Gender differences in the number of boys and girls involved in selected science fair competitions from 2012 to 2021 in secondary schools in Thika West Sub-County, Kiambu, Kenya.

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Abstract

Long before the founding of the Women's scientific Organization in 1921, and the Society for Women Engineers in 1950, a variety of attempts by governments and international bodies have been done to encourage participation of women in scientific technology. However, to date evidence glares that in the majority of the world's science fields, women are underrepresented. It is assumed that participation in science-oriented co-curricular competitions such as science fairs boost students' performance and interest in the science subject. This study sought to analyse Gender Differences in the number of boys and girls involved in selected science fair competitions from 2012 to 2021 in secondary schools in Thika west sub-county, Kiambu, Kenya. The study used descriptive survey design and utilised purposive, simple random and stratified sampling methods to get respondents. It worked with a sample size of 350 respondents and was guided by Social Role Theory. Instruments for data collection included structured interview guides and questionnaires while data collection techniques included self-administration of questionnaires to selected students and conduction of structured interview guides to selected science teachers by the researcher. It obtained secondary data from literature on gender and science, and science fairs. Statistical Package for Social Sciences (SPSS) version 23 was used to analyse quantitative data which was present in frequencies, counts, percentages, tables and figures while analysis of qualitative data was done using content analysis and presented in themes and verbatim. The study found out that there are gender differences in participation in science fairs skewed towards boys and identified strategies such as organisation of workshops to boost self-image and creation of gender equality awareness. Finding of the study will be useful to the ministry of education to supervise gender mainstreaming in science fairs in secondary schools since evidence exists that there is a gender discrepancy in participation in science fairs in secondary schools.

Keywords: Gender differences, boys and girls, science fair competitions, secondary schools.

1.0 introduction

1.1 Background to the study

The quality of human life has unquestionably been greatly improved by science and technology. Consequently, this has prompted a worldwide effort by nations of actively supporting the essential duty of research in identifying verifiable answers to the very difficult

issues facing the world (UNESCO, 2021). Gender equality in participating in scientific innovation at all levels is therefore desirable for maximum benefit to individuals and nations. This study is therefore timely as it researched on Gender Differences in the number of Boys and girls participating in Science Fairs, as studying participation in science fair is one aspect of studying participation in science (Steegh, 2021).

According to a global analysis of participation of women in science, the average global representation of women is 30% (UNESCO, 2017), with the following regional distribution: Arab States: 40.9%, Central and Eastern Europe: 39.0%, North America and Western Europe: 32.9%, Sub-Saharan Africa: 31.1%, East Asia and the Pacific: 25.0%, South and West Asia: 23.1%, Latin America and the Caribbean: 45.8%, Arab States: 40.9%, Central Asia: 48.5%, and Central and Eastern Europe: 39.0% (WIS, 2020). Data therefore shows that women are seated on a less comfortable platform than males, as they try to access technology (Beura, 2017; UNESCO,2017). Again, women's participation in research appears to drop after the master's level of education and steadily declines with each step further up the research hierarchy so that globally only 28.8% of researchers worldwide are female (UNESCO, 2017). This leads to the question, why is it that women face more challenges in pursuit of research careers compared to men? It also implies that barriers and difficulties exist that prevent more women from pursuing careers in science and technology.

Globally, the proportion of women and men participating in science fairs varies. Jones (1991); Greenfield (1995); Lawton & Bordens (1995); & Adamson, Foster, Roark & Reed (1998) established that the participation of males was much higher than that of females in USA. However, Greenfield (1995) also found out that female participation has improved greatly compared to 20 years ago, with noted increase in female participation in physical sciences over the years. Similar to Jones (1991) and Lawton, & Bordens, (1995), she also concluded that the likelihood of women to participate in mathematical, physical and, earth science, is lower than that of men. Recent research on the other hand indicates commendable improvement for some countries. For instance, according to UNESCO (2021), Venezuela has achieved gender parity with a representation of 61.4% of women in research though disparity was noted in areas like Haiti and Cuba. Thornton (2019) on his part identified states such as Guatemala, Trinidad, Argentina, Tobago, Panama and Bolivia to have achieved over 50% researchers as females. Additionally, Academies of Young Scientists were reported to have women as the larger share of members (GenderinSITE, 2021). These studies present gaps in gender as far as participation in science fairs is concerned.

