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# Students' Perceptions of Factors Influencing Choice of Science Streams in Tanzania Secondary Schools

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A Master's Thesis Presented

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# ABSTRACT

This study explored students' perceptions of the factors influencing their decision to choose between the Science and Arts streams for ordinary level secondary schools. The study also examined the kind and level of support, guidance and information students receive before making stream choices. Using both qualitative and quantitative approaches, data was gathered through questionnaires, document review, focus group discussions and semi-structured interviews from 101 students, 13 science teachers, 4 heads of schools and (1) District Educational Officer in Morogoro region. The literature review and research questions guided the analysis of data by organizing the analysis section into several themes.

The findings of this study indicate that factors such as students' examination scores, self-efficacy in science, knowledge of available careers, gender and school resource contexts affect students' choice of science streams. The results also reveal that a majority of students had relatively little knowledge of available careers and how they are related to subject choices.

This study recommends that efforts be made to improve secondary students' performance in science and mathematics since a majority of students perceive performance as a main factor influencing their choice of science subjects. There is a need to review and improve subject streaming processes in schools by providing relevant career guidance and advisory services to enable students make informed stream choices. Finally, special attention should be paid to female performance and participation in science and mathematics because findings from this study have indicated this to be a serious problem.

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# DEDICATION

First of all I thank God for giving me a breath and a healthy school life. I dedicate this work to my parents who gave me life and took care of me. I appreciate the moral, social and academic support that my parents provided for me and I don’t know what I could do without them.

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# INTRODUCTION

## Statement of the problem

Trends in students' choices and persistence in Science, Technology, Engineering and Mathematics (STEM) subjects have been problematic in almost every corner of the world, however, to varying degrees. According to Lavigne, Vallerand & Miquelon (2007), students' participation and persistence in STEM is very minimal in comparison to other fields. Quoting the 2003 National Center for Education statistics, the authors point out that the percentages of graduates in STEM was only "18.1% in France, 18.2% in the United Kingdom, 20.3% in Italy, 14.5% in New-Zealand and 11.8% in the United States" (p. 351). However, this problem varies among different groups of students. According to Ryan & Deci (2009) and Maltese &Tai (2011), as far as the participation and persistence in STEM is concerned, studies point out various forms of disparities in gender, racial, ethnic groups and social economic status. Others note regional disparities. According to Dudu & Vhurumuku (2012) and Semali & Mehta (2012), the problem of poor performance and participation in STEM is more serious in developing countries. Having discussed the students' participation in science in various parts of the world, it is important to illuminate the status of secondary education system in Tanzania. The details on Tanzania secondary education system status will provide the researcher with grounds for justifying the need for this study.

As with many low resource countries, Tanzania recognizes the importance of science education for national development. In today's world of globalization marked by the development of science and technology, Tanzania will need to invest in science education so as to create a scientifically literate society that will be able to compete in a global economy. This is very important because the gaps of development among nations correspond to their gaps in the level of science and technology. Tanzania has taken different initiatives to improve students' performance and participation in science and mathematics.   According to Semali & Mehta (2012), Tanzania has implemented a number of projects in science education. They mention the Science Education Secondary School (SESS) which aimed at improving performance in Science and mathematics, There are Science Improvement Project from 1995 to 2003 funded by the German Government Organization, GTZ and the Education Project II funded by the African Development Bank. The aim of this later project was to develop teaching materials and distribute textbooks to science teachers. Despite all these efforts, students' participation and performance in science and mathematics has continued to challenge Tanzania education (Semali & Mehta, 2012)

Previous research in Tanzania has focused on the reasons for students' poor participation and performance in science and mathematics, specifically, looking much into factors such as few numbers of teachers, unavailability of teaching and learning facilities in science, less motivation among teachers and so forth. In addition, many of earlier studies such as that of Alfayo (1993) and Msegeya (2009) have focused on gender issues in science classrooms particularly, the reason for girl's poor participation and performance in science and mathematics. A few or no studies have focused on the factors that influence students' choices of streams at the beginning of their third year of secondary education (Form III) when they are required to do so.

In this study the argument is that, regardless of those problems in secondary science, there are still those few students who choose to join into science streams. In that respect, understanding the factors (motivational and non-motivational) that influence students' choices of science streams as well as the kind and level of support, guidance and information that students receive before making choices is very important. Educators and policy makers can manipulate these factors to create systems that will encourage more students to join the science streams.

**Purpose of study and Research questions**

The aim of this study was to gain a deeper understanding of the factors influencing students' choices of subjects and what happen before students make their choices. I narrowed this study to students' perception of the factors influencing their choice of science streams. The reason that this study focused primarily on students' choices of science streams (not general subject streaming) is the fact that students' participation in science and mathematics is a big problem that continues to challenge Tanzania's education system. An argument behind this study is that understanding the factors that influence students' choices of science streams as well as support, guidance and information students need before making choices will help policy makers, educators and other stakeholders to discover gaps and opportunities with regard to students' motivation for science. This would then help educators and policy makers take informed decisions on how systems can be improved to increase students' participation and persistence in science and mathematics fields. Specifically, the purpose of this study was to explore the factors that influence form III students' choices of science streams and the kind and level of guidance, support and information students receive before making choices. The study tried to answer the following questions.

Research question 1

*What are students' perceptions of the factors that influence students' choices of the science stream at form III grade?*

Research question 2

*What is the kind and level of guidance support (if any) and information students receive before making choices?*

## Significance of the study

This study will be important for policy makers, teachers and other stakeholders as they can manipulate the factors that influence students' choices of science streams to encourage more students' participation and persistence in science fields. This study will also help in identifying different motivational components that are missing in school streaming processes and hence inform policy makers on how to improve subject streaming in schools. This information will then inform creation of systems that will encourage more students to choose science subjects. In addition, this study will inform pre-service and in-service education programs that train science teachers on the factors that influence stream choices. This may lead to the integration of student support and advisory services into teacher education programs. Tanzania needs a scientifically literate society in order to develop the strong science and technological manpower necessary for Tanzania to compete in the global economy. This dream will only be possible if we have more students participating in science.

## Context of the study

### *Tanzania's secondary education system*

Tanzanian secondary education system is divided into two phases: 4 years of ordinary level (O-Level, Form I to IV) and 2 years of Advanced level (A-level, Form V to VI) also commonly known as high school. The school curriculum is mainly subject-based. Students start secondary education (Form I) at an average age of 14 depending mainly on how early they started primary school. O- Level curriculum requires that students take seven compulsory subjects and up to six optional subjects (Towse, Kent, Osaki, & Kirua, 2002). Toward the end of form II grade/the beginning of form III grade students are required to choose either joining the science streams or art streams. For the few schools with business streams, students can choose to join business streams. There are minimum numbers of subjects required for each stream that students will have to choose. It is at this choice stage where the problem of students' participation and persistence in science and mathematics fields is explicitly seen. Normally only a few students choose to join the science streams. This was the motive behind this study.

***The study area***

Morogoro municipality (commonly called Morogoro) is a capital of Morogoro region located about 191 Kilometers from Dar es Salaam (the commercial capital of Tanzania) with an estimated urban population of 286,248 people according to the Tanzanian 2012 census. According to the District Educational Officer, in 2012 when this study was conducted, Morogoro had a total of 47 secondary schools 23 of which were public schools. The private sector is as large as the public sector with a total number of 13,662 (6621 boys, 7041 girls) students compared to 15,955 (8059 boys, 7896 girls) students in the public sector. In this study I limited my study population to public schools only because most private schools have different procedures and structures in relation to the study topic. Moreover, public schools had a more easily accessible population than the private schools.

Public secondary schools in Tanzania are either under the central government or local governments in respective areas. Schools under local governments are commonly known as "community schools" and represent a larger number of new schools established in the early 2000's.This were a result of the expansion of primary education that consequently fueled expansion in the secondary sector. In addition, community schools are usually under-resourced and with most of students coming from low-income families. 21 out of 23 public secondary schools in Morogoro are community schools. This study involved four schools out of which three were community schools.

