	Students lack the foundation (basics) in mathematics	13 (43.3)	10 (33.3)	2 (6.7)	1 (3.3)	4 (13.3)
8	Students hardly do any of the class activity and homework assigned	5 (16.7)	12 (40.0)	5 (16.7)	6 (20.0)	2 (6.7)
9	Students perceive mathematics containing only arithmetic (numbers, calculations, computations) with nothing interesting and relevant	4 (13.3)	15 (50.0)	4 (13.3)	4 (13.3)	3 (10)
10	Students prefer studying other subjects than mathematics	7 (23.3)	14 (46.7)	3 (10.0)	3 (10.0)	1 (3.3)
11	Students learn mathematics better with technology	5 (16.7)	8 (26.7)	11 (36.7)	6 (20.0)	2 (6.7)
12	Students hardly study for mathematics exams	6 (20.0)	9 (30.0)	6 (20.0)	8 (26.7)	3 (10.0)
13	Most of the students fail mathematics exams	7 (23.3)	15 (50.0)	2 (6.7)	4 (13.3)	2 (6.7)
14	Students do not wish to pursue mathematics, science, engineering, and technology courses in universities	4 (13.3)	9 (30)	9 (30)	5 (16.7)	3 (10.0)

and hardly participated in any classroom activity. The responses from both the students and teachers were similar and derived from the "SA" and "A" columns. The following were a few of the responses from the interviews and student focus group discussions on how students perceive mathematics.

"I enjoyed and liked mathematics in my first three years of primary school only. Now I hate this subject. I do not see any reason why should we study mathematics? Where is it used in real life?" Student FG 13.

"I was really doing well in mathematics till year 4. Then I was taught by a teacher who always confused me. The explanations were not clear and understandable. The same teacher taught me in year 5 and from then I have lost interest in the subject." Student FG 2.

TABLE 5 | Student perception of teachers' attitude toward teaching mathematics.

	Statement	SA (%)	A (%)	U (%)	D (%)	SD (%)
1	Mathematics teachers are always punctual to classes	115 (76.1)	26 (17.2)	2 (1.3)	3 (1.9)	5 (3.3)
2	Mathematics teachers have very good personal and professional characteristics. Very friendly and very approachable	113 (74.8)	31 (20.5)	4 (2.6)	1 (0.7)	2 (1.3)
3	Mathematics teachers give clear and easy to understand explanations	105 (69.5)	34 (22.5)	3 (1.9)	7 (4.6)	2 (1.3)
4	Mathematics teachers always motivate students to learn	103 (68.2)	36 (23.8)	8 (5.3)	3 (1.9)	1 (0.7)
5	Mathematics teachers always assist slow learners	93 (61.6)	41 (27.2)	6 (3.9)	7 (4.6)	4 (2.6)
6	Mathematics teachers relate every lesson to real life to make students understand better	76 (50.3)	39 (25.8)	15 (9.9)	15 (9.9)	6 (3.9)
7	Mathematics teachers go prepared for mathematics classes	109 (72.2)	33 (21.8)	3 (1.9)	4 (2.6)	2 (1.3)
8	Mathematics teachers never ask where he/she left the lesson the previous day/class	45 (30.5)	38 (25.2)	18 (11.9)	37 (24.5)	12 (7.9)
9	Mathematics teacher always recap the previous lesson and ends the class with proper summary	84 (56.3)	43 (24.5)	10 (6.6)	11 (7.3)	3 (1.9)
10	Mathematics teachers cater for all types of learners	85 (56.3)	37 (24.5)	15 (9.9)	11 (7.3)	3 (1.9)
11	Mathematics teachers give easy to understand and summarized notes	99 (65.6)	39 (25.8)	6 (3.9)	4 (2.6)	3 (1.9)
12	Mathematics teachers use games and fun activities and makes the class practical, exciting, and enjoyable	44 (29.1)	42 (27.8)	18 (11.9)	33 (21.8)	14 (9.3)
13	Mathematics teachers use technology to teach mathematics lessons	21 (13.9)	29 (19.2)	22 (14.6)	49 (32.5)	30 (19.9)

"Students have a preconceived idea that mathematics is difficult. Till we change their attitude, we will never be able to achieve a better result in mathematics. Mathematics has to be made compulsory along with English in order to make them realise that they have to study and pass the subject if they want to achieve something in life". Principal 2.

"Mathematics is a scoring subject. My teacher teaches us so well. She always motivates us to learn, but I do not know the basics. When now I am eager to study, I still find mathematics going over my head. I can answer few simple questions but when it comes to complex exercises, I just lose hope again." Student FG 19.

"Students have a negative attitude and perception from primary school. Due to the ministry's policy on compulsory education till year 12, they are just getting promoted. A child not knowing the previous year work is rarely able to grasp the concepts in the current year. It becomes very difficult for teachers in a classroom of over 30 students to go over basics and then teach them the concept." Teacher 5.

"Mathematics is just numbers. It is so boring. Why are there no projects in mathematics like other technical subjects? I love to do technical drawing and computer studies as it has projects. In technical drawing we do practicals and projects which makes me enjoy the subject." Student FG 12.

