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Science Performance of Indigenous Students: A Study from Mahiyanganaya Zone of Education, Sri Lanka

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ABSTRACT

Science education is a vital component for the well-being of individuals and entire nations in the current world. Contemporary research has paid greater attention to the science education of indigenous people. Sri Lanka is home to a longstanding indigenous population called Vedda people and Vedda children learn science alongside with mainstream children at schools. However, research on their science education is scarce. Hence, this study aimed to examine the science performance of Vedda students. This study was conducted in two selected schools (school "A" and school "B") with secondary-level (Grades 6 to 11) Vedda students in Mahiyanganaya Zone of Education, Sri Lanka. The term test science marks (2018 and 2019) and General Certificate of Examination (Ordinary Level) or G.C.E. (O/L) science results (2018, 2019, and 2020) were analyzed descriptively to measure science performance of Vedda students. Results depicted poor science performance of Vedda students and their mainstream counterparts. However, science performance of Vedda students was even lower than that of the mainstream students. Science performance of the students could be affected by different factors related to the schools, curriculum, teachers, students, parents, etc. Hence, it is crucial to investigate the factors that impede science performance of students in the above schools, especially paying attention to Vedda students as they learn alongside with mainstream students.

Keywords: Science education, Science performance, Vedda, Mainstream, Students

INTRODUCTION

Science has marked its position as a field that is indispensable for the survival and development of modern human beings. Science has played a major role in shaping the world and human history. Progress in science has positively influenced the well-being of individuals and whole nations throughout the world. Science provides liberty, vital knowledge, and capabilities for individuals for a successful life in society. It can be mentioned that science is vital for every person to make decisions relevant to their lives, to become an informed person in society, and make decisions related to the occupation [1]. It also improves the quality of life of individuals.

In the current context, scientific literacy is a must and almost all the nations that admire social and economic development try to enhance the scientific literacy of their citizens [2], [3], [4]. Through science education, a country could impart scientific knowledge, skills, and attitudes to their citizens. Therefore, science education is also vital for the development of any nation in the world. Science education is generally considered as sharing scientific knowledge and skills among the general public who are not considered as

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members of the scientific community [4]. They can be laypeople such as school students, peasants, laborers, and journalists who are not actively engaged in scientific research and publication.

Contemporary literature pertinent to science education has paid greater attention to culturally relevant science education and teaching science in multicultural classrooms for better science learning of those with a non-Western cultural background, especially indigenous students [5], [6].

The term indigenous can be defined in different ways. According to [7], indigenous peoples can be identified as, tribal members living in independent countries and people that can be separately identified by social, cultural, and economic aspects from the rest of the members in those nations.

International literature illustrates that there are numerous studies carried out on the science education of indigenous students. Studies on the performance of science, participation in science learning, issues for teachers and students pertinent to science teaching and learning, place of indigenous knowledge in school science curricula, and ways and means of enhancing science education were commonly conducted [6], [8], [9], [10].

However, indigenous people are under-represented in science-related courses even in developed countries like Australia and the United States of America. [11] stated that indigenous students in Australia are under-represented in school education. [9] reported that Native Americans are under-represented in science and related careers. [12] reported the science achievement gap in indigenous Australian students. According to Programme for International Student Assessment (PISA) results in 2012, only 2% of the indigenous students were top performers compared to non-indigenous students. In contrast, 37% of the indigenous students were low performers compared to 13% of non-indigenous students [12]. According to [8], indigenous Australian students were performing poorly compared to non-indigenous students. [10] reported that indigenous students in Australia fell well behind the non-indigenous students of Australia in the Trends in International Mathematics and Science Study (TIMSS) in 2003. In the above assessment, Year 8 indigenous students fell 72 points behind the non-indigenous counterparts and 16 points behind the international mean.

[6] presents evidence on the achievement gap between indigenous students and non-indigenous students in STEM-related (Science, Technology, Engineering, and Mathematics) subjects in Australia. In terms of performance, 15-year-old indigenous students were lagging two and half years behind compared to their non-indigenous peers in Australia. It had been shown that progress was slower despite the attempts made by the government to improve the level of science education of indigenous students [13]. Therefore, [6] stated that STEM performance would not be increased through usual methods of teaching. [6] expressed that even though culture was valued in contemporary science education literature, there were issues with the usage of culture in the science teaching-learning process. [6] stated that teachers should make the relevant connection between the home culture and school science culture of indigenous students. It was also suggested that research should be conducted on how to use diverse knowledge systems as resources for STEM and on the ways and means that can be attempted to discuss mismatches between indigenous knowledge and STEM. Further, it was mentioned that the whole school system should support culturally sensitive pedagogies for STEM. [14] stated that indigenous knowledge should be facilitated more than ever because indigenous knowledge systems were in danger of assimilation or complete eradication due to globalization. Lack of cultural relevance in science curricula has been emphasized as one of the main challenges for indigenous students in science education.