According to the District Educational Officer, in 2012 when this study was conducted public secondary schools in Morogoro had a total number of 821teachers, of whom 282 or 34% are science and mathematics teachers. Overall the teacher-school ratio for Morogoro district is 35:1. This relatively good teacher-school ratio is not surprising because Morogoro is not that remote compared to other districts in this region. Another reason could be that Morogoro region is the second closest region to Dar es Salaam (the country's commercial city). Below is map showing how Morogoro is situated on the map of Tanzania and Morogoro region


**Figure 1: Morogoro region map showing Morogoro District**

Source: Paavola (2008)

# LITERATURE REVIEW

## Theoretical framework

A critical survey of the literature indicates that there are two general categories of emphasis in the literature. For the purpose of this study, the author characterized these two categories as the “Left Extreme-LE” and the “Right Extreme-RE.” Emphasis in LE and RE can be placed along a continuum. This study assessed the nature and implication of these categories in relation to the factors influencing students’ choice of science streams. Factors influencing students’ choices of science subjects are interplay of reasons that can be located at different points along this continuum.

At one extreme, LE regards students’ choice of subjects as primarily linked to career/job aspirations and much of early work put more emphasis on this. The idea here is that students’ choices of subjects are informed by the knowledge about career/jobs that they have at the time they make choices. According to LE, students’ knowledge and information about careers/jobs results in the formation of tight and clear career goals that account for much of students’ motivation to participate and persist with particular school subjects (Siann, Lightbody, Nicholson, Tait & Walsh,1998) This implies that students’ motivation for subjects is more externally oriented. Therefore, to attract more students in science subjects, there is need to tell, counsel and guide the students by giving them knowledge of career opportunities and other external rewards embedded in those careers. These may include high status and paying jobs. The belief is that if students have a clear picture in mind of careers they want to pursue then they are likely to be motivated to study subjects that will lead them to such careers.

At the other extreme, RE regards students’ choices of subjects as being linked to students’ interest in some aspects within the subjects themselves. The nature of science content, the kind of instructional strategies, how teachers link science content to students' real life experiences, and how students are involved in interesting hands-on activities in science are regarded as important ingredients for forming inner students' interests and desire to choose science subjects (Maltese &Tai, 2011). In the RE view, improving instructional strategies in science is the key for insuring students' internal interests. In summary, according to RE intrinsic motivation as opposed to extrinsic motivation leads to long-term outcomes that ensure that students persist in the STEM pipeline (Lavigne, Vallerand &Miquelon, 2007; Ryan & Deci, 2009)

**Discussion of Related Literature**

Research on the factors affecting student choice and motivation in science subjects provides mixed results.  According to Maltese & Tai (2011), students' choices are influenced by students' motivation and interests in science and mathematics. At the same time, students' motivation and interest is affected by many factors ranging from internal classroom factors such as the teaching and learning environment, instructional methods and strategies and the nature of science curriculum to more external factors such as students' social-economic status, gender and ethnic groups (Ryan & Deci, 2000, 2009; Lavigne, Vallerand &Miquelon, 2007; Maltese &Tai, 2011; Msegeya, 2009). It is well known that interest can be developed among students by manipulating these factors. Teachers' intervention in the classroom is frequently cited as most important for sparking and maintaining students' interests (Alfayo, 1993; Hulleman & Harackiwiez, 2009; Jones, 2009; Sandoval & Harven, 2011). Other studies have found a relationship between age and gender on student interests. According to Maltese & Tai (2010), students develop interest in science before and during early middle school age.

Regarding the subjects, Francis (2000) observes that, there has been a hierarchical subject status with the sciences associated with high status and the arts associated with low status. Following this association, Francis (2000) further demonstrates that the sciences have been seen as objective and rational while the arts seen as subjective and less rational. The sciences have been associated with high paying careers such as medicine and engineering. From these observations, one would expect more students to choose the sciences; however, the opposite is the case. While the sciences are considered to lead to high status careers, they are also perceived by many students as difficult and therefore most students avoid them. Francis (2000), subjects such as physics, mathematics and chemistry are perceived by students to be more difficult than other subjects such as English, biology and history. Students' choices of subjects and streams therefore involve a big dilemma between the high status subjects leading to high status careers and the question of ability and/or perceptions of abilities.

While most studies mention various forms of disparities associated with subject choices, gender disparities continue to dominate the literature. According to Towse et al. (2002), most males are attracted and perceived to belong to "control" careers such as engineering and medicine while females are attracted and perceived to belong to "caring" careers such as nursing and teaching. Francis (2000) demonstrates that traditionally subjects have been gendered. According to Francis (2000) traditionally, subjects such as chemistry, physics and mathematics were considered as "masculine" while the arts, languages, history and other related subjects have been considered as "feminine". On the contrary, Francis (2000) notes that work such as that of Whitehead (1996) provide an opposite observation. Francis (2000) illustrates that although gender stereotypes continue, the majority of studies report that girls are performing as well as boys. Francis (2000) demonstrates that there are cases where girls' abilities in sciences subjects have surpassed that of men.

While Francis (2000) and Towse et al. (2002) studies were concerned with gender issues in subject and career choices, other studies have explored other pertinent issues related to subject and career choices. Early work by Siann, Lightbody, Nicholson, Tait & Walsh (1998) point out that family socio-economic status influences career choices for the majority of the students. Parents encourage students to go for high status and well-paid professions. As stated earlier, Siann et al. (1998) conclude that students' choices of subjects tend to be informed by the knowledge they have about possible careers at the time when they make choices. This implies that the support and guidance that students receive before making choices is a very important influence on students' choices and may keep students determined while working towards clear career goals. Moreover, if this is the case, students from high socio-economic status or where parents have higher education are more likely to have more knowledge of career and jobs at a time they make choices than those coming from low socio-economic status where parents are not educated. At the same time, a recent study conducted in Tanzania by Mabula (2012) also reveals that a majority of students had not formed clear ideas about the relationships between school subjects and available careers. According to Mabula (2012), students in government secondary schools in Dar es Salaam where this study was conducted had less information about available careers compared to fellow students from international schools. This represents another way in which socio-economic status can influence subject and career choices.

In a study with Chinese immigrants, Siann et al. (1998) also conclude that most of these young Chinese did not have knowledge of available career opportunities because either their parents were too busy to provide career advice or because of language difficulties. Siann et al.

(1998) also note that the problem is severe for children coming from low-income families. They finally recommend that schools, parents and other agencies work collaboratively to provide career advisory services to school children.

Very few studies on students' choice of subjects have been conducted in African context recently. Earlier work by Efiong (1986) that studied the factors affecting students' choice of science subjects in Nigerian secondary schools produced mixed results. This study revealed that students' attitudes toward science (enjoyment of science) were a very important factor that determined students' choices of science subjects. Students' attitude toward science highly correlated with science subject choice ($r=0.765$). Other factors that related with subject choice in this study were students' spatial intelligence ($r=0.538$) and students' total intelligence ($r=0.556$). According to Efiong (1986), the relationship between gender and subject choice was less significant. However, boys outperformed girls on measures of attitude toward science and interest of science careers. From this study, the author concluded that students are less likely to choose science subjects if they consider them difficult. This implies that students' self-efficacy (perception of abilities) in science is very important for determining students' participation and persistence in school science and science fields. Efiong (1986) also demonstrate that science, as a career was important, but not enough to determine students' choice of science subjects.

Contrary to Efiong (1986) findings that gender is a less significant determinant of science subject choice in Nigeria, a recent study by Kagume (2010) in Kenya identifies gender as a critical problem in science education, particularly career choice in Science, Mathematics and Technology (SMT). According to Kagume (2010), because of many reasons including social and cultural tendencies that put more value on men than women, women's participation in science, mathematics and technology subjects and careers in Kenya represents a big problem. However, similar to Efiong's conclusion, in this study of the social cognitive influences on career choice of SMT, Kagume (2010) also concluded that students' high self-efficacy in SMT was a very important factor that influenced these women's choices of SMT careers. Regarding students' knowledge of available careers, Kagume (2010) found that these women in Kenya did not have accurate sources of information about available careers.