"My mathematics teachers work really hard. Some even take extra classes such as afternoon classes, Saturday classes and evening classes. Teachers go to the extent of going to students home and teach. Despite these efforts, some students do not bother. They do not even show interest and take advantage of extra efforts by our department teachers. Fact is that it is not their fault totally. They do not have a good foundation. By the time they reach year 12 and 13, mathematics is perceived to be a foreign language to them. They know that no matter how hard they try, nothing would change as they would still fail."

b) Research question 2: What is the teachers' attitude toward teaching mathematics at senior secondary grades?

The students were asked to give opinions on teachers' attitude toward teaching mathematics at senior secondary grades.

Table 5 shows the student perception of the teachers' attitude in Tavua and Ba secondary schools. From the results, close to 85% of the students perceived that the teachers had a positive attitude toward teaching mathematics and always motivated them to learn. This is derived from the percentage of responses given under the "SA" and "A" columns. Similarly, teachers had been positively conditioning students at the senior grades; however, students' prolonged negative mindset about mathematics from primary school failed to gain positive predilection for the subject. The teachers provided the students with summary notes for easier understanding and provided recaps before beginning new lessons. About 50% of the students indicated that their teachers' incorporated games, fun, and technology while teaching mathematics. Overall, the teachers' attitude was positive in the delivery of mathematics lessons to the students.

c) Research question 3: What are the teaching methods used by mathematics teachers at senior secondary grades?

For this question, **Table 6** was used as a guideline for the type of teaching methods used by the educators. In total, 23 educators answered this question and the results are presented below.

Data obtained from analyses show that 46.4% of the mathematics teachers used interactive lecture method, 24.3% use learner-centered method, 16.6% used teacher-centered method and 12.7% use collaborative learning method in their mathematics lessons. There were mixed reactions to the type of methods employed by the mathematics teachers of Tavua and Ba secondary schools. From the results it was evident that few of the teachers still preferred teacher-centered method (lecture method) of teaching their mathematics lessons. Many researchers have argued that the lecture method is a passive, ineffective, and antiquated teaching method used by teachers that would soon become obsolete [87]. However, few teachers find lecture method to be useful in covering a substantial amount of content, especially with large class sizes [88].

d) Research question 3: What are the qualifications attained by the mathematics teachers?

TABLE 6 | Teaching methods.

	Teaching methods
A	Teacher-centered method I do most of the talking and students passively listen, I explain everything about the topic, I answer almost all questions, 0% or very little contribution from students
B	Interactive lecture method I actively engage all students in the learning process by the regular teacher–student interaction, student–student interaction, audio–visual aids and hands on demonstrations
C	Collaborative learning method I encourage group work to solve problems, discuss worksheets and papers from other schools, invite other maths teachers to teach few lessons, have audio–visual lectures on the same topic
D	Learner-centered method I just assist the learning process as a guide, I put students interest first, students are asked how they want to learn, what pace they want to learn, how they will assess their own learning, I prepare worksheets according to students' abilities

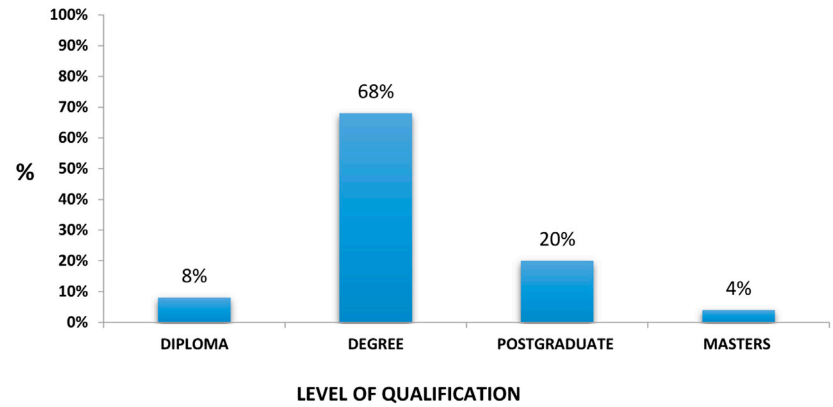

FIGURE 1 | Highest level of mathematics teachers' qualification.

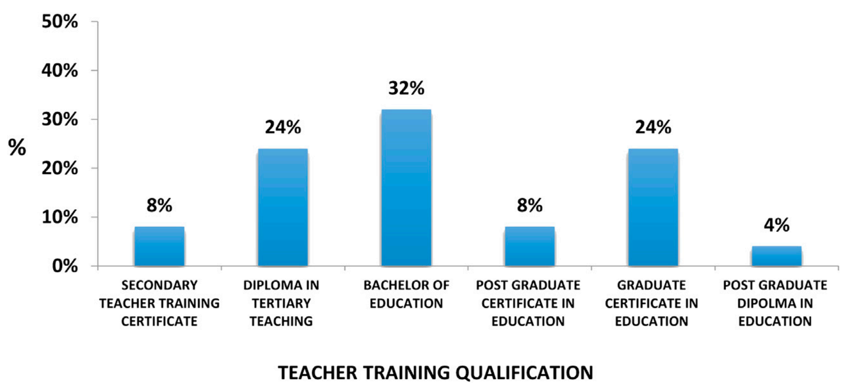

FIGURE 2 | Teacher training qualification of mathematics teachers.