The underachievement of indigenous students in science was highlighted by [14] as well. The conflict between school science culture and home culture, poor self-esteem, poor teacher expectations on indigenous students, poor knowledge of teachers on the subject, culture, and teaching methodologies, and inflexibility in science curriculum were suggested as reasons for the above underachievement.

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Sri Lankan human population also consists of both indigenous people and mainstream people (non-indigenous). Veddas represent indigenous peoples in Sri Lanka. They are a group of people inhabiting the island for thousands of years. Initially, they were found throughout the island but now confined to a limited area known as “Vedi Rata” or “MahaVedi Rata” from Hunnasgiriya mountains to lowlands down to the sea in the east. They have faced many internal and external stresses over the history and currently they are undergoing stresses that lead to modernize their culture [15].

Vedda people in Sri Lanka are also considered under the compulsory education laws. Hence, Vedda students have to attend schools with non-indigenous students and follow the same formal education system including science. According to [15], Vedda communities in Sri Lanka are not prepared for formal education system existing in the island. This is supported by the poor educational achievements of Vedda students in Sri Lanka. There are only eight members from the Vedda community who have obtained degree level qualifications. In the General Certificate of Education (Advanced Level) or G.C.E. (A/L) only 1% of Vedda students qualify while only 2% pass the General Certificate of Education (Ordinary Level) or G.C.E. (O/L) examination. Moreover, Vedda students show high rates of dropouts, 40% at the primary level and 36% at the secondary level. Apart from dropouts, 21% of the Vedda students left behind with no schooling at all [15].

Even though, Sri Lanka is an island consists of a longstanding indigenous community and they learn science alongside with mainstream students, there is a huge gap in literature on the formal education of Vedda people, especially in science. Hence, the main objective of this study was to examine the science performance of Vedda students in two selected schools in Mahiyanganaya Zone of Education, Sri Lanka.

METHODOLOGY

This study was conducted in two selected schools (school “A” and school “B”) with secondary-level (Grades 6 to 11) Vedda students in Mahiyanganaya Zone of Education, Sri Lanka. School “A” was a Type 2 school where there were classes from Grade 1 to 11 and school “B” was a 1AB school where there were classes from Grade 6 to 13 with G.C.E. (A/L) science. The above schools were mixed schools and the medium of instruction was Sinhala. In terms of the total number of students in the secondary level classes (Grades 6 to 11), school “A” and school “B” had 101 and 1,325 students respectively at the beginning of data collection in 2018. School “A” had only one class in each grade. In contrast, school “B” had six parallel classes in Grade 6 and five parallel classes from Grade 7 to 11. The school “A” and School “B” were selected because of the availability of secondary level classes up to Grade 11 and those were the schools that the majority of the secondary level Vedda students attended in Mahiyanganaya Zone of Education to the best knowledge of the researcher.

The term test science marks and G.C.E. (O/L) science results were considered to measure science performance of Vedda students of school “A” and school “B”. A school year in Sri Lanka consists of three terms and the G.C.E. (O/L) is a national examination that is held at the end of Grade 11. Science terms test marks of the students in classes with Vedda students in 2018 and 2019 were collected from relevant results record books. Grades for G.C.E. (O/L) science subject of the candidates of 2018, 2019, and 2020 were collected from G.C.E. (O/L) examination result sheets. Term test science marks were analyzed to find the class average and average marks of Vedda students. G.C.E. (O/L) grades were also analyzed as percentages for all candidates and Vedda students.

RESULTS

Results of the analysis of term test marks and G.C.E. (O/L) grades are given separately according to each school.

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A. Term Test Science Results of School "A"

There were Vedda students in all the Grades (each Grade had only one class) of school "A". The average marks of Vedda students for science in the first term of 2018 were above the class science averages in Grades 7, 10 and 11(Fig. 1). The average marks for science of the Vedda students were higher than class average in Grades 6, 7, 10 and 11 in the second term test of 2018 (Fig. 2). In the third term, average science marks of Vedda students in Grade 10 and 11 were above the class averages (Fig. 3).

