



Effect of Gender Perspective towards Performance of Chemistry Education in Secondary School: Case Study of Three Selected Schools of Gicumbi District in North-East of Rwanda

*Evangeline Irakoze, Emmanuel Gakuba & Claude Karegeya

Chemistry Education, African Centre of Excellence in Innovative Teaching and learning Mathematics and Science (ACE-ITLMS), College of Education, University of Rwanda, Rwanda

*Corresponding author: iraline01@gmail.com

Abstract: Providing science education for both girls and boys and emphasizing on their performance, particularly in chemistry, might play a big role in any country development. The main objective of the present study was to investigate the effect of teachers', students' and parents' attitude towards girls' science education and performance. The adopted research design was descriptive survey under mixed method. A total of two hundred and fifty seven (257) participants consisted of 77.8% students and 4.7% teachers from three schools, and 17.5% parents were selected by using purposive, simple random sampling methods. Quantitative data were statistically analysed using SPSS, whereas qualitative data were recorded and set in themes before reporting in narrations and quotations. The research found out that generally students, teachers and parents have good attitude, beliefs and perceptions towards girls and chemistry education. Teachers showed positive, neutral, and negative attitude on 55.6%, 16.7%, and 27.7% of the total asked statements, respectively. However, there was a slight difference between boys and girls students in terms of attitude, beliefs and perceptions towards chemistry where some girls still need to improve. The findings further revealed that boys and girls have positive attitudes towards chemistry education at 94% and 86.7%, respectively. Some factors underpinning low performance of girls were identified, including inappropriate teaching methods, low confidence among girl students, and limited number of female role models. The present study will benefit decision makers in establishing facts-based policies, which in turn will improve not only parity but also the performance in science education.

Key words: Attitude, perception, beliefs; girls' education, performance; chemistry education.

How to cite this work (APA):

Irakoze, E., Gakuba, E. & Karegeya, C. (2021). Effect of gender perspective towards performance of Chemistry education in secondary schools: Case study of three selected schools of Gicumbi District in North-East of Rwanda. *Journal of Research Innovation and Implications in Education* 5(3), 15 – 25.

1. Introduction

Mathematical capability is mainly related to the science achievement and the boys and girls difference was found to be in favour of boys than girls (Kotte, 1992). Girls tend to lean toward biological science while boys tend toward physical science. Biological science requires less mathematical application and special abilities, it studies life's process including maternal feature, which attract

girls for fulfilment of their motherhood responsibilities. On the other hand, boys are more interested in physical science as it deals with the subjects and topics that are closely connected to the outside of class/school experience where boys get opportunity to develop their attitude and skills in those subjects (Kelly, 1981). Jones et al. (1999) reported that boys showed attitude toward science education more than girls and they expect science to be more useful in their future life. They were active and open to ask for explanation in science classes compared to girls.

For girls, they showed little interest to study sciences even if they could achieve as well as boys or superior than them (Jones et al., 1999).

2. Literature Review

According to (Noddings, 1998), before thinking about how to direct girls so that they can have a positive attitude toward science education, we could first change society about their perception on girls and science education and how they can value female's perspective and benefits to study science courses (Jones et al., 1999). (Osborne et al., 2003; Reid, 2003) reported that boys showed significant attitude towards science than girls. Girls feel that they are less capable to do more practice and to discuss, they get bored easily and loose attention in class, their confidence is low and they do not recognize the role of science and scientist in social life. In addition, (Miller et al., 2006) showed that girls assumed a scientist to be lonely, they don't integrate in society because of limited time for social life. It was also found that the gap between boys and girls in science participation has been impacted by family as well as society where (Aschbacher et al., 2010) confirmed that children's ambitions and perception of science courses and science professions are developed from families. The society, as well as the family, play a major role in shaping the desires and beliefs of children. (Miller et al., 2006) confirmed that there are believes that science courses and related careers are difficult for girls.

Because of its role in everyday life, Chemistry is one of the main subjects studied for different levels of educational system, especially in secondary education. However, teaching and learning of chemistry meet some challenges and some boys and girls report the subject as being difficult to learn and boring regardless of its role for future vocation (Busolo, 2010). Busolo further observes that even if people around the world know and appreciate the vital role chemistry plays in everyday life, there is still problem of performance in this subject. Problem of gender disparity in chemistry comes also in play. Additionally, he showed that poor achievement of students in chemistry has been caused by many reasons, including the students' attitude to that subject. Gender was also suggested as another factor which influences performance of chemistry, as it was found that science subjects require practices and revision, and in many societies home activities are reserved for girls, which in turn hinders them from getting enough time for their revision (Busolo, 2010).

Different research about factors affecting girls contribution and success in science education have been done and some of them highlight some extrinsic factors which accelerate some negative attitude, beliefs and perception of girls toward science, especially chemistry education. Those include method of pedagogy and assessment, teacher-student and peer interactions,

teachers' attitude, classroom practice, curriculum setting, and school environment in general (Ekine & Abay, 2016).

This study was set to investigate the effects of attitudes, beliefs, and perceptions of students, teachers, and parents on students, especially girls' performance in science subjects in general and chemistry in particular. It also investigated different factors underpinning low performance of girls in chemistry and therefore provided practices and actions to be done in order to change the understanding of parents, teachers and students, which in turn could improve girls' performance.