The survey also captured the mathematics and teacher training qualifications. The results are shown in **Figures 1** and **2**.

Figure 1 shows that majority of the teachers at secondary schools have degree qualifications with 24% having post graduate qualifications. The teachers with Diploma are upgrading their qualifications to degree. **Figure 2** shows the teacher training qualifications and 100% of the teachers' have teacher training qualification ranging from secondary teacher training certificate to post graduate diploma in education.

e) Research 5: Is the mathematics curriculum in senior secondary grades effective and relevant?

TABLE 7 | Effectiveness and relevance of mathematics curriculum.

	Statement	SA (%)	A (%)	U (%)	D (%)	SD (%)
1	Mathematics curriculum focuses only on exams (exam-driven)	66 (36.5%)	58 (32.0%)	22 (12.2%)	28 (15.5%)	7 (3.9%)
2	Mathematics curriculum is not relevant and does not prepare for real-life situations	29 (16.0%)	39 (21.5%)	25 (13.8%)	58 (32.0%)	30 (16.6%)
3	Mathematics curriculum is broad and lengthy compared to other subjects	54 (29.8%)	46 (25.4%)	30 (16.6%)	35 (19.3%)	16 (0.8%)
4	Mathematics textbooks are dominated by arithmetic (deals with numbers, calculations, computations)	61 (33.7%)	83 (45.9%)	17 (9.4%)	16 (8.8%)	4 (2.2%)
5	Mathematics curriculum focuses on product (performance in exams) instead of process (learning and understanding)	40 (22.1%)	61 (33.7%)	32 (17.7%)	34 (18.8%)	14 (7.7)
6	Mathematics textbooks do not contain real-life examples and activities	24 (13.3%)	44 (24.3%)	23 (12.7%)	71 (39.2%)	19 (10.5%)
7	Mathematics textbooks are noncontextualized. (notes, examples, and exercises are not based on Fijian setting)	25 (13.8%)	31 (17.1%)	38 (21.0%)	51 (28.2%)	18 (9.9%)
8	Mathematics teachers have difficulty in completing the mathematics coverage within the timeframe	36 (19.9%)	19 (10.5%)	23 (12.7%)	52 (28.7%)	41 (22.7%)
9	Mathematics teachers spend very less time on each topic due to lengthy/broad content	32 (17.7%)	52 (28.7%)	17 (9.4%)	61 (33.7%)	40 (22.1%)
10	Mathematics teachers do not spend enough time on revision and remedial	11 (6.1%)	50 (27.6%)	14 (7.7%)	74 (40.9%)	63 (34.8%)
11	Mathematics curriculum is irrelevant to the students who wish to do further studies in other fields apart from maths, science, and technology disciplines	33 (18.2%)	52 (28.7%)	19 (10.5%)	44 (24.3%)	33 (18.2%)
12	Internal assessments/field work/projects should be part of mathematics curriculum to understand mathematics better	97 (53.6%)	50 (27.6%)	16 (8.8%)	8 (4.4%)	9 (5.0%)

A 14-item Likert scale was developed to assist in detecting the nature and effectiveness of the mathematics curriculum at years 12 and 13 grades as opined by the respondents of Tavua and Ba secondary schools. The responses obtained are presented in **Table 7**, as shown below.

Out of 181 respondents, 145 (79.6%) have indicated that mathematics textbooks are very much dominated by arithmetic. It mostly deals with numbers, calculations, and complex computations. Also, 124 (68.5%) respondents agreed that the current mathematics curriculum at the senior secondary grades focuses only on examinations. In comparison, 101 (55.8%) respondents have shown that the mathematics curriculum in the senior secondary grades focuses mainly on the product (performance in exams) instead of the process (learning and understanding). This strongly agrees with the study by [43] who also identified the exam-oriented curriculum as one of the challenges in the senior grades of secondary schools in Fiji. Furthermore, the data obtained showed that 100 (55.2%) respondents have indicated that the mathematics curriculum at senior secondary grades is broad and lengthy compared to the other subjects. It was quite evident that majority of the teachers, heads of mathematics department, and school heads in the interviews have expressed disappointments regarding the current mathematics curriculum at the senior grades of secondary schools in Fiji.

"Curriculum is broad and lengthy and does not address the needs of students who wish to pursue further studies outside mathematics, science, and technical subjects." (HOD Interview 5).

"Content of Year 13 has very less relevance to the real life." (Teacher 13).

"People are not interested in certain topics because they do not find it relevant to real life." (Student FG 5).

"Years 12 and 13 mathematics curriculum needs to be reviewed and the numbers of strands need to be reduced to incorporate more time for project work/class-based assessments." (HOD Interview 5).