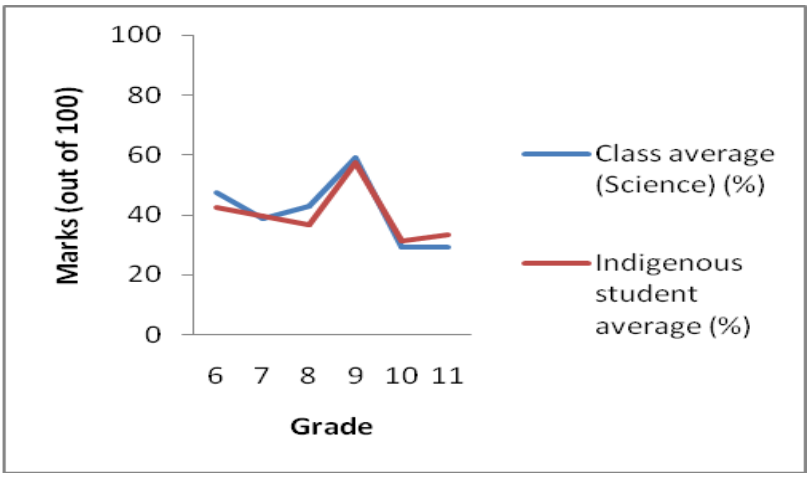

Fig. 1. First term test science results of school "A" in 2018

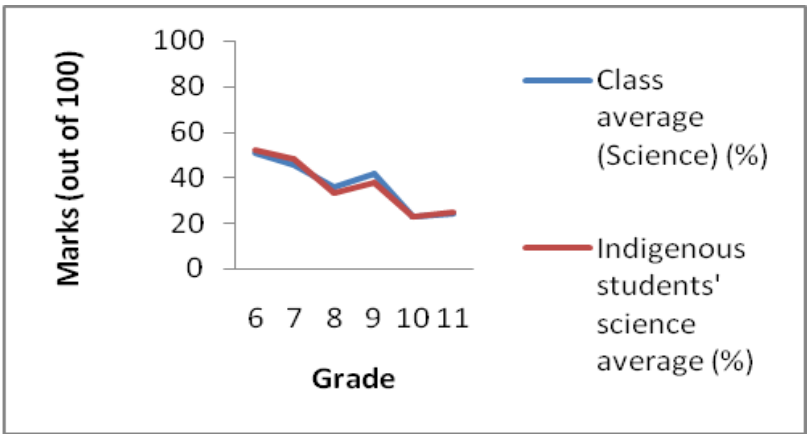

Fig. 2. Second term test science results of school "A" in 2018

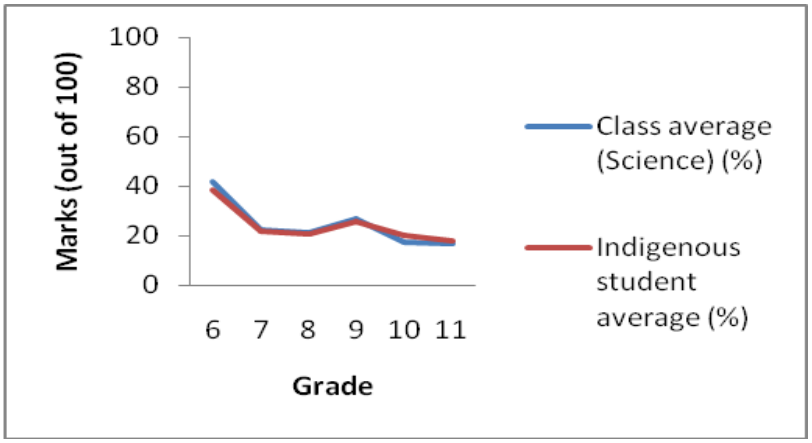

Fig. 3. Third term test science results of school "A" in 2018

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First term test marks of only Grade 9 and 10 were available for 2019 (Fig. 4) at school "A". Science marks of the rest of the classes for the first term test and science marks for the second term and third term of 2019 were not available. Science average marks of Vedda students were higher than the class average in Grade 9. In contrast, Grade 10 science class average was higher compared to the average of Vedda students.