Earlier work by Beukes (1986) that studied the factors influencing standard 10 pupils' choice of post-school training and job entry in South Africa also came up with a number of issues regarding students' subject and career choices. Beukes (1986) demonstrated that students who performed well in schools made more realistic choices than students performing poorly in school. According to Beukes (1986), Parents' occupations were a significant influence of students' choices of occupations only if these parents belonged to engineering and natural science occupations. Regarding gender and school location, Beukes (1986) found that girls were more realistic than boys in making occupation choices and that, students from urban settings were more informed on available career and fields of study than rural students. Contrary to what a number of studies have found, Beukes (1986) found that school guidance did not have any significant effect on students' choices of occupations.

Other studies, however, have used a different approach to explain students' choices and motivation of science subjects. Although these studies recognize that students' career choices are influenced by a complex interplay of social, cultural and economic factors, they, however attach a negative connotation to external motives such as students' career goals. According to Maltese and Tai (2011), students' career goals do not lead to long-term outcomes. Maltese and Tai argue that the attitudes that students have toward subjects are a result of classroom interactions with teachers, the subject matter and fellow students. In other words, students' persistence in science and mathematics subjects has less to do with their career goals than with the quality of science classroom experiences that focus on internal motivations and interests.

Recent studies based on Self-Determination Theory (SDT) have found that students are more likely to persist in science career if they are intrinsically motivated than when students have external motives such future expectations for high status and paying career (Lavigne, Vallerand & Miquelon, 2007; Ryan & Deci, 2009). According to Lavigne, Vallerand & Miquelon (2007), self-determined motivation leads to students' interests in science subjects and these interests influence students' persistence in science fields.

With exception of the study of Siann et al. (1998), very few studies have been concerned with what really happens and specifically, the processes (formal or informal) that students undergo before making choices. Siann et al. (1998) concluded that institutional frameworks such as structures imposed at schools limited students' choices. Although this work mentions institutional frameworks as the influence of students' subject choices, it does not provide a detailed description of what and how these structures influence students' choices. This implies that school processes that students must undergo before making choices (that is, the structures; procedures and information sources) need to be studied in order to find out the extent to which such processes support or limit students' choices of subjects.

This study explored the factors that influence students' choice of science streams in the context of Tanzania secondary schools. Since this study focuses on a particular stage where students are required to make choices, it is also the interest of this study to assess the kind and level of support, guidance and information that students receive before making stream choices.

# METHODOLOGY

## Sample and study population

This study involved a total of 101 students, 21 science and mathematics teachers and 1 district education officer as will be described in the research design and procedures sub-section. Morogoro region was chosen because of the potential to get rural secondary schools that otherwise would be difficult to find in big cities such as Dar es Salaam. I also worked at this area as a supervisor of student teachers from the University of Dar es Salaam who were doing their teaching practice in 2010. During this time as a supervisor, I visited more than 12 schools in Morogoro district and met with teachers, heads of schools and students who made me feel that I could use those connections to make my work easier.

During this study, two urban schools and two rural schools in Morogoro region were selected. I used stratified sampling technique to select two schools from each of the stratum (rural/urban). The researcher defined urban schools as those less than 5 km from Morogoro urban; old schools established prior to 1990's and with good school resource contexts. It should be noted that a majority of these old schools have good school resource environments (science laboratory, teachers, textbooks etc.). Rural schools comprised schools at least 5kilometres from Morogoro urban, new community schools established in the 2000's and a majority of which have poor school resource environments. The researcher decided to use both rural and urban schools in order to determine the extent to which the school environment in terms of resources, age and location (urban/rural) relate to students' choices of science streams. The use of both rural and urban secondary schools also would help to determine if there are differences in the level of support, guidance and information students receive before making choices between rural and urban schools. Urban schools usually are better resourced with teachers and equipment; students in these schools often have access to private tutoring and sometimes the Internet. The case is different for rural schools. The researcher thought that these differences might have effects on students' choices. This study involved public schools only because they represent a large percentage of secondary schools in Tanzania, both in terms of number of schools and students, therefore, need more attention. In addition, private schools have varying and different approaches and procedures in relation to the topic under study. During this study, the researcher used questionnaires, interviews, document review and focus group discussions to collect data from one district officer, heads of schools, science teachers, heads of science departments and students.

The district officer for secondary education was selected because the researcher thought he/she might have considerable information about procedures that guide different activities and issues that involve secondary education in a district. The interview with the district officer helped the researcher to know if there is a policy that guides the process that form II students undergo before making stream choices. The interviewer asked the district officer if there was a structure in place for providing support and guidance for students before making choices.

The heads of schools from four schools were also interviewed to gather data on the kind and level of support, guidance and information students receive before making choices. They also provided the recent documents of form III students' examination scores; exams that the students did a year before they made their choices.

**Research design and procedures**

This study employed a mixed approach (both qualitative and quantitative); however, it was more qualitative than quantitative. The researcher used questionnaires, interviews and focus group discussions to collect data. The researcher mainly used a purposeful sampling technique.

Questionnaires were used to collect data for both question 1 and 2 from both students and teachers. The researcher also interviewed students to collect data for question 1 and 2 and interviewed the district officer responsible for secondary education to collect data on policy or procedures, if any that guide stream choices in schools. The researcher reviewed students' examination scores of the national form II exam (document review) prior to choices in order to determine the extent to which students' results influenced their stream choices. This review also helped the researcher to get a sample of students in the post-choice group who did not choose the science stream but had comparable scores with students who did choose the science stream. These students were also interviewed along with form II students. Focus group discussions were used in order to provide a big picture of the issues from all the four schools. In addition during focus group discussions with 13 science teachers, teachers were asked to share the strategies they use to encourage more students to choose science and mathematics.

Four heads of science departments' one from each school filled open-ended questionnaires which were followed by a brief discussion on their responses. The heads of science departments provided the information on the strategies that schools use to provide support, guidance and information for students as well as general strategies for encouraging students' participation in science and mathematics.

Students formed a large percentage of the total study population because students are the unit of analysis for this study. In each school students were divided into two main groups; an average of 10 students from the pre-choice (form II) group and the 15 students from the post-choice (form III) group.

The pre-choice group was comprised of students who were expecting to choose streams in the next few months when this study was conducted. These were 40 (24 boys and 16 girls) students (an average of 10 from each school). According to Gall, Gall, & Borg (2007), stratified sampling is a good technique to use when randomly sampling is likely to result in a sample that will not be representative of some groups (e.g., minorities) that are very important for a particular study. The researcher used a stratified sampling technique where boys and girls each formed a stratum. Students were then randomly selected from each stratum by counting and selecting every nth student depending on the size of each stratum. The study used a stratified sampling technique to get both girls and boys in the group in order to determine if there is a relation between gender and students' reasons for choosing a particular stream. This was considered very important because many studies have shown that girls participation and persistence in science and mathematics in low compared to boys. The researcher used interviews to collect information related to their plan for choice, questions focused on whether they planned to choose science streams or not and why, the influences on their choices and the likelihood that they will stick to their plans.

The post-choice group of students comprised two sub-groups- 38 (21 boys and 17girls) form III students (an average of 10 from each school) in the science stream and another sub-group of 23 (12 girls and 11boys) form III students (an average of 6 from each school). Non-proportional stratified sampling was used because the researchers wanted to get as good representation of girls as possible. From each stratum in each school, students counted numbers and following the seating arrangement and every $n^{th}$ student was selected. "n" depended on the total number of students in each stratum and varied from school to school. For instance, in school "L" where 5 boys had to be selected from a group of 33 boys in the class, every $6^{th}$ students was selected. Interviews and open-ended questionnaires were used to gather information from these students. Students from the science streams were asked to share information on the factors that influenced their choices, including why they decided to choose the science streams as well as the kind and level of support and guidance (if any) they received before making choices.