3. Methodology

3.1 Research design and sampling

The adapted design for this study is descriptive survey under a pragmatic paradigm. Here in study, the case under study are three selected secondary schools of Gicumbi District, Northern Province, Rwanda in order to get a deep understanding of the phenomenon under study. The population of this study consisted of students, their parents and teachers. The target population of the present study were schools which offered science subjects, including chemistry. The schools were purposefully selected with the use of cluster random sampling to get a meaningful number of schools. This was followed by random sampling to get reasonable and needed sample size of participants. Precisely, students were selected from classes with combinations containing chemistry as core subject, whereas teachers of science subjects, especially chemistry, participated in this study. A total of two hundred and fifty seven (257) participants consisted of two hundred, 200 (77.8%) students and twelve, 12 (4.7%) teachers from three schools, and forty five, 45 (17.5%) parents from the study area were used.

3.2 Data collection methods and instruments

Prior to data collection, questionnaires specific for teachers and learners were developed and used to check learners' and teachers' perceptions and beliefs on gender differences in science courses, especially in chemistry, and the application of chemistry in everyday life. Moreover, a semi-structured interview addressed to teachers, students and parents was used to assess the influence of school structure, family as well as society, and teaching and learning method on gender differences in science education and performance, specifically in chemistry. Observation was also used to perceive the gender differences in science classes. Furthermore, documents review was used to evaluate girls' and boys' performance in chemistry by using the information from school archive, especially mark lists and different reports including Rwanda Education Board (REB) report of finalist students' performance and other related

documents. A closed ended questionnaires with 5-likert scale, from strongly disagree up to strongly agree, for teachers and students were used. Additionally, the questionnaire for teachers also included ten statements to be rearranged according to the most and least importance on how the performance of girls in chemistry may well be enhanced.

3.3 Data analysis

The data collected through questionnaires and document reviews were presented through frequency distributions, percentages, means, and the standard deviation. And the generated values were used to evaluate attitudes, beliefs, and perceptions of participants and performance between

boys and girls, where SPSS software was used. On the other had, the data collected qualitatively were also edited and organised into themes. Specifically, data from the interview and observation collected through note taking, audio and/or video records with the target group were analysed by using thematic analysis method.

4. Results and Discussion

The present study responded to three main research questions. The first research question stated as “What are the attitudes of students, teachers, and society on gender differences toward science education, especially chemistry education in secondary school in Rwanda?” The following are the findings.

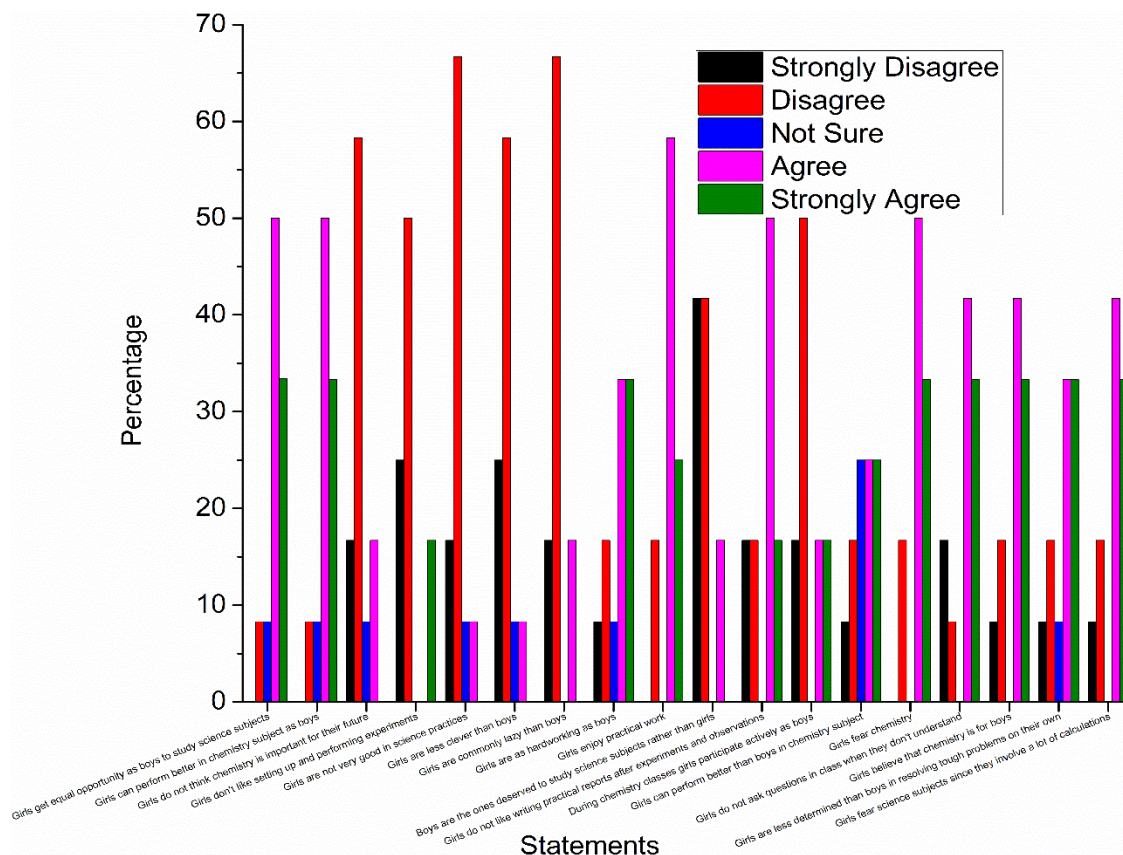


Figure 1: Percentage of Teachers showing positive or negative attitude towards girls and chemistry education, as indicated by agreement or disagreement of asked statements