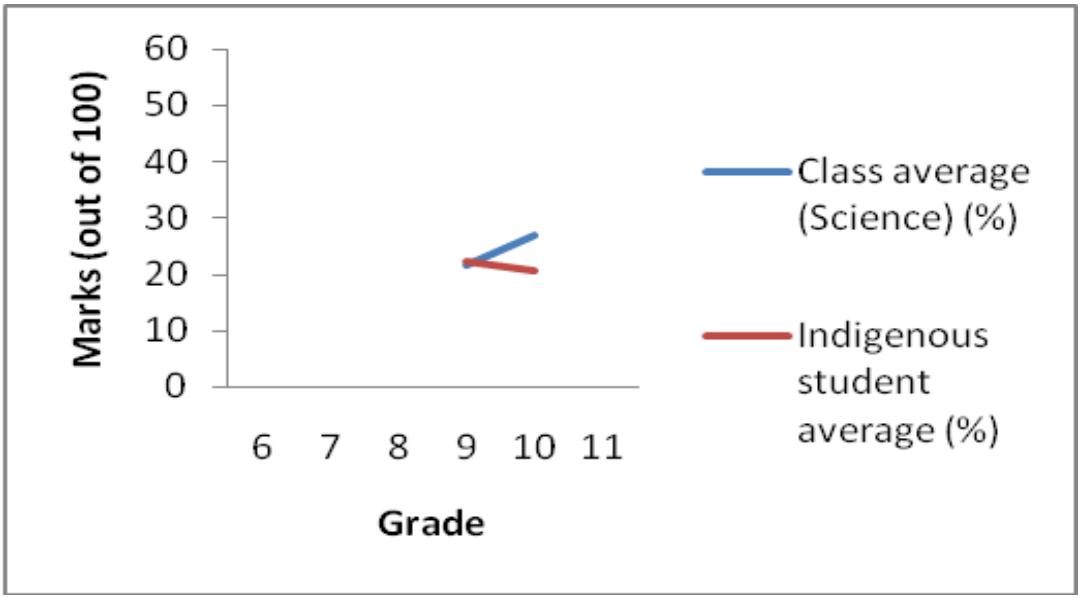

Fig. 4. First term test science results of school "A" in 2019

B. Term Test Science Results of School "B"

There were 9 classes with Vedda students in school "B" in 2018. They were, one class each from Grades 8, 9 and 10, and two classes each from Grade 6,7 and 11. The average marks of Vedda students for science were above the class averages only in three classes in the first term test of 2018 (Fig. 5). Those classes were 6B, 9D, and 11D. In the second term test of 2018, only Grade 6B and Grade 11D showed a higher average for science in Vedda students compared to class average (Fig. 6). There were two occasions (Grades 6B and 8B) where the science average marks of Vedda students were higher than the class average in the third term test of 2018 (Fig. 7). The class average of Grade 10E was not able to calculate as the data was not clear.

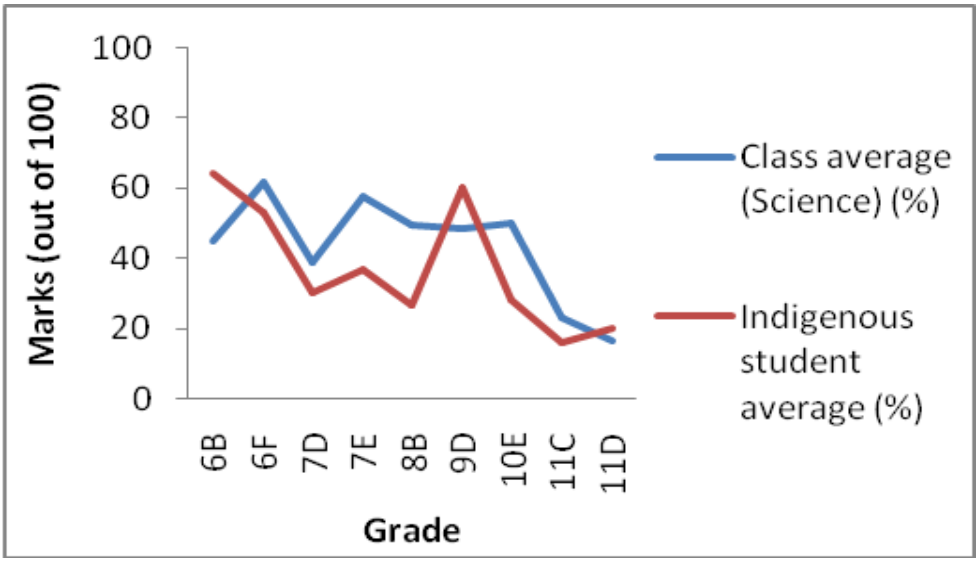

Fig. 5. First term test science results of school "B" in 2018

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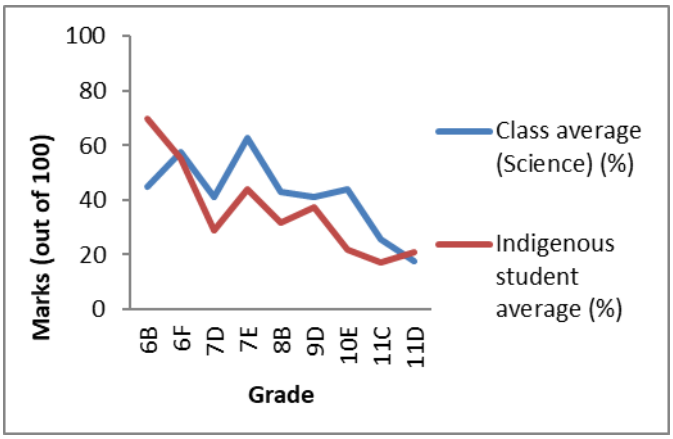