Criterion sampling was used to select the second post-choice sub-group which comprised 23 students who did not choose the science stream but had comparable abilities (in terms of exam scores) with those who are in the science streams. These students were selected based on their past exam scores. An average of 6 students with the highest scores in the art stream was automatically selected for this subgroup in each school. These students were asked why they did not choose science streams although they had good scores comparable to those who joined science streams. The purpose was to determine the influence of students' science exam score on stream choices.

**Table 1:** Sample and population of the study

| S/N | STUDY POPULATON | METHOD | TOTAL |
|---|---|---|---|
| 1 | District Educational officer (Secondary Education) | Interview | 1 |
| 2 | Heads of schools from four selected schools | Interviews | 4 |
| 3 | Science teachers( from 4 schools) including 4 heads of science department | Focus group discussion, Questionnaires | 13 |
| 4 | Students (Post-choice group) 38 in science stream and | Questionnaires, and interviews | 38 |
| 5 | Students (Post-choice group) 23 in art and business streams who had comparable exam results with those in science stream | Interviews, document review | 23 |
| 6 | Students (Pre-choice group) schools | Interviews | 40 |
| | | **Total study population** | 119 |

## Instruments

This study employed four data collection instruments to collect data from students, teachers and the District Educational Officer. These were questionnaires, interviews, a focus group discussion and document review details of which are described below;-

### *Questionnaires*

The researcher developed two sets of questionnaires; one that was administered to form III students in the post-choice group (See annex 1) and another that was administered to science teachers and heads of science department (See annex 2). These questionnaires consisted of both closed and open-ended questions. Research questions and literature review guided the development of items for these questionnaires. For example, construction of the closed-ended items was guided by the literature review in relation to the first research question that is related to the factors that influence students' choices of subjects. These students' questionnaires contained 12 closed-ended items each with a 5-point scale ranging from strongly disagrees to strongly agree. Open-ended questions (8 items) were related to the second research question that sought information on the kind and level of support, guidance and information students receive before making choices. The researcher decided to use open-ended questions because understanding this part required a lot of information from students that could not be captured by closed-ended questions easily. The reason to use questionnaires was because of the easiness in administration. According to Gall et al. (2007), collecting data using questionnaires is easy and simple to administer.

Questionnaires for science teachers and heads of science department consisted of open-ended questions (5 items) that were meant to collect data on the kind and level of support, guidance and information students receive before making choices. These questions also collected data on the initiatives that science teachers and schools in general undertake to improve students' participation and persistence in science and mathematics. A research assistant randomly distributed a total of 38 questionnaires to students (post-choice) in science streams and waited until students completed filling them. The rate of return was 100%. I left 16 questionnaires with heads of science departments who distributed them to science teachers including themselves so that teachers could fill them at their convenient time. The rate of return was 81% (13/16) and this was because there were only 13 science teachers in these schools and not 16 as I envisioned.

***Interviews***

During this study the researcher used four sets of semi-structured interviews for students, heads of schools and the District Education Officer. Interviews were used because of their potential for obtaining naturalistic, detailed and complete information that would otherwise be almost impossible to obtain using other methods (Gall et al, 2007).

Interviews with post-choice students were face to face (about 4 minutes per student) and collected information on the students' perception of the factors that influenced their choice of science streams as well as the kind and level of support, guidance and information they received before making choices. With pre-choice students, interviews collected data on students' plans for the next few months when they will also be required to make stream choices. Questions were related to whether students wanted to choose science streams or not, why they wanted to do that and what influenced their future plans. Due to time and resource constraints, the researcher used group interviews to collect data from pre-choice students. A group comprised an average of 10 students and interviews for each group lasted for about 30 minutes. A 10 minutes interview with the District Educational Officer collected data related to the policy (if any) that guides subject streaming in schools as well as the district office's efforts to improve students' participation and persistence in science and mathematics. The researcher also interviewed 4 heads of schools and each interview was about 6 minutes long. All interviews were face to face and the mode of data collection was field notes. (For interview guiding questions see annexes 3, 4 & 6)

***Focus group discussions***

The plan was to get 16 teachers (4 from each school) but only 13 teachers participated in a focus group discussion. The researcher used a focus group discussion both as a data collection and learning tool. During these two and half hours session, science teachers from four schools came together to discuss issues that were related to this study. The researcher grouped teachers into two groups (A & B) with each group consisting at least one teacher from each school. This could help teachers from different schools to share experiences on how subject streaming is conducted in respective schools. Each group discussed one question for 45 minutes followed by a whole group discussion. The question for group A was "What is the kind and level of support, guidance and information students receive before making stream choices? And "Why and what should be improved?" For group B the question was "What are the factors that influence form III students' choice of science stream? Why is it important to know these?"

As a data collection tool, focus group discussions helped the researcher to obtain detailed information related to the research questions of this study. I used this opportunity also to share with teachers current issues related to my study so that we can all gain knowledge and experience on how systems can be strengthen to improve students' participation and persistence in science and mathematics fields. The researcher considered this as a having a direct and immediate impact on science teachers, rather than waiting for the report that might not be accessible to them.

***Document review***

The conducted a review of post-choice students' past form II national examination results to determine the effect of examination scores on students' choice of streams. These examination results documents helped in obtaining a sample of pre-choice students who did not choose science streams but had comparable results with those who did choose science streams.

**Data analysis**

The researcher organized a data analysis section depending on the nature of data (qualitative or quantitative) and the method of data collection employed during the study. The researcher used frequency count technique to analyze field notes interview data, open-ended questionnaire data and field notes data from focus group discussion. Frequency count technique involved identifying the number of respondents who mentioned/cited particular reasons/factors and /or issues. These were then related to one or more themes and/or sub-themes that the researcher developed to organize the research findings. Frequency count was also followed by quantifying the number of respondents in terms of percentage of respondents who responded and /or reacted to particular reasons/factors and /or issues as they relate to main theme and sub-themes. Analysis also involved identifying important quotes form participants words that were deemed important in conveying participants' messages in their natural occurring forms.

Closed-ended questionnaire data formed the quantitative part of data analysis. The researcher coded and filled these data on Microsoft Excel sheets to form a data base that could be used to serve in answering the research questions. For each item of a closed-ended questionnaire (5-point Likert scale, from strongly disagree to strongly agree), the researcher recorded the number of students (frequency) who circled each response (e.g. "SA" for strongly agree). I used

Microsoft Excel software to plot graphs of number of students against these responses. I plotted and used these graphs as they related to themes and sub-themes that I used to organize research findings.

**Protection of research subjects**

Protecting human subjects is a very important issue that all researchers should consider when conducting research. Throughout the study (planning to data reporting) researchers should work in humanly possible ways to minimize potential harm and ethical issues that may arise regarding research participants (Gall et al, 2007). To ensure that participants are protected throughout the study, research participants filled consent forms (See annex 7) as a contract to agree to participate to the study. Although the form contained all the details, the researcher also discussed with participants their rights during the study, the significance of the study and confidentiality issues. Teachers or heads of schools filled these consent forms on behalf of the students since these students were below 18.

**Limitations of the study**

This study has a number of limitations that might influence its internal and external validity. I have identified the following issues that might have affected the internal validity. Firstly, this study did not control students' socio-economic status (SES) which is frequently mentioned as one of the factors affecting students' choice of subjects. Although, the researcher categorized schools as urban or rural community that may have relationship with SES, it is not always the case that this relationship exists.

Secondly, language barriers may have affected the accuracy of students' questionnaire data. The researcher developed questionnaire items using English language basing on the fact that schools at secondary level use English language as a medium of instruction. However, during interviews the researcher discovered that a majority of students were struggling to express ideas in English and we decided to use Swahili language where possible to get more information. From this observation I thought that English language might have limited students' expression of ideas on questionnaires.

Lastly, due to shortage of time and resources, group interviews were used to collect data from pre-choice students (form II students). This might have limited students' freedom to talk about future plans of subject choice. For example, students may feel shy to say before others that they plan to choose art or business streams fearing that fellow students would label them as dull students.