The findings from the present study revealed that teachers have good attitude towards girls and science education as indicated by the percentage of agreement for asked statements (Figure 1, data generated by using SPSS analysis and graphed using OriginPro 8.5), where they showed positive attitude for statements from 1 up to 10 (55.6%), neutral to statements 11 up to 13 (16.7%) and negative attitude to statements 14 up to 18 (27.7%). Teachers confirmed that girls get equal opportunity as boys to study science subjects agreed at 88.3%, which may be due to different policies, initiatives and strategies of

promoting girls' access and performance in mathematics and science subjects that are being implemented in Rwandan education system. Here we can say the girls' education strategic plan that was approved in 2009, the First Lady's national awards for the best performing girls, sanitation and hygiene facilities that are provided in some schools, all to ensure equal opportunities for girls and boys to access education and science education in particular (Uwineza et al., 2018). Teachers also confirmed that girls are as hardworking as boys and can perform better in chemistry subject as boys, where they agreed at 66.6% and

88.3%, respectively. This was in line with the study of (Sabitu & Matazu, 2016) which showed that options such as engineering, medicine, natural sciences, computer science, physical sciences, that were absolutely destined for men would also include more women as performance of male and female students in biology, chemistry and physics is equivalent in a conducive environment.

However, this study found that teachers have some negative views on girls and science education as well as their participation and performance. Including where they rejected that, ‘during chemistry classes girls participate actively as boys with a disagreement of 66.7% and confirmed that ‘girls do not ask questions in class when they don’t understand’, ‘girls fear chemistry’, ‘girls fear science subjects since they involve a lot of calculations’, ‘girls believe that chemistry is for boys’, ‘girls do not like writing practical reports after experiments and

observations’ and ‘girls are less determined than boys in resolving hard problems on their own’ at 75%, 88.3%, 75%, 81.3%, 66.7% and (66.6%), respectively. The results from this study clearly show that there is still a gender difference in learning science subjects which leads to the difference in performance as demonstrated by teachers, and showed low confidence among girls as they think that there are many learning related tasks which can be performed by boys better than them. These findings are in accordance with the study of (Burkam et al., 1997), which confirmed that boys participate more than girls. This low participation of girls in classroom would in turn lead to underperformance of girls in science education and chemistry in particular as it was found in this study that girls performed less than boys in chemistry in national examinations (Figure 6).

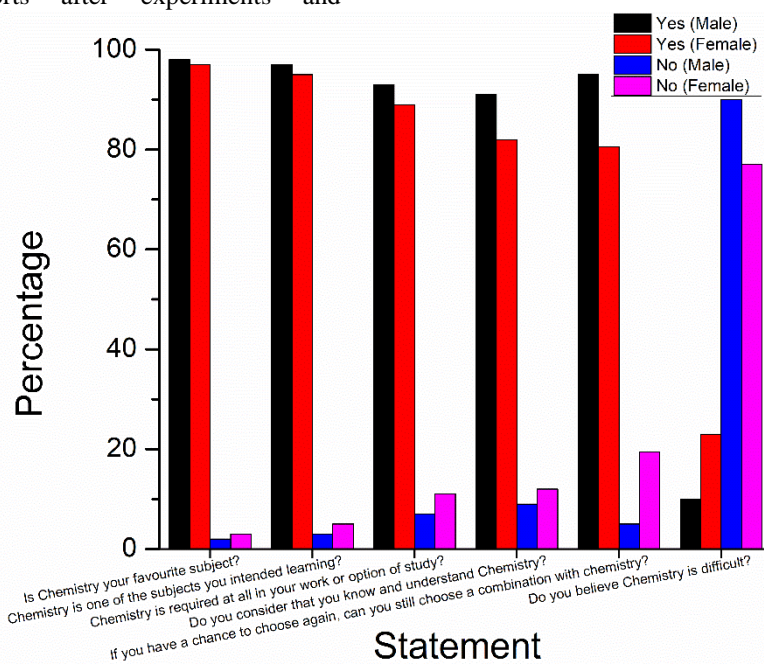


Figure 2: Percentage of boys and girls students on their attitude towards chemistry education, indicated by the degree of acceptance of different statements

Alternatively, students showed positive attitudes for all asked statements, the degree of acceptance (yes) or rejection (no) for each statement was rated by percentage of male and female respondents. All sentences were accepted except only one which asked ‘Do you believe Chemistry is difficult?’ where the degree of rejection for males and females was at 90% and 77%, respectively (Figure 2). Thus, students showed a good attitude towards chemistry, however there is a slight difference by sex where more girls tend to show negative attitude toward that subject than boys, as indicated in the Figure 2. These results are in accordance with the findings presented by (Mahdi, 2014) indicating that even if the respondent showed the perception that chemistry subject is difficult, they also indicated good attitude toward that subject and furthermore they said that chemistry is an interesting and

not a boring subject. The findings from this study are also supported by the study of (Cheung, 2011), who reported that despite some factors which are still influencing students attitude towards chemistry and leads them to poor performance in that subject, students have good attitude towards chemistry.