The number of women studying science and technology in India is increasing, according to data (Gupta,2019). However, he notes that although though the number of women obtaining doctorates in various branches of science and technology is rising annually, the number of women scientists joining the industry is not increasing at a comparable rate. He suggested putting a gender equity focus on career days, scientific fairs, and awareness campaigns to help with this. Similarly, Beura (2017) observed that as late as in the 21st century, in several countries, the statistics of women in physics, engineering and computer science is as low as below 30%, and linked this to challenges that women face trying to access science and research. He identified factors responsible for this to be inequality in distribution of resources and gender biasness and prejudices and advised among other things yearly organization of fairs and quizzes at several levels for both secondary and primary learners, mainly targeting females to boost interest in them. Thus, the fact that women have lower likelihood than men to participate in science and science fairs seems perverse in many countries.

Africa tells a similar tale. Prior to 1970, African women had never been given significant representation in planning for science (Kimani, & Mwikamba, 2010). A dramatic shift in thinking basing on fundamental assumption of human justice and equality is essential to make this transition, they add, because gender bias and technological inequities are so firmly ingrained in African sociocultural norms and values. In addition, in Africa, female scientists rarely work as research directors or Principal Investigators, rather, they work at junior posts (UNESCO, 2018). This gender gap is seen to roll back to school days where boys are reported to be more active in science than girls are (Akala, 2010). Therefore, this intensifies the relevance of the current study which tried to seek the truth of the matter participation in science fairs in schools in the area of the study.

On the other hand, UNESCO (2017) identified countries like Tunisia as having achieved gender parity at 56.1% women researchers. This is a major score and a source of encouragement. However, other countries were found to be progressing quite slowly. For instance, UNESCO (2021) found The Democratic Republic of Congo to be at 8.7% women researchers (in 2015) and Chad at 3.4% (in 2018). This implies that Africa is heterogeneous and therefore it is important to find out the case for individual countries too.

In Kenyan context, science fairs are enshrined in the basic education act (2014) and are meant to boost performance in STEM subjects as well as strengthen research, science, technology and innovation (M.O.E., 2019). They also offer students across the country an opportunity to become enthused by science and explore scientific research, as they encourage innovative thinking for practical solutions in everyday life (RSC, 2019). The government boosts performance of these fairs by both promotion and funding of co-curricular activities through the Subsidized Secondary Education (SSE) (Ndunguri, 2017). While this confirms that the Kenyan government highly appreciates the role of science fairs in advancing science and innovation, it creates concern that there is very little research in science fairs in the country.

Kimani (2010) established that women feature less than men in science and that the gap is even wider in the field of physics, however, his study was on participation in science subjects; According to Mbirianjau (2009), women made up just approximately 30% of students in VET institutions on a national level, and they were infrequently admitted to fields like engineering and information technology. His study was however on participation in VET institutions. On the other side, Muthike (2017) observed a beneficial connection between school administration support and students' involvement in extracurricular activities like scientific fairs. Her study was however generally on co-curricular activities. Mitchell, & Esmann, (2016) found out that science fair competitions in Kenya ended abruptly after the finalists were announced and awarded. Their study did not however adopt a gender perspective. Additionally, UNESCO (2017)) placed Kenya at around 28%, female researchers, which is too low. These studies confirm the need for a study on participation in science fairs with a gender perspective.

Much as studies on gender and participation in science fairs abound, gender disparity in this field still exists in favour of men (Beura, 2017). Why is it so? More still, evidence exists that there are gender differences in choice of projects (Jones, 1991; Lawton, & Bordens, 1995; Greenfield 1995, 1996; Bunderson & Bunderson 1991 and Hazari 2013). The question therefore is, what brings this difference? Besides, there seems to be limited scholarly research on participation of girls and boys in science fair competitions in Kenya yet research has proved that science fairs boost students' interest in science and technology (Bruce, & Bruce, 2000; Steegh, 2021). This study is therefore timely as precise information is required on ways to increase gender parity in science fair participation in secondary schools hence reduce gender

disparity in science.

Of interest too, is that Kiambu county has the largest number of national schools (8, with 3 in Thika west sub-county) in Kenya (M.O.E, 2021) in essence carrying the country's academic 'cream'. However, boys' and girls' participation in science fair in this county and sub-county is not to expectation. For instance, in 2018 the best performing students nationally came from Nairobi, Nakuru and Baringo counties (The Standard, 9th June 2018), while the best performing schools between 2010 and 2018 consecutively came from Nairobi County, with boys featuring more than girls in the fairs (Shree Cutchi Leva Patel Samaj School and College, 2020). This provokes the question, what limits full participation of these students in science fairs?