There were also issues that might have threatened the external validity of this study. Firstly, the study sample consisted of public schools only making it difficult to generalize the findings to all secondary schools including private schools. Secondly, this study studied subject choice at Ordinary Level (O-level) secondary education and may not be generalized to subject choice at Advanced level (A-Level) secondary education.

Thirdly, the researcher used non-proportional stratified sampling to ensure enough representation of girls in the study. The intention was to obtain at least 40% representation of girls which for some classes did not match the real proportion of girls in particular classrooms. Although non-proportional sampling affects the external validity, it was used to strengthen the internal validity of the study which I considered important.

Lastly, my position as a researcher also might have influenced the validity and reliability of my study. Since I worked with these teachers a year before during my field work, the connections I have with them and my position as an employer of a state university may have influenced their responses in one way or another. For example, although I assured heads of school that information from them will be kept confidential; may be they feared that because of my position the information may reach their superiors. Also being a stranger in these schools may have affected students' responses during interviews, fearing that information may reach teachers. I can imagine that fear, especially, in such contexts where the power distance between teachers and students is wide. The research assistant was a tutor at Morogoro teachers' college whose position, I presume, had a negligible influence to the study.

# RESULTS AND DISCUSSION

The purpose of this study was to explore students' perceptions of the factors that influence their choice of science streams at form III level and the kind and level of support, guidance and information students receive before making choices. Following the design of this study being more qualitative, the researcher used coding to breakdown data so as to make analysis easy. Microsoft Excel software was used to analyze closed-ended questions from the questionnaires. Research questions and data from this study guided the organization of these findings into themes that will be presented in this chapter. I start with themes related to the first question (What are students' perception of the factors that influence their choice of science stream?) followed by those related to a second research question (What are the kinds and level of support, guidance and information students receive before making choices?).

## Students' perception of the factors influencing their choice of science stream at form III

### *a) Stream choice being determined by a form II national examination results*

The majority of respondents from each category of research respondents mentioned the national form II examination scores as the main factor influencing students' choices of science streams. This (form II National Examination) is a central and national examination that all form II students in Tanzania sit for at the end of their second year of secondary education. This examination tests students' knowledge and understanding of the content they have learned in all subjects and covers content for both the first year and second year of secondary education. As students start their third year (Form III), schools require them to make subject stream choices.

There was ample evidence from this study that students' scores from this examination influenced their choice of science streams.

*Students (post-choice) in science streams*

During interviews, 76% (29/38) of form III students (post-choice) in science streams perceived that the results of a form II national examination they took a year before was mainly a ticket that led them into science streams. Students who had good results on this national exam had a greater chance of choosing science streams. Review of the National form II exam results that we conducted in each school also confirmed this. The list of students in science streams corresponded to the list of students that scored highly on the national examination. However, there was no common pass mark between and within schools. Everything depended on an overall performance of the school in this national exam.

There was also a tendency to balance gender. Review of exam scores indicated that in all four schools girls, generally performed more poorly in the national exam than boys. To balance gender, girls with lower average scores were allowed to join science streams than boys. In all schools, however, the rule was that no one with average of "F" would be allowed to join a science stream.

Responding to an open-ended question that asked the extent to which students were free to make stream choices, 70% (12 /17) form III students (post-choice) in science streams from rural schools "M' and "N" reported that teachers made choices for them based on their exam scores. One student wrote;

> *"Yes, the school did because of my exam score in science subject but even if they not choose me I was about to do it by my own". But in my school teachers are the one who decides according to students' performance"*

It is not surprising that in one urban school "L" a majority of the students reported that they made choices of science streams by themselves because a majority of students did well in form II exam. Since school "L" represents a school whose students had higher average scores in the national exam, this may mean that students who receive higher scores in this national exam, have more freedom to choose streams. The reverse was true for schools that perform poorly in this exam because teachers are forced to intervene in their choices so that only the few students who do well go to science streams. It should also be noted that school "L" is a school under the central government, better resourced with competent teachers, science laboratories and other teaching and learning materials such as books and was established more than 30 years ago.

The rest of the schools of this study population are community schools established in the 2000's. Despite the fact that school "K" was a community school and recent one, it was well resourced and in the middle of the urban area compared to school "N" and "M". For this reason, it was categorized in the group of urban schools along with school "L". Review of examination scores data showed that these community schools performed poorly in the 2011 form II national examination compared to school "L". This implies that school resource contexts influenced students' performance and consequently, their choice of science streams. Students' examination scores in respective streams also confirmed this. For example, form III students in the science streams in urban school "L" had average scores ranging between A's, B's and few C's on the 2011 form II national examination results, while in rural school "N" only 17% (15/86, 3 girls, 12 boys) of students in science streams had scored an average of "C" and "D" in the same exam. The remaining 71(83%) students had failed their examination with averages of "F". During interview, head of school "N" had this to say:

> *"Because most girls did not do well in the examination we allowed few girls with average of "F" but who showed good records in science subjects to join science stream"*

This implies that during subject streaming, schools that perform poorly in this exam are left with no option other than letting students, regardless of poor scores, into the science streams otherwise science streams in these schools will remain empty for that academic year. This may imply that using this national exam only as a requirement for making choices is meaningless after all; even students with "F" averages can go to science streams in some situations.

Data from questionnaires also indicate that students' exam scores influenced the degree of freedom to make choices. Overall school performance and students' performance in the study sample corresponded to the degree to which students in respective schools perceived teachers' influence on their freedom to make choices. This means that students in rural schools which underperformed in this exam perceived more influence from teachers on their choices than was true for students in urban schools who performed comparatively well in the same exam. A total of 38 form III students (post-choice) in science stream responded to a closed-ended item (5-point scale, from strongly disagree "SD" to strongly agree "SA") that was written as "*I chose science stream because teachers told me to do so"* and graphs below (figure 2 & 3) show the degree to which teachers influenced students' freedom of choice as per students' responses on this questionnaire item by type of school (rural/urban).

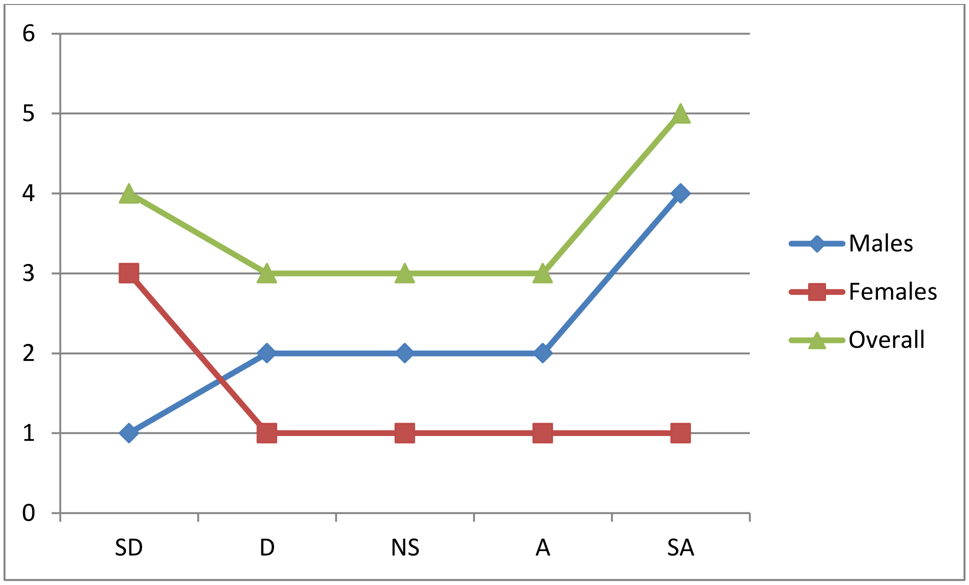


**Figure 2: A graph showing the degree to which students perceived teachers' influence on science stream choices in rural school "M" and "N"**

Figure 2 above presents data from rural schools “M” and “N” showing that the degree to which students perceived teachers influence as being important for their science stream choices. This can be explained by the fact that these students underperformed in their form II examination, the very examination that teachers use to screen students into science streams. This graph indicates that girls perceived less influence from teachers on their freedom to make choices than boys. This is not surprising since girls had a greater chance to be allowed to join science streams than boys with the same exam results. The case was different for urban schools as indicated in figure below:

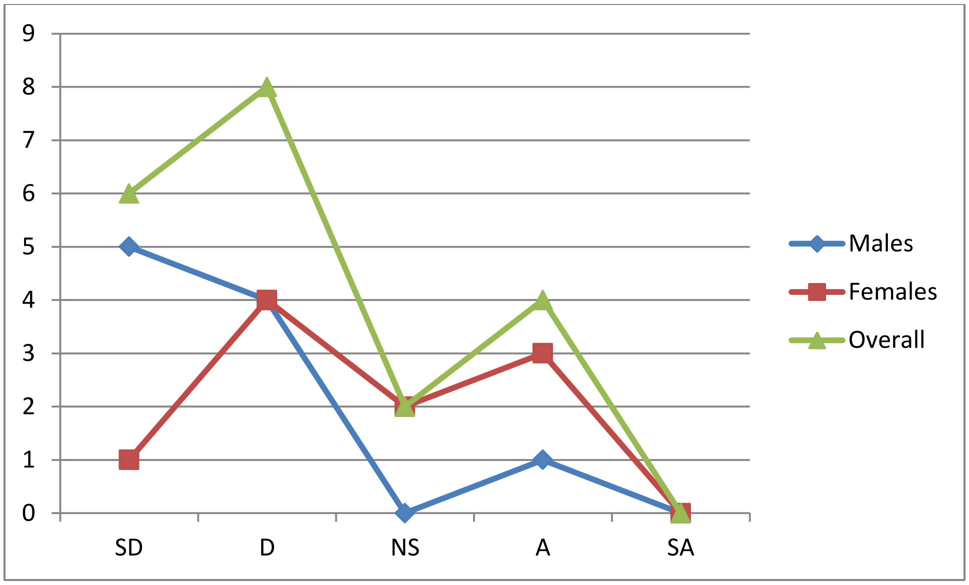


**Figure 3: A graph showing the degree to which students perceived teachers' influence on science stream choices in urban schools "K" and "L"**

Figure 3 above shows data from urban schools “K” and “L” showing that the degree to which students perceived teachers’ influence on their freedom to make choices of science streams is skewed. A majority of students disagreed that teachers had influence on their freedom. This is not surprising because students in urban schools performed well in a national form II exam. A majority of girls perceived less influence (strongly disagreed) than boys. This is expected since girls were more likely to be allowed to join science streams than boys with the same examination results.

*Heads of schools and science teachers*

As related to examination scores, interviews and focus group discussion data indicate that there were variations between schools with regard to the extent to which students were free to make choices by themselves. In urban school “L” teachers labeled the classroom doors as “Art”, “Science” or “business” and students would go to the classes they like. On the contrary, in a rural school “M” teachers created a list of students who were considered qualified to join science streams without their consent based on their form II national examination scores. During interviews, the head of a rural school "N" reported that students who did not qualify to join science streams were given chance to write application letters and would be allowed to join science streams on a probation period of six month, if teachers were convinced by their progress then they would be allowed to continue.

Focus group data also confirmed that teachers used form two examination results to determine students' subject streaming. One science teacher from school "N" highlighted that:

> *"We must do that (choose for them depending on scores) to help them because if we do not do that they will blame us when they fail their form IV examination".*

Some teachers were against this and recommended the use of continuous assessment and not only one central national examination.

*General trends and implications*

Data from questionnaire and interviews indicate that a majority of the students perceived that their form II examination results were the main factor that influenced their choice of science streams. Students expressed this in relation to the degree of freedom of choice in their respective schools. In all cases, however, students knew one thing; a good form II exam score is an important ticket for any students to join a science stream. Using single examination scores as a base for students' subject streaming may have different implications for students' choices of streams. Firstly, it communicates that improving students' performance is an important path on our journey to improve students' participation in science fields among students in Tanzania. In other words, efforts to improve the participation of girls and boys in science must therefore start with the improvement of students' performance in all school subjects which will lead to improved average scores in form II national examination. Secondly, this examination may limit students' freedom to make subject choices and hence lower students' motivation to continue with school, especially in situations where students end up in a stream that doesn't match his/her career goals.

Thirdly, because students' performance on an examination can be hindered by a variety of factors like anxiety, difficult examination conditions or illness, some students who have abilities to make it in science subjects can be denied a chance to show their abilities simply because they performed poorly in a single examination. Finally, this may fuel further social disparities in the science profession. Students from low- income families are more likely to perform poorly in national examinations because most of them don't have access to private tutoring which plays a role in students' performance. This implies that students from low-income families are more likely to be screened out from science streams. Moreover, most students in community schools come from low-income families

**b)** ***Students' abilities and self-efficacy***

Self-efficacy refers to the perceived abilities that one has for a particular task. According to Bandura, Freeman & Lightsey (1999), people with high self-efficacy believe that control over something is possible, as such; they set high goals and maintain strong commitments to achieve those goals. Students with high self-efficacy have strong feelings that they can approach difficult tasks and be able to accomplish such tasks. Bandura et al. (1999) demonstrate that high self-efficacy leads to improved task performance which consequently raises self-efficacy in that task to higher levels. On the contrary, low self-efficacy creates environments of stress and anxiety that lead to avoidance of a tasks and/or poor performance on a task. Poor performance on a task as a result of low self- efficacy consequently leads to a vicious circle of low self-efficacy. This implies that, High self-efficacy can lead to improved task performance and vice-versa (a mutual relationship between self-efficacy and performance)

*Students (post-choice) in science streams*

Related to students' examination scores, students' perceived abilities (self-efficacy) to do science subjects was frequently mentioned as the reason for choosing science streams. During interviews 71% (27/38) of form III students(post-choice) in science streams said that they chose science streams because they believed they could do well in science subjects. More than half (58%) of the same students gave the same reason on questionnaires; one student wrote

*"My performance in science subject is good since form one and I can do well in science"*

Regardless of significant differences in examination performances, both rural and urban students in science streams perceived that they chose science streams because they were sure they would do well in science. The fact that even students in rural schools with such overall poor school performance reported high self-efficacy in science may mean that self-efficacy is very relative. In other words, self-efficacy was related more to students' percentiles than to their actual scores. This calls for more studies to explore the relationship between students' performance and students' self-efficacy in Tanzania.

A total of 38 students (post-choice) in science streams responded to a closed ended item on questionnaires that stated "*I chose science streams because I was sure I can do well in science.*" This item was designed to determine the degree to which students' self-efficacy (perception of abilities) in science affected their choice of science streams. A graph below (figure 4) shows the degree to which students perceived self-efficacy as a factor that influenced their choice of science streams;

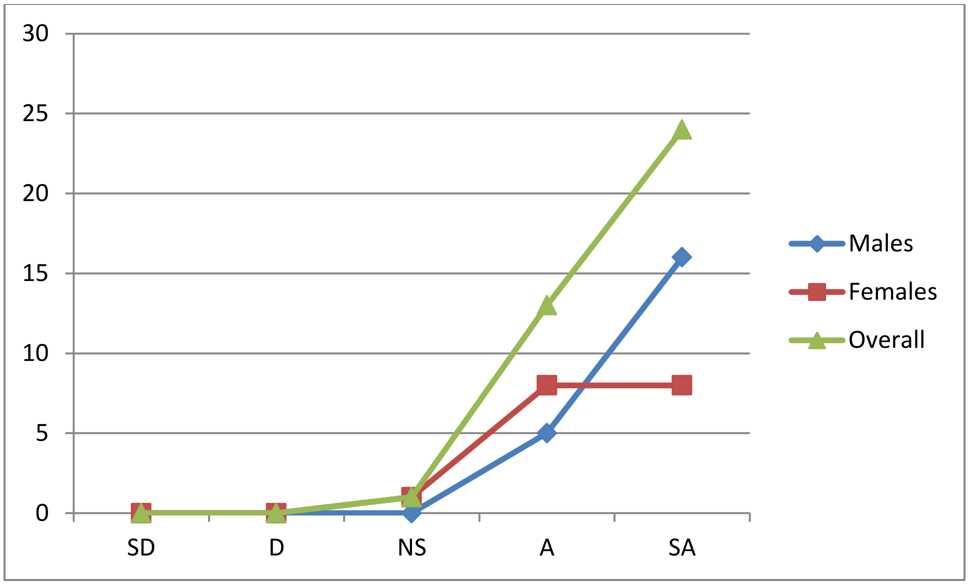


**Figure 4: A graph showing the degree to which both rural and urban students perceived self-efficacy as an influence of science stream choices**

Questionnaire data in Figure 4 above indicate that a majority of urban and rural students in science streams reported high self-efficacy in science. The graph indicates a significant difference in gender with the majority of boys strongly agreeing on the item than girls. This may be explained by the fact that in all schools girls generally underperformed compared to boys. This, however, holds only under the assumption that self-efficacy is positively related to performance.