"Experienced teachers or department heads are the best stakeholders in terms of consultation and amendment of mathematics curriculum. Furthermore, there has to be consistency in external exam papers from year to year" (HOD Interview 5).

"The mathematics curriculum needs to be realigned to suit the Fijian context and the need of students." (HOD Interview 2).

"Some students totally lose interest in mathematics upon reaching years 12 and 13 and therefore focus on subjects with projects to get a good aggregate. They ignore mathematics as they know that there is no chance of passing mathematics purely through exams." (HOD Interview 6).

"External exams need not to be abolished but the weighting should be inclusive of projects and class internal assessments." (HOD Interview 5).

There had been very poor results over the years in year 12 and 13 external exams. This means both the examination and the curriculum do not serve its purpose." (HOD Interview 7).

- The overall mean response of the students, teachers, heads of the mathematics department, and school heads indicates that the mathematics curriculum at the senior grades of secondary schools is ineffective and irrelevant and therefore needs to be reviewed.

The data below show the rating of respondents' perception of factors that contribute to poor achievement in mathematics. Out of 181 respondents, only 93 entries were analyzed since the remaining 88 entries were invalid. The responses obtained are analyzed in **Figure 3** below.

Figure 3 revealed that students' attitude and perception toward mathematics (58.1%) and poorly developed curriculum and examinations (34.3%) were the factors perceived to be significantly contributing to students' poor achievement in mathematics at the senior grades of secondary schools. The respondents perceived that teacher attitude (2.2%); teaching methodologies (2.2%); and teacher quality, performance, and qualification (4.3%) had the least impact on students' poor achievement in mathematics.

LIMITATIONS AND STRENGTHS

There was a dearth of local literature on poor achievement of students in mathematics and as such international literature was

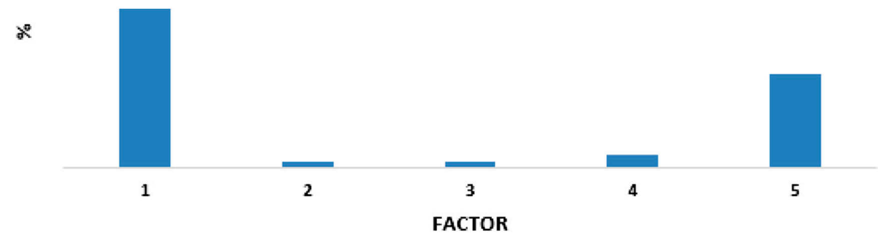

FIGURE 3 | Factors that contribute to poor achievement in mathematics **(A)**. Students' attitude and perception toward mathematics **(B)**. Teachers' attitude toward teaching mathematics **(C)**. Teaching methods used by mathematics teachers **(D)**. Quality, performance, and qualification of mathematics teachers (**E**). Poorly developed curriculum and examinations.

mostly referred to as a guide. Furthermore, time constraint was a factor since the principal researcher holds a full-time academic position during the time of this project. Hence, the sample schools chosen were around the vicinity of the principal researchers' district origin. Despite these limitations, the study utilized an expansive approach to study different dynamics contributing to students' poor achievement in mathematics from the views of students, teachers, heads of departments, and the school heads. The findings of the study also depict the notion of the problem faced in the teaching and learning of mathematics.

CONCLUSION AND RECOMMENDATIONS

The study was carried out to examine and assess the factors contributing to the poor achievement of students at the senior grades of Tavua and Ba secondary schools in Western Fiji. Students' attitude and perception toward mathematics, student perception on teachers' attitude toward mathematics, teacher methodologies, teacher qualification, and student and teacher perception on the current curriculum in mathematics were the factors studied for this research. The study found that students had a negative attitude and perception toward mathematics. Furthermore, students perceived that mathematics teachers had a positive attitude toward teaching mathematics and are fully qualified to teach mathematics at secondary school levels as far as the teaching of mathematics and delivery of the subject matter was concerned. The method of teaching by the mathematics teachers was also appropriate and was fairly justified; however, limited use of technologies by the mathematics teachers in teaching mathematics was a matter of concern among most of the students. Furthermore, the study revealed the students and educators perceive that the current mathematics curriculum for years 12 and 13 are ineffective. This implied that students' negative attitude and perception toward mathematics and the ineffective mathematics curriculum are the significant factors perceived to be significantly contributing to poor achievement of students in mathematics at the senior secondary grades. Moreover, many of the primary school teachers lacked potential and competence to teach mathematics at primary school levels, and this largely contributed toward the lack of interest among students, hence translating into poor achievement at both upper and lower secondary levels were found to be the reasons for students' negative attitude and poor performance at secondary schools.

The following recommendations are made based on the findings of the study: The mathematics curriculum at both years 12 and 13 need to be reviewed and amended in order to allow outcome-based teaching and learning to take place. The relevance and application of mathematics in real life should also be reflected in the curriculum.