Every nation aspires to generate as many qualified scientists as possible. Science fair participation has been connected to increased interest in science and increase in scientists, which would enhance living standards and lengthen life expectancy. It is therefore expected that women and men participate equally in science and science fair at different levels. Participation of women has however been indicated to be as low as 30%. This is despite provision in the Kenyan Constitution of 2010 (section 27,3) and National Policy on Gender and Development of 2000 (Sessional Paper No. 02 of 2019), which stress the significance of mainstreaming of gender in all development-related fields. This suggests that women who want to participate in science confront obstacles.

Data from national science fair also indicates that Kiambu county, which hosts most national schools nationally and therefore thought to have the best students overall, has not participated in science fairs as satisfactorily as Nairobi and Nakuru for some time. Similarly, in Thika-west sub-county, between 2017 and 2020, participation of girls in science fairs ranged between 27% and 41%. This gender disparity raises concerns about denying women access to scientific opportunities and impeding their economic and social advancement. Science is a lucrative industry that benefits scientists and can boost a nation's productivity growth by up to 2% annually. It would essentially be attracting men and women's attention, yet research shows that women trail behind.

Research on participation of women and men in science fair exists. However, participation varies in nations and regions. Besides, the reasons underlying the limited involvement of girls in scientific fairs in Kenya are little understood from an empirical standpoint. Additionally, little is known about how participation in scientific fairs is affected by factors like the availability of role models, media depiction, the role of science teachers and gender stereotyping. The researcher carried out the aforementioned study in light of this gap.

2.0 MATERIALS AND METHODS

2.1 Research Design

This study adopted descriptive approach to collect both quantitative and qualitative data. According to Orodho (2005), descriptive survey designs can be used to gather data on people's attitudes, beliefs, habits, or any number of educational and societal issues. Participation in science fairs has a lot to do with people's attitudes, opinions and perception of things, making it appropriate to use this research design. Bhasin (2019) identifies some of the advantages of using the descriptive survey design as that it offers possibility of collecting data from a large

population and that variety of data can be obtained using this research design. It is also cheap and quick to conduct since one does not require having a great space dedicated only to research.

2.2 Data Collection Procedure

Primary data was gotten by self-administration of questionnaires and structured interview guides conducted face to face by the researcher. Self-administered data collection methods make it possible to contact a lot of potential respondents quickly (Mugenda & Mugenda, 2008). Permission was also sought from Kenyatta University and a permit obtained from County Director of Education, Kiambu before embarking on collection of data from the field. literature on gender in science and science fair was used to obtain secondary data.

2.3 SITE OF THE STUDY

The study was conducted in schools in Thika-West sub-county, Kiambu County which is in the central part of Kenya. Thika west sub-county has a total of 22 secondary schools; 3 nationals, 3 extra county, 1 county and the remaining are sub-county schools. The total student population is around 18723 (MOE, Kiambu,2021). It is therefore clear that this subcounty has a variety of secondary schools and diverse students and teachers hence findings of this study are highly representative. As far as science fair is concerned, this sub-county is known to host several science fair competitions. For instance, in the years 2016 and 2019, it hosted competitions at the regional level (Nova Pioneer Kenya, 2019, October 9th). This portrays adequate exposure to science projects and activities.

2.4 Dependent Variable for the Study

The dependent variable in this study was students' participation levels in science fair competition. The indicators were Gender equitable representation of boys and girls in science fairs and Increased participation of women in science careers. Failure to have them, students' participation levels is likely to go down.

2.5 Independent Variables for the Study

The independent variables for the study included participation-related aspects affecting participation in science fair competitions and gender responsive strategies that promote participation in science fair. Gender stereotyping negatively affected participation of girls in science fairs more than it did to boys while the strategy of creation of awareness on gender equality was seen to boost the participation of boys and girls in science fair competitions.

2.6 Intervening Variables

Students' self-efficacy and affirmative action in science fairs, however important these variables are in enhancing boys and girls participation levels in science fair competitions, were not considered in this study.

3.0 RESULTS AND DISCUSSION

3.1 Introduction

This section presents data analysis, presentation, interpretation and discussion on the findings from the study 'Gender as a Determinant of Students' Participation levels in Science Fair Competitions in Secondary Schools in Kiambu county, Kenya.' The data was analysed with the help of a computer program, SPSS version 23. This section presents the results and discussion

of data based on the analysis of the data collected from the field. The objective was to determine gender differences in the number of boys and girls involved in science fair competitions in secondary schools in Thika-west sub-county, Kiambu.