Students' responses on another closed-ended item of the same questionnaire related to self-efficacy "*I chose science stream because it is easier to do science subjects than other subjects*" as shown in figure 5 below indicate that a majority of students (post-choice) in science streams perceived science subjects as easier compared to other subjects. This is another indication that students had high self-efficacy in science.

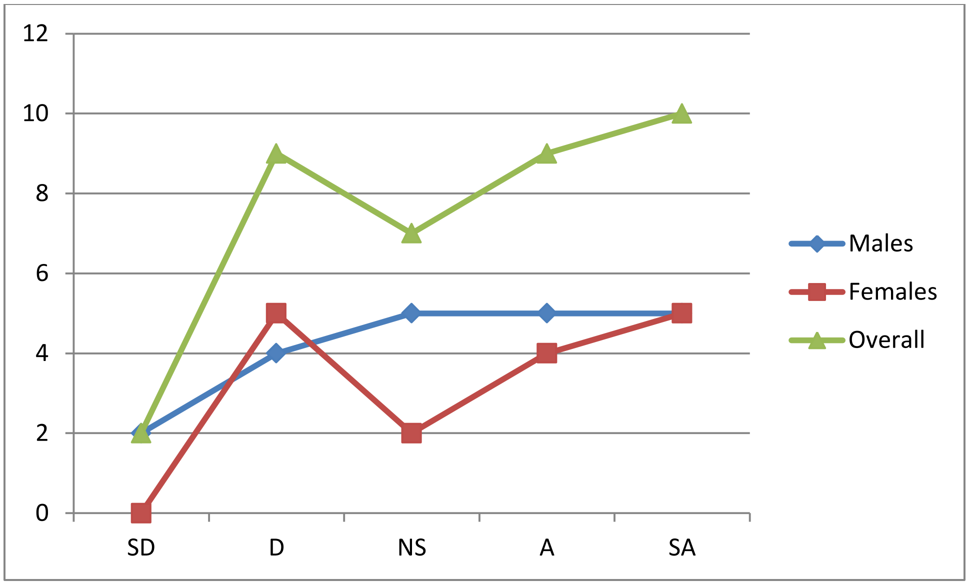


**Figure 5: A graph showing the degree to which both rural and urban students perceived science subjects as easier compared to other subjects**

Figure 5 above also indicates that a few students disagreed that science subjects were easier compared to other non-science subjects although this did not affect both their beliefs that they could do well in science and their decision to choose science streams as shown in Figure 4 above. This may mean that there were other factors, other than science subjects being easier, that influenced these students to join science streams.

*Form II students (pre-choice group)*

During interviews with students in the pre-choice group, 63% (17/27) of students who were planning to choose science streams in the next few months said that they were planning to do that because they have the ability to do science subjects. In addition, they also reported that their performance in science were promising. The opposite was the case for pre-choice students who said that they were not planning to choose science when they reach form III level. 69% (9/ 13) of students in the pre-choice group who were not planning to join science streams perceived themselves as having poor abilities and performance in science subjects. They gave these as their main reasons to run away from the sciences. They equated choosing science subjects with a risk of a life time because that would lead them to fail the final national examination which is a determinant of their future education and life. From interview data, there were no significant differences between schools and gender in relation to this sub-theme.

*Science teachers*

The majority of science teachers also believed that students' abilities were very important and related to students' choice of science streams. During focus group discussion, 61% (8/13) of science teachers believed that providing school conditions for students to perform well in science was necessary to encourage more students' to choose science streams. This suggests that increasing students' participation in science fields must begin with improving students' performance in science subjects. Improved students' performance in science subjects may increase their self-efficacy (perception of abilities) in science that consequently may result to more students choosing science streams.

*General trends and implications*

As noted above, students' high self-efficacy (perceived abilities) in science subjects was highly rated as a factor that influenced student' choices of science streams. Students' perception of their abilities to survive in science streams was very important in counteracting the risks that are involved, especially the possibility to pass a final secondary school leaving examination. In other words, students were less likely to choose science streams if they perceived science subjects as difficult. This appears to replicate both Francis (2000) and Kagume (2010) findings that identify students' self-efficacy in science as a main factor that influence student's choice of science subjects. These findings also support Efiong's (1986) conclusion that students' attitudes toward science subjects influenced their choice of science subjects. While data on examination performance shows variation between schools and gender , there were no significant variation between schools in terms of students' self-efficacy in science indicating that students' gauged their abilities to do science against fellow students in the same schools and not the standards in place. In all schools students reported self-efficacy in science despite their overall poor performance in the final form II national examination scores. However, a majority of boys than girls reported high efficacy of science. This also appears to support Efiong (1986) findings as well.

***c) Linking science streams with after-school opportunities such as employment, higher education loans and further education***

*Students (pre and post-choice)*

This theme is linked to the idea that because few students take science subjects, there is automatically less competition for future opportunities in education and life. During interviews and from questionnaires, a majority of the students stated this as a factor that influenced choices of science streams. Interview data indicate that a majority of parents and relatives at home used this reason to encourage their children to join science streams. These are two quotes from two students (pre-choice) who were planning to choose science streams in the next few month that came out during interviews;

*"Rahisi kupata ajira, art ni wengi sana, no ajira"*

Meaning that it is less competitive to get employment because few people are in the science as compared to those in art fields. (Researcher's translation)

*“ Cos walimu wa science hakuna sisi tuna nafasi kubwa ya kujaza nafasi hizo”*

Meaning that since science teachers are scarce, we have a greater chance to get employment in order to fill these gaps. (Researchers’ translation)

Responding to an open-ended interview question that required students to describe why and who encouraged them to choose science streams, 26% (10/38) of student (post-choice) in science streams reported that they were encouraged by either parents or relatives. 70% (7/10) of these student reported that parents encouraged them to choose science streams because it would be easier for them to get employment, admission to high school and universities as well as higher education loans. This implies that this factor was not only emanating from the students themselves but also was the result of pressure from parents.

There can be even more external pressure coming from the system because as part of Tanzanian  government’s policy to encourage students’ participation in science, the central Higher Education Students’ Loan Board (HESLB) offers a 100% loan for students who are admitted into the sciences in universities. In contrast a majority of the students in humanities and other social sciences usually have to cover the remaining part of tuition fees and other costs for themselves. For this reason it is not surprising that parents would like their children to pursue science careers to avoid future costs that are usually a burden especially for students from low-income families.

*As it relates to Tanzania context*

From this sub-theme, it is clear that students’ choice of science streams can be influenced by other social, economic, political and cultural factors that are unique to particular contexts. For example, interview data indicated that students’ choices of the science stream was influenced by future opportunities such as admission to high school and universities, access to loans when they get admission to university and employment. Students believed that regardless of poor performance, a science student has a greater chance for admission, student loans from the central students' loan board and employment because few students go to science streams and hence there is less competition. Also parents who advised students to choose the science stream used these reasons to convince their children. This is not surprising because a majority of parents cannot afford the costs of university tuition if their children do not get a 100% loan. Parents also cannot afford the costs incurred if their children remain unemployed for long time which is always the case in Tanzania if they pursue careers such as law, political science, administration and related careers.