The teachers, heads of departments, and the school heads have strongly emphasized (*via* interviews) the need for MEHA and CDU to involve all the academic stakeholders including even the students and mathematics teachers in regards to any consultation, reviews, and amendments to the school curriculum. Exams should not be the only method of assessing students' performance in mathematics. Internal assessments/field work/projects need to be a part of mathematics curriculum to understand mathematics better and at the same time develop interest among students with diverse needs. Students tend to learn better with technologies. There is a need for teachers to incorporate 21st century teaching tools, gadgets, and technology in teaching mathematics. Technology provides additional opportunities for students to see and interact with mathematics concepts and develop a positive attitude and perception toward the subject. Teacher quality should not be compromised at any cost, especially teachers who are responsible to teach the foundation of mathematics in primary schools. Content-focused teacher training to be implemented for primary school teachers in Fiji to teach specialized subjects in schools in order to build a good foundation among students and maintain positive attitude and perception of students toward mathematics across all levels.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

Study conception and design: SC and KC; data collection: SC; analysis and interpretation of results: SC, AP, and VC; draft manuscript preparation: SC and KC. All authors reviewed the results and approved the final version of the manuscript.

REFERENCES

1. Suleiman Y, and Hammed A. Perceived causes of students' failure in mathematics in kwara state junior secondary schools: implication for educational managers. *Int J Educ Stud Math* (2019). 6(1):19–33.
2. Enu JA, Agyman OK, and Nkum D. Factors influencing students' mathematics performance in some selected colleges of education in Ghana. *Int J Edu Learn Develop* (2015). 3(3):68–74.
3. Kafata F, and Mbetwa SK. An investigation into the failure rate in mathematics and science at grade twelve (12) examinations and its impact to the School of Engineering: a case study of Kitwe District of Zambia. *Int J Sci Technol Res* (2016). 5(8):71–93.
4. Kiwanuka HN, Van Damme J, Van Den Noortgate W, Anumendem DN, and Namusisi S. Factors affecting mathematics achievement of first-year secondary school students in central Uganda. *S Afr J Educ* (2015). 35(3):1–16. doi:10.15700/saje.v35n3a1106
5. Krajcik J. Learning progressions provide road maps for the development and validity of assessments and curriculum materials. *Meas Interdiscip Res perspective* (2011). 9(2, 3):155–8. doi:10.1080/15366367.2011.603617
6. Mbugua ZK, Kibet K, Muthaa GM, and Nkonke GR. Factors contributing to students' poor performance in mathematics at Kenya certificate of secondary education in Kenya: a case of Baringo county, Kenya. *Am Int J Contemp Res* (2012). 2:87–91.
7. Ali HH, and Jameel HT. Causes of poor performance in mathematics from teachers, parents and student's perspective. *Am Sci Res J Eng Technol Sci (Asrjets)* (2016). 15(1):122–36.
8. Karakolidis A, Pitsia V, and Emvalotis A. Mathematics low achievement in Greece: a multilevel analysis of the programme for international student assessment (PISA) 2012 data. *Themes Sci Technol Edu* (2016). 9(1):3–24.
9. Sa'ad TU, Adamu A, and Sadiq AM. The causes of poor performance in mathematics among public senior secondary school students in Azare metropolis of Bauchi State, Nigeria. *J Res Method Edu* (2014). 4(6):32. doi:10.9790/7388-04633240
10. Reddy P, Chaudhary K, Sharma B, and Chand R. He two perfect scorers for technology acceptance. *Educ Inf Technol* (2020). 25(5):1505–1526. doi:10.1007/s10639-020-10320-2
11. Chaudhary K, Dai X, and Grundy J. Experiences in developing a micro-payment system for peer-to-peer networks. *Int J Inf Technol Web Eng* (2010). 5(1):23–42. doi:10.4018/jitwe.2010010102
12. Chaudhary K, Fehnker A, and Metha V. Modelling, verification, and comparative performance analysis of the B.A.T.M.A.N. ProtocolUppsala, Sweden. In: H Hermanns and P Höfner, editors. Proceedings 2nd workshop on models for formal analysis of real systems (MARS 2017); 2017 Apr 29; Uppsala, Sweden (2017). p. 53–65.
13. Reddy P, Sharma B, and Chandra S. Student readiness and perception of tablet leaning in HE in the Pacific: a cased study of Fiji and Tuvalu. *J Cases Inf Technol* (2020). 52–69. doi:10.1109/apwc-on-cse.2016.049
14. Raj J, Raghuwaiya K, and Vanualailai J. Novel lyapunov-based autonomous controllers for quadrotors. *IEEE Access* (2020). 8:47393–406. doi:10.1109/ACCESS.2020.2979223
15. Raj J, Raghuwaiya K, Vanualailai J, and Sharma B. Navigation of car-like robots in three-dimensional space. In: 2018 5th Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE); 2018 Dec 10–12; Nadi, Fiji (2018). p. 271–5.
16. Tshabalala T, and Ncube AC. Causes of poor performance of ordinary level pupils in mathematics in rural secondary schools in nkayi district: learne' s attributions. *Med Biol Sci* (2016). 1:1–10. doi:10.20286/nova-jmbs-010113