3.2 Demographic Information of Respondents

3.2.1: Distribution of Boy and Girl Respondents by School and Gender

Students' distribution by school and gender was established to know how many boys and girls participated in the study and from which school they came. This was useful as different schools have different policies that can determine girls' and boys' participation in science fair and again it was useful to capture the responses of variety of students from different schools. besides, participation in science fair can be determined by the gender of the students as concluded by earlier studies such as the one by Thornton (2019). The research established the data to be as presented in table 4.2

Table 3.2: Distribution of Boys and Girls by School and Gender

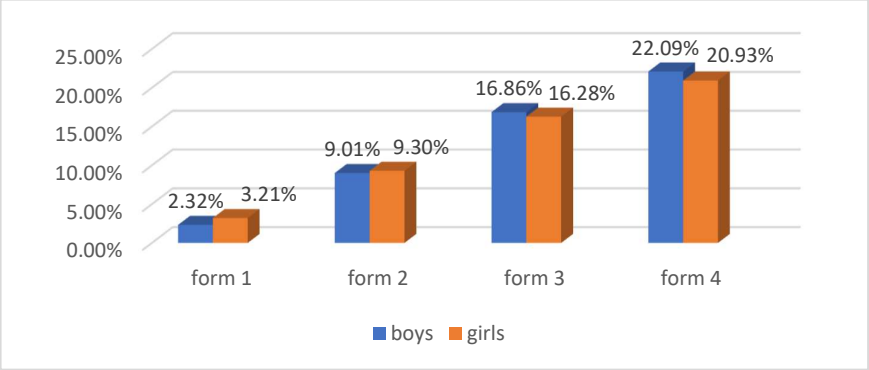
Kind of school	Girls involved		Boys involved		overall	
	N	%	N	%	N	%
National, special, mixed boarding	21	53.8	18	46.2	39	11.3
Extra-county, mainstream boys' boarding	0	0	104	100	104	30.2
County, mainstream, girls boarding	88	100	0	0	88	25.6
Sub-county, mainstream mixed day	34	63.0	20	39.0	54	15.7
Sub-county, mainstream mixed day	28	47.5	31	52.5	59	17.2
TOTAL	**171**	**49.7**	**173**	**50.3**	**344**	**100**

Out of the 344 students who participated in the study, 173 were boys, a representation of 50.3% while girls were 171 (49.7%) as indicated in table 4.2.1. Initially, the research had wished to work with equal representation of boys and girls, that is, 175 for each gender but ended with a slightly higher number of boys (50.30%) compared to girls (49.70%). This was occasioned by the state whereby more boys than girls were willing to participate in the study. On the other hand, all the categories of schools participated as anticipated by the researcher. It however emerged that findings of the study were not greatly affected by the kind of school the respondents came from as responses were relatively similar and different per gender of student as compared to per the kind of school. Therefore, gender of the students turned out to be one of the determining factors in participation in science fair in the study area.

3.2.2: Distribution of Boy and Girl Respondents by their Class

The classes of the boys and girls who participated in the study was also established. This was important since boys and girls in different classes have different exposure to scientific knowledge and science fairs. The classes of the student respondents were as summarised in figure 4.2.1 below:

Figure 3.2.1: Distribution of boy and girl respondents by class



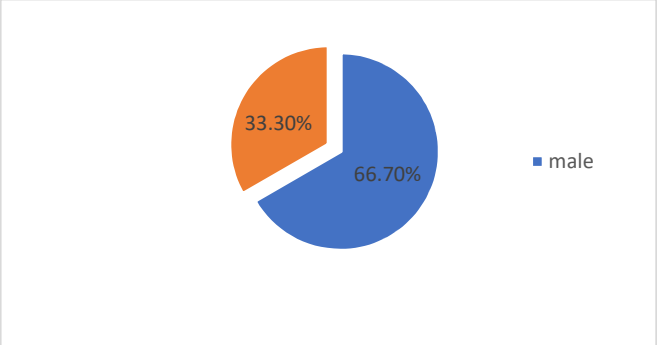
Source: Selected Secondary Schools in Thika-west sub-county (2022)