The interviewed parents showed that most of rural parents do not know which subject is important for their children’s future career where they answered with the exact career they need for their children instead of mentioning subjects. Some of them said that medical career could be better for their children’s future, others said that they think that subjects which can direct their children in accountancy, teaching and local leaders like executive secretary of sector could be better for their children. However, some

few parents who attended school and were aware of Rwandan educational system said that the most important is the choice of the students and mentioned that the study of chemistry can help their children to study in public universities and follow medical career. It is clear that most of the parents and children don't have enough knowledge and information about careers chemistry and science can lead to, because most of them know and believe that studying science leads to medical career only.

Moreover, students also claimed the home activities as hindrance in their studies and performance, this issue varies from school to school depending on its type and sex to sex, where most of the students who raised this question are from day (non-boarding) schools and girls. Those from day schools said that when they get home parents don't give them time for revision and doing their homework, this occurs even in holidays where students from boarding schools come in. They said that some take responsibilities of taking care of home animals, others cook, clean and attend market for home economic issues. They also mentioned that girls perform most of those home activities and when it comes to choosing who could perform these home duties, parents prefer girls over boys. Parents interviewed when asked home activities boys and girls are likely to be involved in, most of them said that boys are likely to take care of home animals, fetching water and playing while girls cook, clean, fetch water, attend market,

and care for their little siblings and so on. This makes it clear that some home works are only reserved for girls.

The second research question stated that "Could the perception of society, students, and teachers on gender differences be one of the factors, which affect performance in chemistry education?" The following are the findings.

The present study further investigated students' perception and beliefs toward chemistry education (Figure 3). When comparing the accepted and rejected statements, they all lead to complementary results depending on how questions were asked. These findings show that most students have good beliefs and perceptions towards chemistry education as indicated by the percentage of acceptance and rejection. However when it comes to students' gender more girls have some negative beliefs and thoughts in this area than boys where by comparing the acceptance and rejections for all five statements boys always have a high percentage which indicates their high confidence than girls. This was also confirmed by interviewed teachers that girls still show low confidence than boys and it was in line with findings reported by different studies that students' beliefs, especially self-confidence, were more of an effect on success for girls than for boys (Jovanovic & King, 1998).