17. Umameh M. *A survey of factors responsible for students poor performance in mathematics in senior secondary school certificate examination (SSCE) in Idah local government area of Kogi state, Nigeria*. [Master's thesis]. Benin (Nigeria): University of Benin (2011).
18. Visser M, Juan A, and Feza N. Home and school resources as predictors of mathematics performance in South Africa. *S Afr J Educ* (2015). 35(1):1–10. doi:10.15700/201503062354
19. Ke F, and Grabowski B. Gameplaying for maths learning: cooperative or not? *Br J Educ Technol* (2007). 38(2):249–59. doi:10.1111/j.1467-8535.2006.00593.x
20. Cooper S. An exploration of the potential for mathematical experiences in informal learning environments. *Visitor Stud* (2011). 14(1):48–65. doi:10.1080/10645578.2011.557628
21. Pattison S, Rubin A, and Wright T. Mathematics in informal learning environments: a summary of the literature Updated. *Math Making* (2017).
22. Sharma B, Lauano FJ, Narayan S, Anzeg A, Kumar B, and Raj J. Science teachers accelerated programme model: a joint partnership in the pacific region. *Asia Pac J Teach Educ* (2018a). 46(1):38–60. doi:10.1080/1359866x.2017.1359820
23. Sharma BN, Nand R, Naseem M, Reddy E, Narayan SS, and Reddy K. Smart learning in the Pacific: design of new pedagogical tools. In: IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE); 2018 Dec 4–7; Wollongong, NSW, Australia. IEEE (2018).
24. Sharma B, Prasad A, Narayan S, Kumar B, Singh V, Nusair S, et al. Partnerships with governments to implement in-country science programmes in the South pacific region. In: IEEE Asia-Pacific Conference on Computer Science and Data Engineering; 2019 Dec 9–11; Melbourne, Australia. IEEE (2019). p. 1–6.
25. Naiker M, Sharma B, Wakeling L, Johnson JB, Mani J, Kumar B, et al. Attitudes towards science among senior secondary students in Fiji. *Waikato J Edu* (2020). doi:10.15663/wje.v25i0.704
26. Akhter N, and Akhter N. Learning in mathematics: difficulties and perceptions of students. *J Educ Res* (2018). 21(1):1027–9776.
27. Gafoor KA, and Kurukkan A. Why high school students feel mathematics difficult? An exploration of affective beliefs. In: Pedagogy of Teacher Education: Trends and Challenges, At: Farook Traiing College; 2015 Jan 30–31; Kerala, India (2015).
28. Sharma B, Fonolahi A, Bali A, and Narayan S. The online mathematics diagnostic tool for transformative learning in the pacific. In: A Singh, S Raghunathan, E Robeck, and B Sharma, editors *Cases on smart learning environments*. Hershey, Pennsylvania: IGI Global (2018). p. 63–80.
29. Ampadu E. Students' perceptions of their teachers' teaching of mathematics: the case of Ghana. *Int Online J Educ Sci* (2012). 4(2).
30. Daso PO. Strategies for teaching and sustaining mathematics as an indispensable tool for technological development in Nigeria. *Mediterr J Soc Sci* (2012). 3(15):74.
31. Chidi O. *History of education, A global trend. Enugu. Printed by fabson graphic production* (2007).
32. Yan C. 'We can't change much unless the exams change': teachers' dilemmas in the curriculum reform in China. *Improving Schools* (2014). 18(1):5–19. doi:10.1177/1365480214553744
33. Yeh CY, Cheng HN, Chen ZH, Liao CC, and Chan TW. Enhancing achievement and interest in mathematics learning through math-island. *Res Pract Technol Enhanc Learn* (2019). 14(1):5. doi:10.1186/s41039-019-0100-9
34. Nicholas J, Poladian L, Mack J, and Wilson R. Mathematics preparation for university: entry, pathways and impact on performance in first year science and mathematics subjects. *Int J Innovation Sci Math Edu* (2015). 23(1).
35. Deo D. Serious concerns raised in relation to low pass rates for Year 13 Mathematics. Fiji Village (2013). Available from: https://www.fijivillage.com/news/Serious-concerns-raised-in-relation-to-low-pass-rates-for-Year-13-Mathematics-s5rk29/.
36. Chand S. Mathematics year 13 Low Pass Rate Hurts Mass. Fiji Sun (2013). Available from: https://fijisun.com.fj/2019/12/14/mathematics-year-13-low-pass-rate-hurts-mass/.
37. Radhika R. Fiji national university backs decision on maths intake mark. Fiji sun (2013). Available from: https://fijisun.com.fj/2020/01/31/fiji-national-university-backs-decision-on-maths-intake-mark/.
38. Ministry of Education. Heritage and Arts, Fiji Strategic plan (2019). : Available from: http://www.education.gov.fj/wp-content/uploads/2019/11/MEHA-SP-2019-2023-Short-Version-26082019.pdf (Accessed December 3, 2020).
39. Kupari P, and Nissinen K. Background factors behind mathematics achievement in Finnish education context: explanatory models based on TIMSS 1999 and TIMSS 2011 data. (2013). Proceedings: IEA conference 2013. 17–21 June, 2013. Available at: http://iea-aie2013.few.vu.nl/index.shtml
40. Yang X. Investigation of junior secondary students' perceptions of mathematics classroom learning environments in China. *Eurasia J Math Sci Technol Educ* (2013). 9(3):273–84. doi:10.12973/eurasia.2013.935a
41. Ifeoma OJ, Chinyere AS, Efeyadu UH, and Juliana A. Perceived factors influencing academic performance of students in accounting in secondary schools in anambra state. *IOSR J Humanities Soc Sci* (2017). 22(2):96–9. doi:10.9790/0837-2202039699