In the study, there was high participation of boys and girls in form 3 (114 students) which is 33.20% and form 4 (148 students) which is 43.00% compared to form 1(19 students) at 5.50% participation rate and form 2 (63 students) at 18.30%. In form 1 and 2, the participation of girls was more than that of the boys at 11 (3.21%) against 8 (2.32%) that of the boys in form 1; and 32 girls against 31 boys in form 2. However, in form 3 and form 4, boys were more at 16.86% (58 boys) against 16.28% girls in form 3; and 76 boys (22.09%) against 72 girls (20.93%). Overall, the number of boys in form 3 and 4 was higher than the rest. This points at gender differences and suggests that boys become serious in science fairs up the class levels compared to girls. Therefore, gender differences in participation of the respondents at class level were witnessed. This is more so because priority of participation was given to members of the science-related clubs.

3.2.3: Distribution of science teachers by gender

Data on the gender of science teachers involved in the study was captured. It was important for the study to collect such data since previous studies by Amunga & Musasia (2020) had concluded that gender determines participation in sciences. findings are as presented in the figure 4.2.2 below:

Figure 3.3.2: Gender distribution of science teachers



Out of 6 science teachers who participated in the study, 66.7% were male while the remaining 33.3% were female. This means that there was a higher participation of male science teachers as compared to female science teachers in secondary schools in Thika-west sub-county. This number was proportional to the total number of female and male science teachers in the sub-county (M.O.E. Kiambu County, 2022) which was marked by fewer female science teachers compared to male science ones. The gender distribution in the study therefore reflects male dominance in the science field as observed by Steegh (2021) in his study where he found out that the males in the science field in USA are more than half of the total population in the field. UNESCO (2021) similarly placed women involved in science and research at only 30% globally and as low as 28% in Kenya. Science teachers are key in promotion of scientific ideas and research and there is therefore need to have both men and women equally represented in the teaching and in general participation in sciences.

3.2.4: Distribution of male and female science teachers by subjects taught

Data on the subjects taught by the male and female science teachers who participated in the research was taken. This would help establish what science subjects the boys and girls had an opportunity to study in school. The more science subjects available in school also would determine the opportunities to participate in many different science fairs, since science projects are affiliated to various science subjects. Table 4.2.3 shows that distribution.

Table 3.2.3: Science subjects taught by male and female science teacher respondents

subjects taught	males involved	females involved	Total
Chemistry	2	1	3
Physics	2	0	2
Biology	2	1	3
Mathematics	2	1	3
Home science	0	1	1
Total	**4**	**2**	**6**

Source: Selected Secondary Schools in Thika-west sub-county (2022)

The 6 science teachers taught different science subjects. Each secondary school teacher in Kenya is expected to have two teaching subjects which are examinable by Kenya National Examination Council (TSC, 2021). Therefore, with respect to this, the study found out that 2 of the teachers, both male, taught chemistry and biology, 1 who was female taught chemistry and mathematics, another female taught biology and home science while the last 2, both males, taught mathematics and physics, as indicated in table 4.2.3. None of the male teachers interviewed taught home science and likewise none of the female teachers taught physics. This was important for the research since most of the major science subjects were represented by teachers and hence the findings representative as far as different sciences are concerned. Therefore, data on science subjects taught by science teachers involved in the study was important in determining the participation of boys and girls in science fair competitions. It however did not escape the research that there are gender differences in the choice of subjects taught by various male and female teachers, since the study did not find a single male teacher teaching home science; nor a female teacher teaching physics. This agrees with the study by Beura (2017) who found out that most males preferred working on technical subjects like physics while females preferred biological and home science.

3.3 Gender Differences in Participation in Science Fair Competitions

3.3.1 Number of Boys and Girls involved in Science Fair Competitions.

The number of boys and girls involved in science fair was arrived at by asking the questionnaire respondents to mention the kind of students who participate in science fair and also to comment on how many girls as compared to boys participate in science fair in their school or subcounty. The interviewed respondents (science teachers) were on the other hand asked about their opinion concerning boys' and girls' participation in science fair.

The responses were alike and divergent with regard to the gender of the respondents such that girls as a group seemed to hold a certain opinion while boys as a group seemed to hold their own opinion.