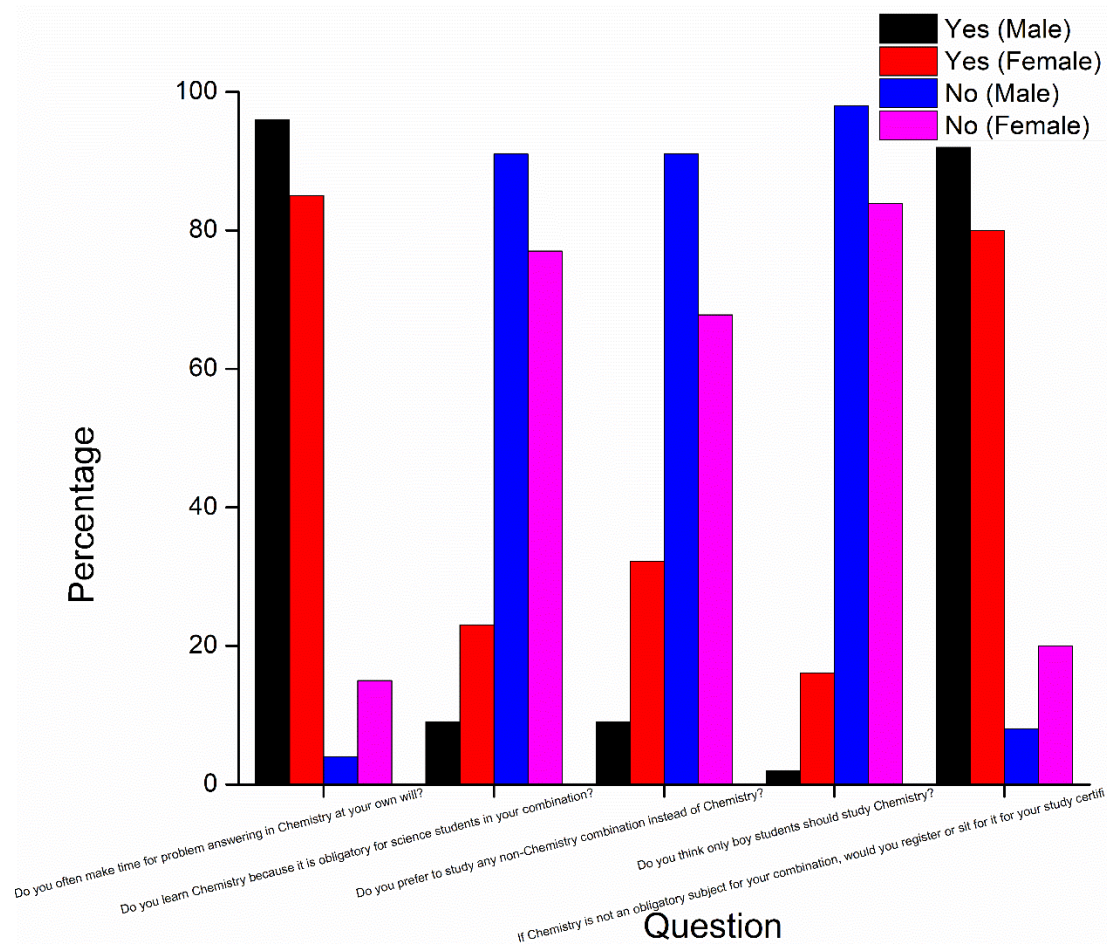


Figure 3: Boy and girl Students' perceptions and beliefs about chemistry education, indicated by the percentage of acceptance on asked questions

The results further showed that teachers (Table 1) as well as students (Figure 4) believed that chemistry is not difficult at all. However, students stressed that teaching methodologies which do not involve real life applications and examples as well as more calculations could make chemistry more difficulty where more girls emphasized on

these factors than boys. These findings were in accordance with the results of (Cardellini, 2012) who reported that chemistry is not difficult among other science subjects but sometimes it seems difficult to students depending on many reasons, including learning style, inappropriate teaching methods, and the nature of the subject.

Table 1. Teachers' beliefs and perceptions about ease of chemistry subject

Statements	SA		A		N		D		SD		Mean	St. D
	F	%	F	%	F	%	F	%	F	%		
1. Chemistry is difficult among other science subjects	0	0	1	8.3	1	8.3	7	58.3	3	25	2.00	0.853
2. Writing balanced equations is difficult to girls than boys	0	0	1	8.3	0	0	9	75	2	16.7	2.00	0.739

SA: Strongly Agree, A: Agree, NT: Not Sure, D: Disagree, SD: Strongly Disagree, F: Frequency, St. D: Standard Deviation

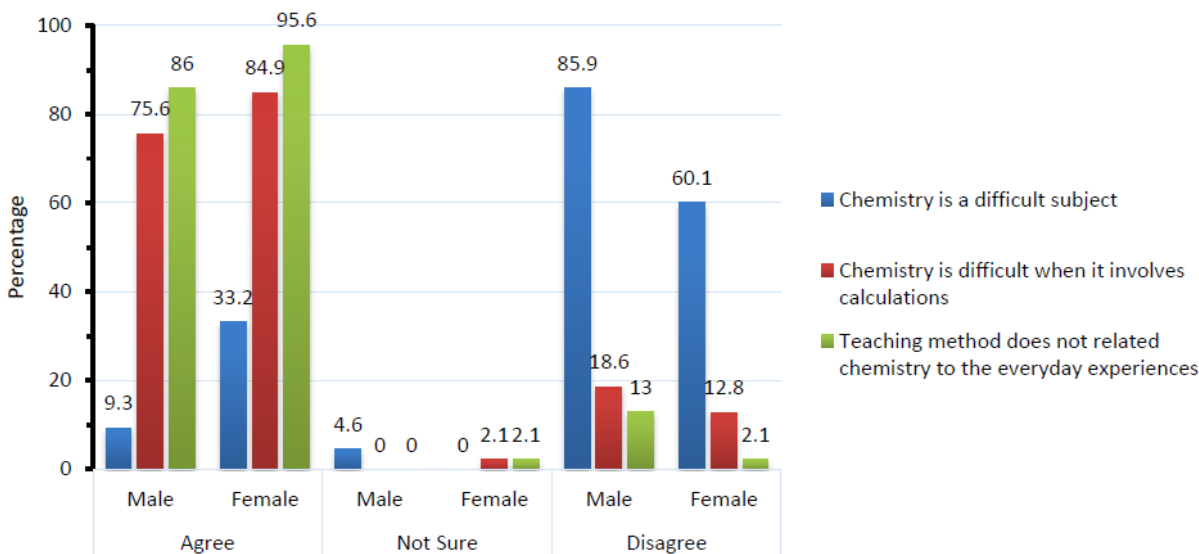


Figure 4: Students' beliefs and perceptions about ease of learning Chemistry

Moreover, both boys and girls showed interest in learning chemistry with slight difference where boys were more interested than girls (Figure 5.a). They further revealed positive beliefs and perceptions towards beneficial aspects of chemistry (Figure 5.b), which imply that students know the importance of chemistry to society and country

development in general and this can benefit and motivate them to study chemistry and other science subjects. These findings are in line with the results reported by (Fowotade, 2012) who confirmed that natural sciences such as chemistry play a vital role in national building in general and economic growth as well as improving people's way of life.