Fig. 6. Second term test science results of school "B" in 2018

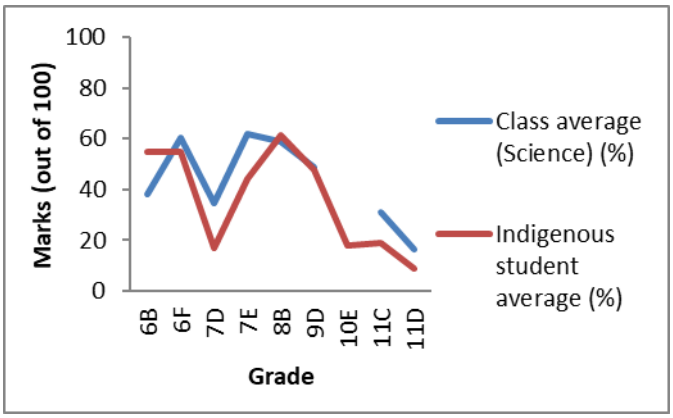

Fig. 7. Third term test science results of school "B" in 2018

There were 10 classes with indigenous students in school "B" in 2019. They were (one class each from Grades 7, 9, 10 and 11, two classes from Grade 6 and four classes from Grade 8. In the first term test of 2019, average science marks of Vedda students of three classes (6A, 6F and 7D) were above that of the class average (Fig. 8). Grades 6A, 6F, and 8C had higher averages for science in Vedda students compared to class average in the second term test in 2019 (Fig. 9). There were three occasions where the science average marks of Vedda students were higher than the class science average in the third term test of 2019 (Fig. 10). Those occasions were 6A, 7D and 9E.

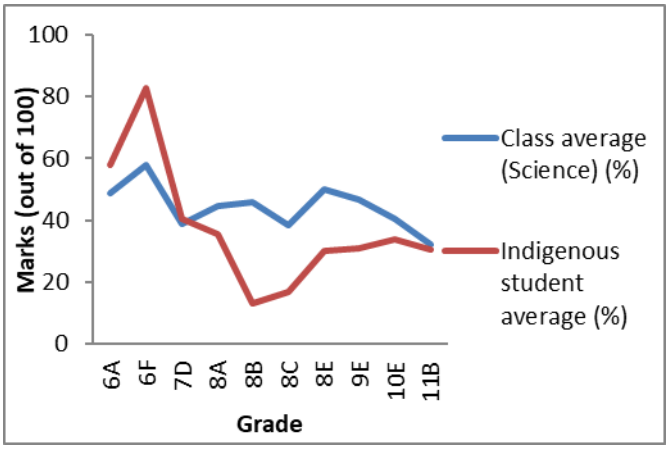

Fig. 8. First term test science results of school "B" in 2019

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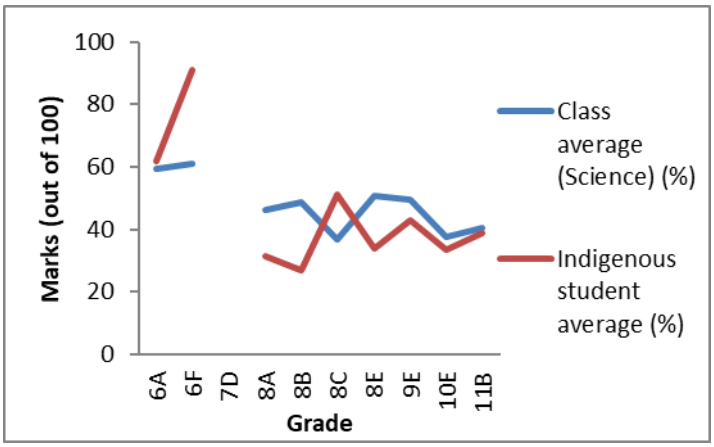

Fig 9. Second term test science results of school "B" in 2019

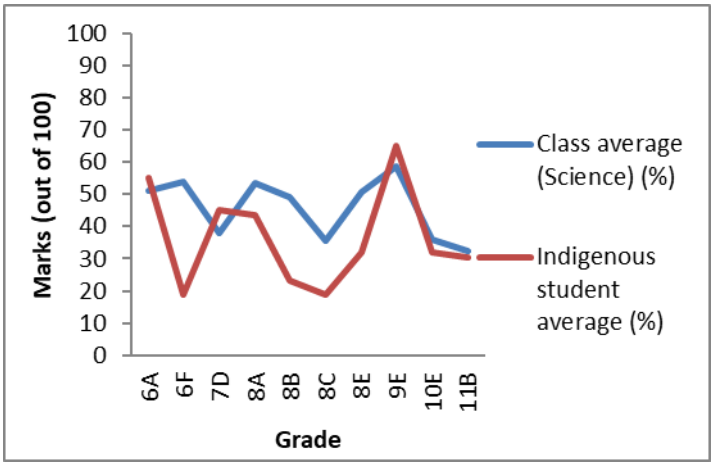

Fig. 10. Third term test science results of school "B" in 2019

- **C.E. (O/L) Examination Results of School "A"**

In school "A", results of the 2018 G.C.E. (O/L) examination showed that 91% of total candidates sat (10 of the 11 candidates) failed the science subject and only one mainstream student had passed science. The above student had a "Simple Pass" (S). Three mainstream candidates were absent to the science examination. There were 3 Vedda candidates and all of them had failed science (Fig. 11).