The following table summarises the information on the number of boys and girls involved in science fair competitions as reported in various types of schools:

Table 3.4: Proportion of boys and girls involved in Science Fairs

Type of school	**Boys involved**		**Girls involved**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Two mixed schools	126	83	26	17	152	100
Boys' school	94	90	10	10	104	100
Girls' school	46	52	42	48	88	100
Total	**266**	**77**	**78**	**33**	**344**	**100**

Source: Selected Secondary Schools in Thika-west sub-county (2022)

As indicated in table 4.3, various students had various answers concerning the number of boys and girls participating in science fair. It is easy to note that responses on the number of boys involved in science fair is highest in the boys' only school at 94%, followed by the mixed schools at 83% and lowest in the girls only school. The girls' only school reported the highest number of perceived girls' participation in science fair competitions, at 42%, which is still lower than the perceived number of boys at 52%. It is worth to note that on average, schools reported that the participation of boys in science fair is higher, at 77% compared to that of the girls at 33%. This presents a gender gap in participation in science fair. Much as the Ministry of Education Science and Technology (MOEST) has persistently underscored the importance of co-curricular activities, including science fairs, in secondary schools in Kenya (Ndunguri, 2017), and have therefore opened participation for all students irrespective of their age, gender, school or religion, the involvement of boys and girls in science fair in Thika-west sub-county is skewed towards boys since fewer girls were seen to participate. The study therefore found gender differences in the number of boys and girls involved in science fair competitions.

As for the 6 science teachers interviewed, 4 (66.7%) agreed that boys' participation in science fair competitions is more than that of the girls, while 33.3% (2) felt that girls and boys participate in science fair by equal numbers. No teacher felt that the participation of girls is higher than that of boys.

Findings of this study therefore agree with those of the studies by Beura (2017) who found out that in India, the representation of boys in science is higher than that of the girls. Steegh (2021) had similarly found higher numbers of boys participating in science fair in USA compared to girls. Gender gap in the number of boys and girls participating in science fairs in Thika-west sub-county may therefore contribute to gender differences in participation in science.

3.3.2: Science Fair Projects selected by Boys and Girls

The respondents were asked to state the kind of projects most students in their schools undertake. Most respondents felt that there were no major differences in the kind of projects selected, and that girls as well as boys can comfortably deal with any project. This is as indicated in table 4.3.2:

Table 4.3.2: Science Fair projects selected by boys and girls

Projects mostly selected	**Boys involved**		**Girls involved**	
	Number	Percent	Number	Percent
All sciences	116	67.1	113	66.1
Chemistry	14	8.1	12	7.0
Physics	14	8.1	10	5.9
Mathematics	14	8.1	14	8.2
Biology	12	6.9	12	7.0
Home sciences	3	1.7	10	5.9
TOTAL	**173**	**100.0**	**171**	**100.0**

Source: Selected Secondary Schools in Thika-west sub-county (2022)

As discussed in table 4.3.2, majority of the respondents (67.05% of boys and 66.08% of girls) indicated that boys and girls in their schools and sub-county have no problem tackling any

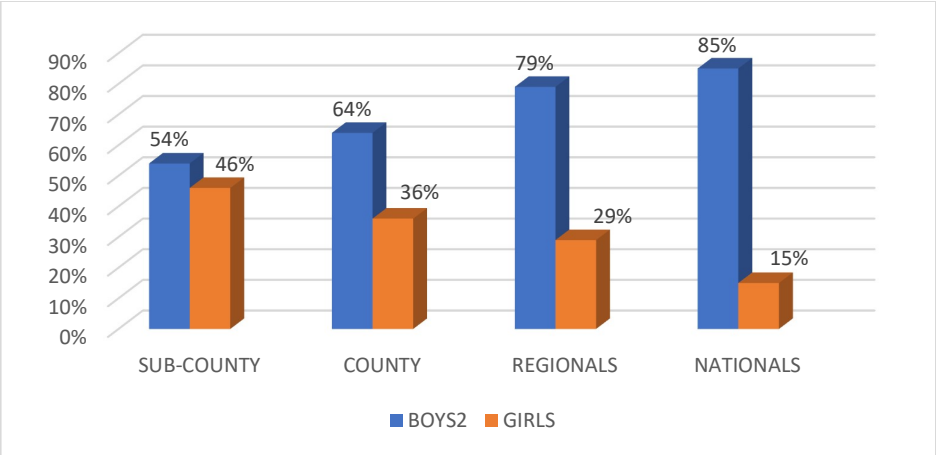
science project and hence any student, irrespective of their gender, can tackle science projects leaning to any science subject. It however emerged that more girls (5.85%) than boys (1.74%) preferred home science projects, indicating that indeed there are gender differences in the choice of the projects. For projects leaning on the other subjects, the differences appeared minimal. This suggests positivity on the side of the students towards participation in any kind of projects. Going by the responses of the girls particularly, it is easy to conclude what Gasant (2011) concluded that 'While the stereotype of a scientist as a man is still prevalent, some girls are challenging it and speaking out just as forcefully as boys.'