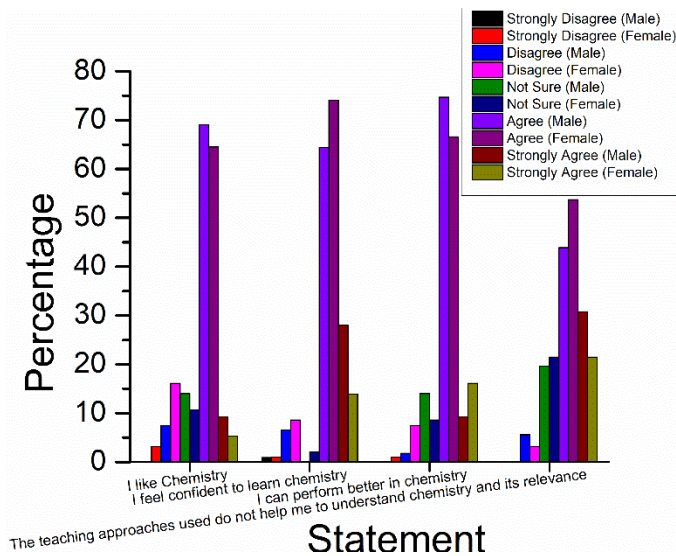
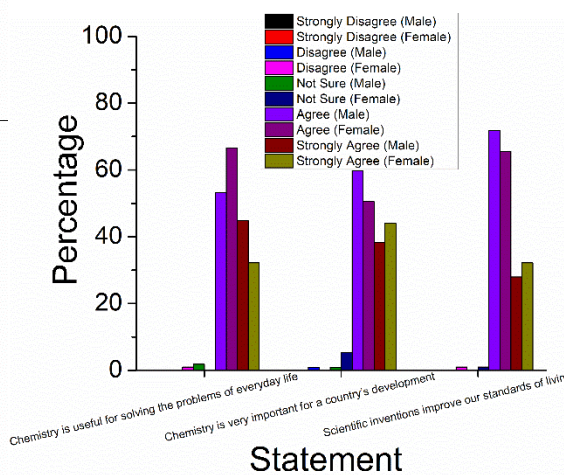


Figure 5.a: Students' Interest in Chemistry

The third research question stated as "Are there some other factors underpinning the gender difference in chemistry academic performance?" The findings are as follows:

It has been found that girls perform less compared to boys, especially in science subjects. This was revealed by the analysis of results for national examination of two successive years (2018 and 2019) showing that boys outperform girls in chemistry where a big number occupy



5b: Students' Beneficial aspects of Chemistry

the first grades (figure 6). This also confirms that albeit the enrolment of girls in science combination have been increased and some students, teachers and parents attitudes have been positively changed at high level, there are still some remained negative attitudes, beliefs and perceptions in addition to other mentioned factors which influence girls' performance in science and chemistry in particularly. Something has to be done to increase the performance of girls in science in broad and specifically chemistry, some might goes with changing the mentioned

attitudes, beliefs, and perceptions of parents and teachers while others have to deal with the teaching and learning methodologies. Teachers participating in this study gave

some suggestions which could be focused on in order to increase the performance of girls in science in general and chemistry in particular (Table 3).

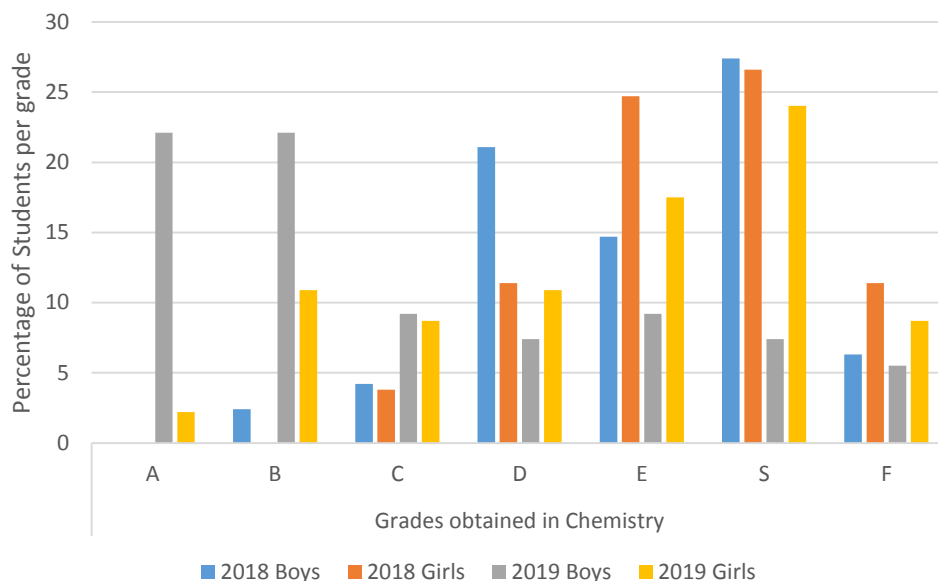


Figure 6: Performance of students of the three selected schools in chemistry national examination of 2018 and 2019

The outcomes from this study showed that the interactions that occur between students and their teachers throughout the teaching and learning activities, especially science subjects and the parents’ knowledge, beliefs, perception and attitudes as well their support for girls’ education especially in science area are closely related to students’ performance. Some interviewed students said that teachers, especially their science teachers, treat both boys and girls equally throughout teaching and learning process. Though they mentioned some problems which affect their performance like teaching methods which do not favour them, limited facilities and bad management of those available, learning conditions where students from day schools said that they do not have enough time for revision because of after school home activities, and some parents still have negative beliefs on girls and science education accompanied by their lack of knowledge about science subjects. In addition, interviewed students showed that only lecturing method is used during teaching and learning of science subjects in general and chemistry in particular and they believe that teacher is the only one in charge of teaching and learning process by giving them knowledge without their contribution, which in turn reduces their contribution, interest and motivation during teaching and learning process. This issue of teaching methods was also reported by (Byusa et al., 2020) who confirmed that in Rwandan secondary schools, lecturing method dominates other methods during teaching and learning process.