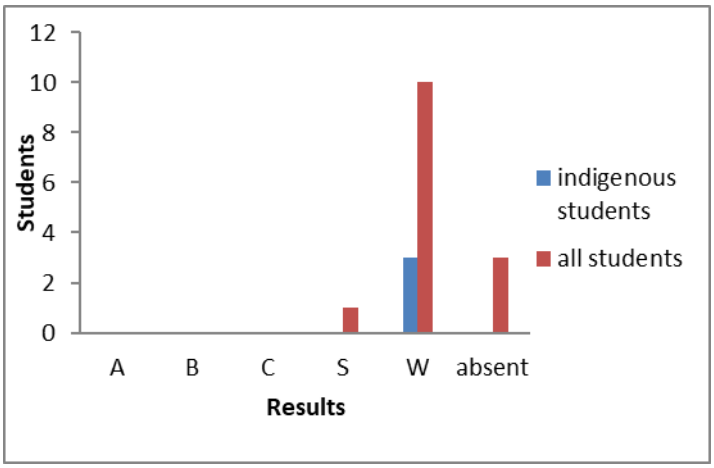

Fig. 11. G.C.E. (O/L) 2018 science results of school "A"

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The 2019 G.C.E. (O/L) examination results showed that 3 of the 6 candidates sat had passed science. There were 3 students who had failed science and another 3 students who were absent to the above science examination. However, the 3 students who passed science were mainstream students and all of them had achieved "Simple Passes" (S). From the 3 Vedda candidates, 2 had failed the examination and the other candidate was absent to the examination (Fig. 12).

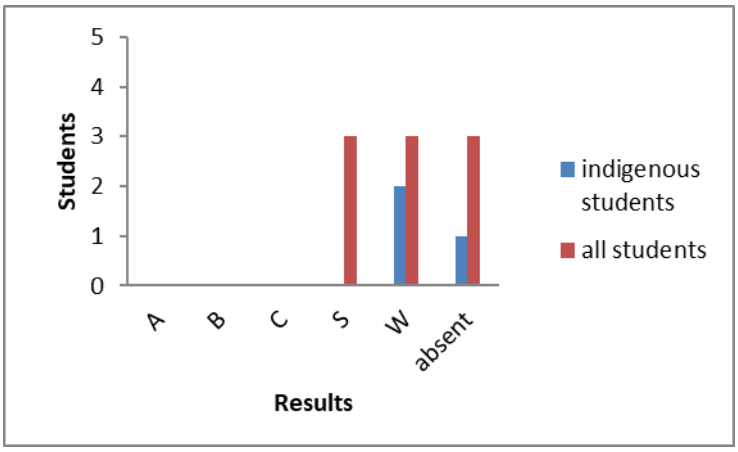

Fig. 12. G.C.E. (O/L) 2019 science results of school "A"

According to the G.C.E. (O/L) examination results of 2020, 3 of the 8 candidates sat had passed science (37.5%). However, all those students who had passed science were mainstream students and one student had passed with a "Credit Pass" (C) whereas the other two had "Simple Passes" (S). On the other hand, 1 of the 5 Vedda candidates were absent to the above examination and the remaining 4 candidates had failed science (Fig. 13).

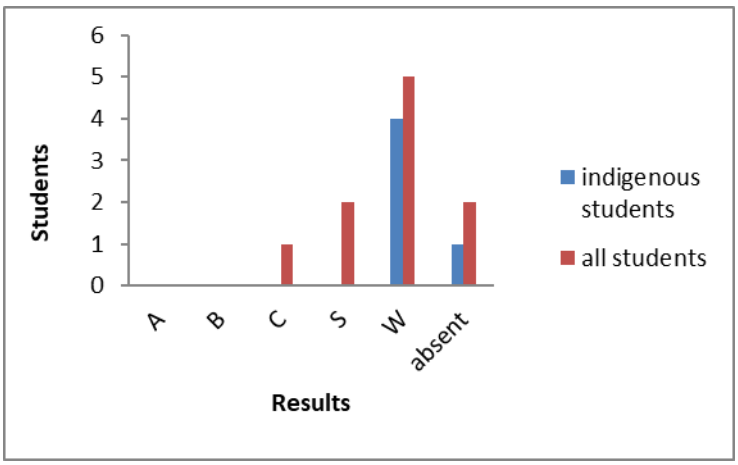

Fig. 13. G.C.E. (O/L) 2020 science results of school "A"