Findings of this study therefore are contrary to studies by korkmax (2012) and Greenfield (1995) who found out that boys tended to choose physics projects and girls biological projects. However, the responses of student respondents differed with those of the majority of science teacher respondents (66.67%) who felt that boys choose more technical and more challenging projects like energy and transport which lean on physics, whereas girls choose simpler projects such as those associated with home economics and lean on biology and home sciences.

3.3.3: Levels of Participation Reached

Findings on the levels of participation reached in science fair competitions was established by asking the respondent the questions 'What is the highest level reached by your school in science fair between 2012 and 2021? Who reached that level?' The responses indicating the highest level reached by different school is as summarised in figure 4.3.1

Figure 3.4.1: Highest levels of participation reached in science fair between 2012 and 2021



Source: Selected Secondary Schools in Thika-west sub-county (2022)

As indicated in figure 4.3.1, the percentage of boys who participated in science fair between 2012 and 2021 was higher than that of the girls at all levels of competition. At the sub-county level, which is the lowest level of participation, boys who participated were 86 (54%) compared to girls who were 72 (46%). This presents gender differences in the level of competition reached, in favour of boys. Similarly, the number of boys compared to girls increased with rise in the levels of participation, while that of girls decreased. The percentage for boys moves to 64% (21 participants) against girls' 36% (12 participants) at the county level. At the regional and national levels, boys are at 79% (19 participants) and 85% (11 participants) respectively

while girls are at 21% (5 participants) and 15% (2 participants) respectively. This suggests that boys perfect their projects as the competition gets tougher as opposed to girls. The number of girls decrease with rise in the level of competition which implies that they get less chances to participate in more meaningful levels of science fair competitions and hence less exposure to scientific challenges. This might therefore be used to explain the gender gap in technical departments of science (UNESCO, 2018) which argued that in Africa, female scientists rarely work as research directors or Principal Investigators, rather, they work at junior posts, and that women tend to leave more senior scientific posts for their male counterparts. Akala (2010) argues that this gender gap is seen to roll back to school days where boys are reported to be more active in science than girls are. She also argues that the situation happens regularly such that it appears like the normalcy hence when girls and boys grow up, men and women are used to this gender gap in science and embrace it as the norm.

One of the interviewees, asked about her opinion on participation of boys and girls in science fairs in the sub-county said;

"Girls participating in science fairs in the subcounty are very few. Actually, we almost know that girls who bring quality projects only come from one school (the mainstream national school in the sub-county). Other girls bring very uncreative projects and they don't seem to care to improve. Boys on the other hand try, irrespective of their school. Most of their projects are logical and proceed to higher levels" (Interviewee, female science teacher and judge).

Another said;

The only thing girls have in science fair is communication skills and confidence. Most of their projects are shallow, they don't go beyond the sub-county level. Boys may lack language but their projects speak volumes (interviewee, male science teacher).

These responses confirm that there are gender differences in the levels reached by boys and girls in science fair in the study locale. These differences seem to be in favour of boys where they were reported to produce more quality projects compared to girls, projects that are likely to proceed to higher levels of competition.

Findings of this study are in contrast with the study by Westbury (2017) which found out that boys and girls compete equally at all levels of science fair competitions and that equal number of boys and girls often reach the highest levels of competition.

Strategies to Enhance Participation of Boys and Girls in Science Fair

In evaluating the strategies to promote boys' and girls' participation in science fair, questionnaire Respondents were given seven potential tactics and asked to assess their agreement with each one on a 5-point Likert scale. The responses ranged from one (Strongly Disagree), two (Disagree), three (Neutral), four (Somewhat agree) to five (Strongly Agree).