Moreover through the interview with the participants, different school environments like, school type, facilities, policies, opportunities, professional development and role

models were mentioned as some other factors, which affect students’ performance in chemistry. This study found that students from non-boarding schools are mostly affected because the school only provides day service, thus after school, students do not find enough time for revision and doing homework, where girls are more affected by doing more home activities (Table 2). It was also found that there is a lack of hope, vision and motivation for young girls as they lack female role models in different careers, where the percentage of female teachers of science subjects from the three schools under this study represents 23.5% of all teachers, which reflects on the low performance of female through their education and their diminution as they go up in their education and leads to their low number in some careers especially in science. This was also confirmed by (Pontikis et al., 2019) from the Nobel Foundation that there occur gender differences concerning participation in different completion and exhibition especially in science career, the little difference occur in biology. Since 1901, Nobel Prizes in 6 different Prize categories where in a total of 904 individuals Laureates only 51 were women and the rest were men. This underrepresentation of females in different careers, competition and awardees is related to and come from the early age in secondary schools where generally gender difference in science occurs through choosing their specializations and how they go through them while at this stage it is a good time to help all students to get equal opportunities to take part in different out class and schools event which increases their knowledge, confidence and attitude to participate in different competitions, thus influencing their overall performance. This study further

revealed a limited number of professional development where the interviewed teachers mentioned a lack of these professional developments or other training related to gender education. Thus, this might be one of the reasons

for poor performance of girls because most of their teachers have teaching skills in general but not gender education.

Table 2: Some others factors that cause the underperformance of girls in chemistry

Statements	SA		A		NS		D		SD		Mean	St. D
	F	%	F	%	F	%	F	%	F	%		
1. Because of household duties girls do not have enough time for revisions	6	50	5	41.7	0	0	1	8.3	0	0	4.33	0.888
2. Parents don't support their daughters to study chemistry	4	33.3	5	41.7	1	8.3	1	8.3	1	8.3	3.83	1.267
3. Poor previous experience in science is accountable for poor performance of girls in chemistry	4	33.3	6	50	1	8.3	1	8.3	0	0	4.08	0.900
4. Girls do not get the opportunities as boys to take part in science expositions and competitions	2	16.7	4	33.3	1	8.3	3	25	2	16.7	3.08	1.443

Looking for solutions in order to tackle challenges and factors behind the underperformance in science subjects in general and chemistry in particular, teachers participating in this study made some suggestions on how this issue could be handled. They were requested to rank the statements from the most to the least importance concerning the action under which could be taken to improve the performance of girls in science education and chemistry in particular (Table 3). Their suggestions match with the mentioned factors underpinning the

underperformance of girls and it is believed that putting these suggestions in action could reverse the mentioned factors and improve girls' performance. Giving girls additional facts on how Chemistry will be beneficial in their life after school was the first suggestion, followed by training teachers to satisfy the necessities of girls in the Chemistry education and make teachers acknowledge the differences that girls and boys present to Chemistry education. The results presented in Table 3 rank different statements according to their mean value, with the lowest mean ranked as the most important statement.

Table 3: Suggestions of teachers for improving the performance of girls

Statements	Frequency of ranking										Mean	St. D
	1	2	3	4	5	6	7	8	9	10		
a) Relate chemistry curriculum to the necessities of girls and more applicable to their daily life.	0	0	0	0	1	4	4	3	0	0	6.75	0.965
b) Relate Chemistry education to the daily practices of girls like cooking, farming and so on.	0	0	0	4	4	2	1	1	0	0	5.25	1.288
c) Inspire girls to carry out enough experiments.	0	0	0	0	0	1	0	3	4	4	8.83	1.193
d) Provide more coursework to girls	0	0	0	0	0	0	1	1	5	5	9.17	0.937
e) Group girls with boys while instructing Chemistry in mixed schools.	0	0	0	0	0	0	2	4	3	3	8.58	1.084
f) Offer girls occasions to participate in science workshops, competitions and exhibitions.	1	1	1	5	4	0	0	0	0	0	3.83	1.267
g) Provide enough facts to girls which illustrate the beneficial aspects of Chemistry in life after school	7	3	1	1	0	0	0	0	0	0	1.67	0.985
h) Apply various educational materials while instructing Chemistry.	0	0	1	0	3	4	4	0	0	0	5.83	1.192
i) Make teachers acknowledge the differences that girls and boys present to Chemistry education.	2	1	6	2	0	1	0	0	0	0	3.00	1.348
j) Train educators especially teachers about how to satisfy the necessities of girls in the Chemistry education.	2	7	3	0	0	0	0	0	0	0	2.08	0.669

5. Conclusion and Recommendations

Chemistry is a branch of science, which is foundation of technology and industry. It is very important for country development as it supports different disciplines such as chemical industry, food industry, pharmacy, medicine, biotechnology, and so on. Science education is one of the utmost crucial subjects in school owing to its significance to students' lives and the entirely pertinent problem-solving and critical thinking skills it uses and develops. The low performance of girls in chemistry at secondary schools were illustrated herein with the emphasis on the effect of the attitudes, beliefs and perceptions of students, teachers and parents on this underperformance. Other factors which influence the gender difference as well as performance in science and chemistry in particular have been revealed and some suggestions underpinning actions to be made at different levels to maintain girls' interest in science and chemistry in particularly as well as to improve their performance in this area.