D. G.C.E. (O/L) Examination Results of School "B"

The 2018 results showed that 54% of all the candidates sat (164 including both mainstream and Vedda students) passed science and 22% of the all candidates had grades higher than "Simple Pass" (S). However, 60% of the students who passed science had "Simple Passes" (S). Further, 46% of the all candidates sat had failed science. Only a 4% and 5% of total candidates had taken "Distinction Passes" (A) and "Very Good Passes" (B) respectively (all of them were mainstream students). There were 6 Vedda candidates and 4 (66%) of them had passed science with Simple Passes. However, the other two (33%) had failed science (Fig. 14).

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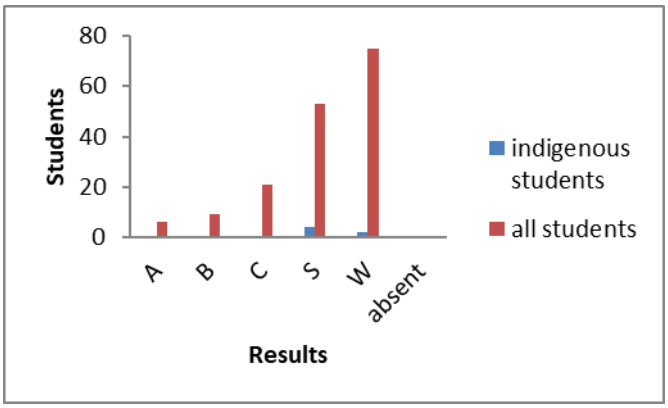

Fig. 14. G.C.E. (O/L) 2018 science results school "B"

The 2019 G.C.E. (O/L) examination results showed that 65% of the total 175 candidates sat had passed science. There were 4% "Distinction Passes" (A) and 3% "Very Good Passes" (B). However, majority (62%) of passed students had taken "Simple Passes" (S). Further, 35% of the total candidates sat had failed science. There were only 2 Vedda candidates and one of them had passed science with a "Credit Pass" (C) but the other students had failed science (Fig. 15).

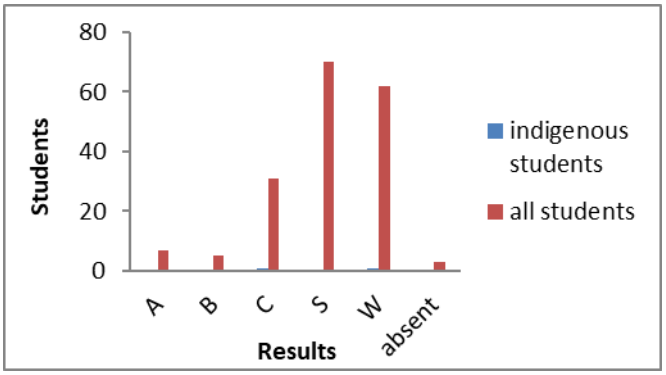

Fig. 15. G.C.E. (O/L) 2019 science results of school "B"

According to the G.C.E. (O/L) examination results of 2020, 66% of the 190 total candidates sat had passed science. From the total candidates sat, 7% and 6% had taken "Distinction Passes" (A) and 3% "Very Good Passes" (B) respectively. However, 50% of the students who passed science had taken "Simple Passes" (S). Further, 34% of the total candidates sat had failed science. There were 2 Vedda candidates and only one had passed science (with a "Simple Pass" (S) (Fig. 16).

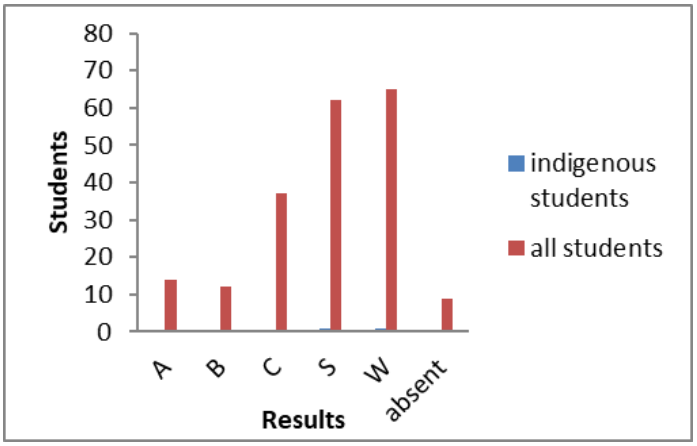

Fig. 16. G.C.E. (O/L) 2020 science results of school "B"