42. Kizito R, Munyakazi J, and Basuayi C. Factors affecting student success in a first-year mathematics course: a South African experience. *Int J Math Educ Sci Technol* (2016). 47(1):100–19. doi:10.1080/0020739x.2015.1057247
43. Dayal HC. Teachers' perceptions of teaching mathematics at the senior secondary level in Fiji. *Aust Senior Math J* (2013). 27(2):25.
44. Prasad B. Fiji secondary mathematics: looking ahead. *Directions* (1991). 36–41.
45. Ministry of Education. *Educating Fiji: Examination free system. Fiji Sun* (2015). Available from: https://fijisun.com.fj/2010/08/13/educating-fiji-examination-free-system/ (Accessed December 3, 2020).
46. Cava L. Why Scaling Was Scrapped: Reddy. Fiji Sun (2015). Available from: https://fijisun.com.fj/2015/02/11/why-scaling-was-scrapped-reddy/ (Accessed December 3, 2020).
47. Mala S. Reddy Concerned with Quality Of Graduates. Fiji Sun (2015). Available from: https://fijisun.com.fj/2015/09/08/reddy-concerned-with-quality-of-graduates/ (Accessed December 2, 2020).
48. Nacei L. Quality of education and graduates not up to par. Fiji Sun (2016). Available from: https://fijisun.com.fj/2016/01/08/quality-of-education-and-graduates-not-up-to-par/ (Accessed December 3, 2020).
49. Ministry of Education. Fiji. 2019 TEACHER PRIORITY AREAS: Available from: http://www.education.gov.fj/wp-content/uploads/2019/03/2019-Teacher-Priority-Areas.pdf (Accessed December 5, 2020).
50. Hannula MS. Attitude towards mathematics: emotions, expectations and values. *Educ Stud Math* (2002). 49(1):25–46. doi:10.1023/a:1016048823497
51. Binti Maat SM, and Zakaria E. The learning environment, teacher's factor and students attitude towards mathematics amongst engineering technology students. *Int J Acad Res* (2010). 2(2).
52. Karasel N, Ayda O, and Tezer M. The relationship between mathematics anxiety and mathematical problem solving skills among primary school students. *Proced Soc Behav Sci* (2010). 2(2):5804–7. doi:10.1016/j.sbspro.2010.03.946
53. Mazana M, Suero Montero C, and Casmir R. Investigating students' attitude towards learning mathematics. *Int Electron J Math Edu* (2018). 14. doi:10.29333/iejme/3997
54. Mistima S, Maat B, and Zakaria E. The learning environment, teacher's factor and students' attitude towards Mathematics amongst engineering technology students. *Int. J. Acad. Res.* (2010). 2: 16–20.
55. Mohamed L, and Waheed H. Secondary students' attitude towards mathematics in a selected school of Maldives. *Int J Humanit Soc Sci* (2011). 1(15):277–81.
56. Nicolaidou M, and Philippou G. Attitudes towards mathematics, self-efficacy and achievement in problem solving. *Eur Res Math Edu* (2004). 3:2.
57. Tuimavana R, and Datt N. Teachers attitude towards teaching mathematics at upper primary levels in Fiji's primary schools: a case study of the Western primary schools. *Int J Humanities Cult Stud (Ijhcs) ISSN* (2017). (4) 272–93.
58. Reddy E, Sharma B, Reddy P, and Dakuidreketi M. Mobile learning readiness and ICT competency: a case study of senior secondary school students in the Pacific Islands. In: 4th asia-pacific world congress on computer science and engineering (APWC on CSE). 2017 Dec 11–13; Suva, Fiji. IEEE (2017). p. 137–43.
59. Reddy E, and Sharma B. Mobile learning perception and attitude of secondary school students in the pacific islands. In: Proceedings of the 22nd pacific asia conference on information ystems (PACIS 2018); 2018 Jan 26; Yokohama, Japan. AIS (2018). Available from: https://aisel.aisnet.org/pacis2018/319.
60. Uusimaki L, and Nason R. Causes underlying pre-service teachers' negative beliefs and anxieties about mathematics. In: Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education; 2004 July 14–18; Bergen, Norway. (2004).
61. Onuoha JC, and Eze E. Students' attitude towards the study of geography in Nsukka local government area, Enugu state. *Afr Rev Arts Soc Sci Edu* (2014). 3:141–57.
62. Yılmaz Ç, Altun SA, and Olkun S. Factors affecting students' attidude towards Math: ABC theory and its reflection on practice. *Proced Soc Behav Sci* (2010). 2(2):4502–6. doi:10.1016/j.sbspro.2010.03.720
63. Cronhjort M, Filipsson L, and Weurlander M. Improved engagement and learning in flipped-classroom calculus. *Teach Math its Appl Int J IMA* (2018). 37(3):113–21. doi:10.1093/teamat/hrx007