Descriptive survey was applied in this study under mixed method to ensure validity and reliability. Thus, data were collected by using different instruments including questionnaires, interviews, observation and documents review. The quantitative results were analysed by using descriptive statistics (with SPSS software, graphed using OriginPro 8.5) and the qualitative data were analysed thematically, both quantitative and qualitative data were

collected and analysed simultaneously. The findings from this study showed that in general participants had positive attitudes on gender difference toward science, especially chemistry education. Despite the positive attitude found among most students, teachers and parents toward science and girls' education, some negative perceptions were found among other factors, which still underpin this students' underperformance. Here we can mention the school type and environment, lack of professional development for teachers, limited number of role female models for girls, and unequal participation of home activities between girls and boys, which in turn affect studies of girls.

Referring to the findings from the present study we would recommend teachers, deputy head teachers and head teachers to improve and control the teaching and learning environments; students to improve their attitudes and beliefs towards science education, which in turn will help them improve their performance; parents to overcome some old beliefs and perceptions about girls education and learn to make equal participation of home activities between boys and girl, which afterwards might give boys and girls equal chance to use their spare time in doing homework and revisions; the government and partners in education to set and implement some additional policies which will facilitate teachers getting desired knowledge about not only parity but also gender equity in teaching and learning process and the best ways to overcome some factors behind girls underperformance.

References

- Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine. *Journal of Research in Science Teaching*, 47(5), 564-582.
- Burkam, D. T., Lee, V. E., & Smerdon, B. A. (1997). Gender and Science Learning Early in High School: Subject Matter and Laboratory Experiences. *American Educational Research Journal*, 34(2), 297-331. <https://doi.org/10.3102/00028312034002297>.
- Busolo, A. J. (2010). Gender Differences in Students' Achievement in Chemistry in Secondary Schools of Kakamega District, Kenya [Kenyatta University].
- Byusa, E., Kampire, E., & Mwesigye, A. R. (2020). Analysis of Teaching Techniques and Scheme of Work in Teaching Chemistry in Rwandan Secondary Schools. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(6). <https://doi.org/10.29333/ejmste/7833>.
- Cardellini, L. (2012). Chemistry: Why the Subject is Difficult? *Educación química*, 242.
- Cheung, D. (2011). Evaluating Student Attitudes toward Chemistry Lessons to Enhance Teaching in the Secondary School. *Educación química*, 22(2), 117-122.
- Ekine, A., & Abay, N. A. (2016). Enhancing Girls' Participation in Science in Nigeria: A Driver for National Development and Social Equality.
- Fowotade, S. (2012). Chemistry and National Development. *National Journal of Humanities, Science and Technology*, 1, 192-197.
- Jones, M. G., Howe, A., & Rua, M. J. (1999). *Gender Differences in Students' Experiences, Interests, and Attitudes toward Science and Scientists*. John Wiley & Sons, Inc.
- Jovanovic, J., & King, S. S. (1998). Boys and Girls in the Performance-Based Science Classroom: Who's Doing the Performing? *American Educational Research Journal*, 35(3), 477-496.
- Kelly, A. (1981). The missing half. Girls and Science Education. In. Manchester University Press.
- Kotte, D. (1992). Gender Differences in Science Achievement in 10 countries, 1970/71 To 1983/84.
- Mahdi, J. G. (2014). Student Attitudes towards Chemistry: an Examination of Choices and Preferences. *American Journal of Educational Research*, 2(6), 351-356. <https://doi.org/10.12691/education-2-6-3>
- Miller, P., Blessing, J., & Schwartz, S. (2006). Gender differences in high-school students' views about science. *International Journal of Science Education*, 28(4), 363-381.
- Noddings, N. (1998). Perspectives from feminist philosophy. *Educational Researcher*, 27, 17-18.
- Osborne, J. F., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049-1079.
- Pontikis, A., Petterson, J., & Studio, R. F. (2019). The Nobel Foundation · Annual Review 2018. The Nobel Foundation 2019, P.O. Box 5232, 102 45 Stockholm, Sweden.
- Reid, N. (2003). Gender and physics. *International Journal of Science Education*, 25(4), 509- 536.
- Sabitu, A., & Matazu, D. (2016). Comparative Analysis of Gender Performances in Biology, Chemistry and Physics among Pre-Degree Students of Federal University, Dutsinma. *International Journal of Educational Ben Chmark (IJEB)*, 5, 108-118.
- Uwineza, I., Rubagiza, J., Hakizimana, T., & Uwamahoro, J. (2018). Gender attitudes and perceptions towards mathematics performance and enrolment in Rwandan secondary schools. *Rwandan Journal of Education*, 4(2).