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DISCUSSION

This study was conducted to examine the science performance of Vedda students in two selected schools in Mahiyanganaya Zone of Education, Sri Lanka. The term test science marks showed that the class averages and average marks of Vedda students were at a moderate level. In most of the terms, class average science marks and the average science marks of Vedda students showed a declining trend from Grade 6 to Grade 11. It was also shown that the science marks of the Vedda students in school "A" and school "B" often followed a similar pattern to the class averages. Moreover, most often science average marks of indigenous students were even less than that of class average science marks of school "A" and school "B" in the years 2018 and 2019. However, 2019 term test marks were unavailable for the first term (except for Grades 9 and 10), second term, and third term in school "A". In addition, average marks of Grade 10E in the third term of 2018 and 7D in the second term in 2019 of school "B" were unavailable.

G.C.E. (O/L) results depicted poor science performance of both mainstream and indigenous students in the two selected schools. There was no indigenous student who passed science from 2018 to 2020 in school "A". Apart from that the highest grade achieved by a mainstream student was a "Credit Pass" (C) since 2018 to 2020 in the above school. In contrast, there were six indigenous students who had passed G.C.E. (O/L) science from 2018 to 2020 in school "B" (pass rates with respect to the number of indigenous candidates from the school were 66.66%, 50% and 50% in 2018, 2019 and 2020 respectively). However, except on one occasion, no indigenous students had passed science taking a grade above a "Credit Pass" (C) from 2018 to 2020 in school "B". Moreover, the majority of the students who passed science had "Simple Pass" (S) grades in the selected schools. In addition, both selected schools had lower pass rates compared to that of the island's average pass rate in the G.C.E. (O/L) science.

In terms of the island's G.C.E. (O/L) science pass rates, 69.83%, 65.45%, and 69.07% of the school candidates who sat the first attempt had passed science in 2018, 2019, and 2020 respectively [16]. Accordingly, the gap between the science pass rate of school "B" and the island's average rate is comparatively smaller (15.83% in 2018, 0.45% in 2019 and 3.07% in 2020) compared to the relatively wide difference between the science pass rate in school "A" and that of the island's rate (60.83% in 2018, 15.45% in 2019 and 31.5% in 2020).

There is no literature on science achievement of Vedda students in Sri Lanka. However, [15] provided evidence on the low-level of educational attainment of the Vedda people. According to the above authors, the majority of the Vedda members in the indigenous settlement associated with school "A" and school "B" had attained only up to primary level education. There were only 2% of Vedda members who had attained G.C.E. (O/L). Hence, the poor performance in science among Vedda students exemplified the findings of [15]. Further, the above finding confirms the gap in educational attainment between rural and urban populations as the study was conducted in two rural schools [17]. The above findings also confirm the international literature on underperformance and achievement gap between indigenous students and mainstream students in science [6], [8], [10], [12].

The declining trend in the class average science marks and the average science marks of Vedda students from Grade 6 to Grade 11 in most of the term tests could be due to the increasing complexity of the science subject along the above grades. The unavailability of science term test marks of school "A" in 2019 (except science marks of Grades 9 and 10 in the first term test) is due to the lack of a permanent science teacher in school "A" since the end of 2018. However, average marks of Grade 10E in the third term of 2018 and 7D in the second term in 2019 of school "B" were not calculated due to the poor clarity of data recorded at the school.

The extremely poor science performance of Vedda students in school "A" at G.C.E. (O/L) examinations from 2018 to 2020 (pass rate 0%) could be mainly due to the lack of a permanent science teacher. The

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comparatively better science performance of school "B" could be due to the enhanced interest of students and support from the school and parents towards science education compared to those of school "A".

It could be assumed that factors such as the conflict between school science culture and home culture, poor self-esteem, poor teacher expectations on Vedda students, poor knowledge of teachers on culture and teaching methodologies, inflexibility in science curriculum, [14], lower educational attainment and unawareness of parents [15], shortages in human and physical resources, financial constraints, lack of academic assistance from parents affect the above underachievement of Vedda students.

CONCLUSION

The above study was conducted to examine the science performance of Vedda students in two selected schools in Mahiyanganaya Zone of Education, Sri Lanka. Results depicted comparatively poor science performance of Vedda students and their mainstream counterparts. However, science performance of Vedda students was even lower than that of the mainstream students. Science performance of the students could be affected by different factors related to the schools, curriculum, teachers, students, parents, etc. Hence, it is crucial to investigate the factors that impede science performance of students in the above schools, especially paying attention to Vedda students as they learn alongside with mainstream students.

Resolving teacher shortages, improving the awareness of parents about science education and enhancing the cultural relevance of the science curriculum could be suggested as possible steps to develop science performance of students in the selected schools.

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