64. Igwe A, and Ikatule O. *Effects of computer tutorial and drill (CTD) on senior secondary school students' achievement in basic electronics in Lagos State*. [PhD thesis]. Nsukka (Nigeria): University of Nigeria (2011).
65. Obikwere F. Breaking the jinx in mathematics understand. *Daily Indep* (2008). 3:3008.
66. Ferreira MM. The effect of an after-school program addressing the gender and minority achievement gaps in science, mathematics, and engineering. *ERS Spectr* (2001). 19(2):11–8.
67. Johnson D, and Johnson R. Cooperative learning: improving university instruction by basing practice on validated theory. *J Excell Coll Teach* (2015). 25:85–118.
68. Lal N. Title: critical evaluation of teacher's role in implementing cooperative learning in the mathematics class in Fiji. *Int J Educ Res (Dhaka)* (2016). 4.
69. Keong CC, Horani S, and Daniel J. A study on the use of ICT in mathematics teaching. *Malaysian Online J Inst Technol* (2005). 2(3):43–51.
70. Totaram RL. *Investigating the use of ICT tools to teach year 1 mathematics in Fiji: creating interactive learning activities to teach numeracy skills*. [Master's thesis]. Pretoria (South Africa): University of South Africa (2018).
71. Reddy P, Sharma B, and Chaudhary K. Measuring the digital competency of freshmen at a higher education institute. In: PACIS 2020 proceedings AIS Electronic Library (AISeL); 2020 June 20–24 (2020b). p. 1–13.
72. Reddy P, Sharma B, and Chaudhary K. Digital literacy: a review of literature. *Int J Technoethics* (2005). 11(2):65–94. doi:10.4018/IJT.20200701.oa1
73. Ittigson R, and Zewe J. "Technology in the mathematics classroom" in *Challenges of teaching with technology across the curriculum: Issues and solutions*, Pennsylvania, United States: IGI Global (2003). p. 114–33.
74. Popoola F, and Olarewaju R. Factors responsible for poor performance of students in mathematics in nigerian secondary schools. *J Res Educ Soc* (2010). 1(2):55–65.
75. Mji A, and Makgato M. Factors associated with high school learners' poor performance: a spotlight on mathematics and physical science. *S Afr J Educ* (2006). 26(2):253–66.
76. Prakitipong N, and Nakamura S. Analysis of mathematics performance of grade five students in Thailand using newman procedure. *Kokusai Kyoiku Kyoryoku Ronshu* (2006). 9(1):111–22.
77. Arends F, Winnaar L, and Mosimege M. Teacher classroom practices and mathematics performance in south African schools: a reflection on TIMSS 2011. *South Afr J Edu* (2017). 37(3). doi:10.15700/saje.v37n3a1362
78. Betiku OF. Causes of mass failures in mathematics examination among students a commissioned paper presented at government secondary school. Karu Abuja Science Day 1st March. 2001.
79. Kalhotra SK. A study of causes of failure in mathematics at high school stage. *Acad Res Int* (2013). 4(5):588.
80. Lingam GI. *Planning for teacher supply and demand for Fiji primary schools*. Pretoria (South Africa): University of the South Pacific (1996).
81. Khan MII. *The need for reforms in educational assessment in primary schools in Fiji for the 21st century*. [Master's thesis]. Pretoria (South Africa): University of the South Pacific (2017).
82. Legotlo M, Maaga M, and Sebego M. Perceptions of stakeholders on causes of poor performance in Grade 12 in a province in South Africa. *S Afr J Educ* (2002). 22(2):113–8.
83. Lockheed ME, and Verspoor AM. *Improving primary education in developing countries*. New York, NY: Oxford University Press for World Bank (1991). p. 93.
84. Psacharopoulos G, and Woodhall ML. *Education pour le developpement: une analyse des choix d'investissement*. Washington, DC: The World Bank (1985).
85. Dayal HC, and Lingam GI. Fijian teachers' conceptions of assessment. *Aust J Teach Edu* (2015). 40(8):43–58. doi:10.14221/ajte.2015v40n8.3
86. Kumar J. *Teachers'and students'perceptions and experiences of mathematics assessments in Fiji: a case study of a rural and an urban primary school.* [Master's thesis]. Pretoria (South Africa): University of the South Pacific (2018).
87. French S, and Kennedy G. *Reassessing the Value of University Lectures. Issues and ideas paper*, Parkville, VIC, Australia: Melbourne Centre for the Study of Higher Education (2016).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.