Table 4.6.1: Strategies to Enhance Participation of Boys and Girls in Science Fair

	Variables	Rate 5	Rate 4	Rate 3	Rate 2	Rate 1	total
	Change the stereotypical view of girls' involvement in science fair through public education	203 59.0%	76 22.1%	32 9.3%	20 5.8%	13 3.8%	344 100%

	Add women judges and adjudicators in science fairs to act as role models for girls who want to participate in science fair	215 62.5%	63 18.3%	33 9.6%	23 6.7%	10 2.9%	344 100%
	Conduct workshops on self-image for secondary school boys and girls to make them more assertive as they participate in science fair.	213 61.9%	75 21.8%	43 12.5%	11 3.2%	2 0.6%	344 100%
	Ensure that there is no gender harassment or prejudice at the science fair environment.	200 58.1%	79 23.0%	51 14.8	9 2.6%	5 1.5%	344 100%
	SEMASTEA and Government Departments need to sponsor girls and boys to train on demands of science fairs.	275 79.9%	42 12.2%	20 5.8%	4 1.2%	3 0.9%	344 100%
	Engage girls and boys equally in science fair.	273 79.4%	46 13.3%	18 5.2%	4 1.2%	3 0.9%	344 100%
	Portray boys &girls in diverse roles in science fair.	276 80.2%	41 11.9%	18 5.2%	5 1.5%	4` 1.2%	344 100%
	Change the stereotypical view of girls' involvement in science fair through public education	203 59.0%	76 22.1%	32 9.3%	20 5.8%	13 3.8%	344 100%

Source: Selected Secondary Schools in Thika-west sub-county (2022)

In the table, it can be seen that most respondents strongly agreed with the strategies suggested by the statements, ranging from 58.1% to 80.2% respondents. This implies that the respondents found the strategies suitable to tackle the challenges facing girls and boys in participation in science fair. The lowest number of respondents, ranging from 0.6% to 3.8%, strongly disagreed with the statements. These strategies are covered in more detail in the subsections that follow, as shown below:

CONCLUSION AND RECOMMENDATIONS

5.3 Conclusion

The study concludes that, participation of girls in science fair competitions in Thika-west sub-county is lower than that of the boys. Consequently, girls do not prioritize participation in technical science fair projects since they have been pushed to less prestigious projects such as home science and environmental projects which may not take them as far as where projects in engineering, energy and transport, and modern technology may take boys. Because of this, they frequently struggle to find the services and help they need to realize full participation in science fair competitions. The study findings also conclude that most girls tend to favour projects with less complex technical requirements. A few are satisfied with participation at this point. However, those who choose to venture to more technical projects face several challenges. Where there is presence of successful girls in technical projects, the belief that these girls are outliers rather than the norm is prevalent. Irrespective of their hurdles in participation in science fairs, this study reveals that girls are constantly asserting themselves as fully capable of participating in science fairs. There are girls who have reached the highest levels of science fair participation despite being trivialized. The research suggests policies that would provide women additional opportunities to participate in science and scientific fairs. These include Workshops to boost self-image, creation of gender equality awareness, and provision of role modelling and mentorship programmes. With these strategies, it is expected that girl's participation in science fair competitions will increase as time moves on

5.4 Recommendations

Following the conclusions of the study, the following recommendations are made to address the participation of boys and girls in science fair competitions.

i. Secondary school boys and girls should endeavour to fully participate in science fair competitions acknowledging that science is a field that can empower them both economically, through creation of job opportunities availed by invention and scientific engagements, and socially through interaction with fellow scientists.

ii. Science teachers should foster gender equality and equity in the school environment as well as in science fair competitions to encourage both boys and girls comfortably participate in the fairs. This can be done through portraying both boys and girls as capable in all sectors including in science fairs.

iii. Ministry of Public Service, Youth and Gender and the National Gender Commission should be more vigilant in ascertaining that science fairs arrive at gender parity through observing and assessing the execution of gender-responsive programs, in accordance with the 2010 Kenyan Constitution and the 2000 National Policy on Gender and Development.

iv. Scientific bodies such as CEMASTEA and SMASSE should support gender-sensitive programs, civic education, and campaigns to support the rights of women scientists and raise awareness of the accomplishments of women scientists who are role models in the county and throughout Kenya. This would encourage young women to imitate them and participate in science fairs, as well as work to combat stereotypes about the capability and abilities of women scientists. In order to safeguard women from sexual harassment in science, the bodies should also ensure that the Science Act is enforced.

v. Ministry of Education, Science and Technology (MOEST) should work hand in hand with the Ministry of Public Service, Youth and Gender to ensure that scientific organizations implement complex and organized programs like workshops, mentorship, sponsorship, and training for boys and girls in order to ensure that both boys and girls actively participate in science programs. It should also endeavour to have more women train for teaching courses in science to promote female role models who will help to inspire more girls for involvement in science and science fairs. As a result, science fairs would be able to more easily develop a pool of female technical employees.

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