Another reason could be that a child's education is normally an important family investment in Tanzania where once employed, a child is expected to take care of parents and siblings therefore, parents want their children to enroll in programs that assure them quick employment. Some of these strategies are very intentional. For example, Tanzania Higher Education Students' Loan Board (HESLB) policy indicates clearly that students who get admission into universities in science fields get a 100% loan in order is to attract more students in science fields. It is good to have such motivating mechanisms; however, it is also more important to invest in motivational strategies that have direct impacts to students' classroom learning in the classroom such as teaching and learning equipment including science laboratories and qualified and motivated science teachers.

### *d) The relationship between science stream choices and career choices*

*Students (pre-choice)*

Few students mentioned career choices as being related to their stream choices. This may be the case because the questions on an open-ended questionnaire were not framed to capture much of information regarding this sub-theme. However, during interviews with students both in the pre-choice and post-choice group efforts were made to capture from student information on this sub-theme. Responding to an interview question that asked what plans students in pre-choice group had about stream choices, interestingly, 68% (27/40) of students from all four schools reported that they are planning to choose science stream during the next year when they will be required to do so. This indicates that most students would like to join in science streams. There were no significant differences between schools as well as between boys and girls with regard to this question. When students were asked to explain why they had those plans, very few students in pre-choice group mentioned career goals as the reason why they plan to choose science streams. About 38% (5/13) pre-choice students who planned to join arts streams said they wanted either to be lawyers or politicians. The majority of the students related their plans to their abilities and performance in those subjects rather than to a desire for particular careers. Therefore, they were interested in the fact that they can do well in those subjects and pass their final secondary education examination. Very few students, however, had formed strong career goals. One female student from urban school 'L' contended tha:

> *"Ninayapenda masomo ya sayansi hasa baiologia na ninataka kuwa dokta kwa sababu ya masilahi"*

Meaning that I like science subjects especially biology and I want to be a doctor because it pays to be one. (Researcher's translation)

Another young male student in school “L” said that he was planning to choose science streams because he wanted to be an engineer. Although a few students mentioned their career goals they had not formed a clear relationship between subject choice and particular careers. This indicates that many students had less information about available careers and how selection of subjects might lead them to such careers. There were no significant gender differences in regard to the formation of career goals. There were, however, variation between schools with urban students more confident and well informed about available careers compared to students in rural schools. This can be attributed to the fact that students in urban schools are more likely to interact with formal and informal sources of information about careers such as the internet and people in urban who have more diverse careers compared to rural residents. All students who had formed career goals mentioned either engineering or medicine as the only career. This may also indicate that students have less knowledge about other careers such as pharmacy, forestry, animal sciences etc.

*Students (post-choice) in science streams*

A total of 38 students (post-choice) in science streams responded to three closed-ended items on questionnaires. These questions were framed as “I joined a science stream because (1) I want to get a good job in future (2) if I study science I will be rich (3) I will be respected at school and society” and were designed to determine the degree to which students chose the science stream because it could lead them to high status and well-paying careers. Analysis was carried out by adding up cumulative responses from these items. A graph below (Figure 6) shows that a majority of students believed that science streams could lead them to high status and paying career. However, there was a majority of students who said they were not sure as indicated in Figure 6 below. This can be attributed to the fact that a majority of students had less knowledge of available careers.

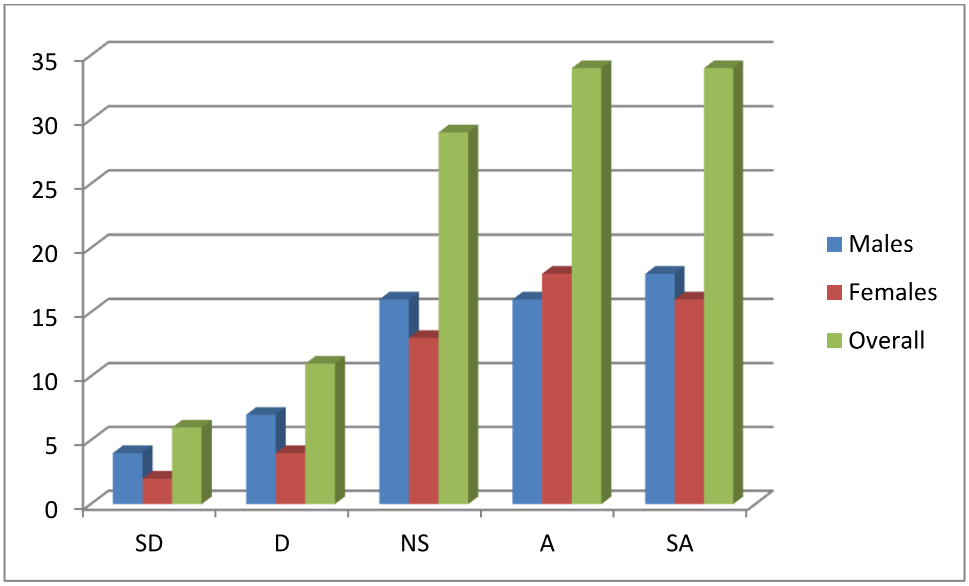


**Figure 6: A graph showing the degree to which both rural and urban students perceived that studying science would lead to high status and paying careers**

*Students (post-choice) in non-science streams*

The majority of students in the post-choice group who did not choose science but had at least comparable results with students who were in science streams had clear career goals as compared to students in the science streams. 70% (16/ 23) of students (post-choice) in art streams said that they had chosen arts because they wanted to be either lawyers or political scientists. Those who wanted to be lawyers said because it is a high paying profession. In school "L" which has a business stream, 1 out of 3 in the business stream said they wanted to be accountants because they would be rich in future.

*General trends and implications*

The majority of students did not perceive science as a career to influence their choice of science streams. At the same time, those few students who mentioned career goals in science as a reason for joining science streams, perceived science, as a career, important but not enough reason for them to choose science streams. This appears to support Efiong's (1986) findings in Nigeria where career goals influenced choices of science subjects among secondary students less than students' attitudes toward science and intelligence. This may be partly because a majority of students had less knowledge of available careers and how these careers relate to subjects choices. It is important for schools to create structures and programs that will inform students about available careers so that students direct their choices toward their career goals. This will also help students to avoid the "too late" moments when they discover that they cannot pursue a certain career because they did not study certain subjects. However, compared to other students, a majority of post-choice students who went into art and business streams but had comparable examination results to those in science streams had formed clear goals in relation to their subjects although they also did not have much knowledge of careers in art and business other than being a lawyer, a politician or an accountant.

***e) Structural reasons affecting the chances to pass final leaving secondary education depending on the number of subjects (7 for arts and 9 for science)***

This was another factor that a few students raised. This has to do with the options that students have in terms of number of subjects on the final leaving national secondary (form IV) examination requirement. The final leaving examination requires seven compulsory subjects for every student. Only these seven subjects are counted as part of the GPA. In other words, if a student sits for 10 subjects, only the best seven performing subjects will make his/her final GPA.

This has to do with streaming process and how subjects are categorized in schools. The structure is such that, students who join science streams are usually taking 9 (2 extra) subjects while those in art streams are usually left with an option of 7 subjects (the minimum requirement). During interviews, 18% (7/38) of post choice students in science stream mentioned this as one of the reason for joining science stream. They perceived that having 9 subjects as compared to 7 subjects in art streams would increase their chances to pass the final secondary examination. This is an alert that streaming process and subjects categorizations in schools should be reconsidered so that students are provided with more options.

***f) "Science is interesting"***

Science, as interesting, was not very important in determining students' choices as many of us would expect. Very few students believed that they had made their choice because they like science or particular science subjects/aspects. During interviews, only 11% (4/38) of post choice students in science streams said that had chosen a science streams because science and/or particular aspects of science were interesting to them.

22% (5/23) of pre-choice students who were planning to join science streams in few months reported interest in science as a reason. 40% (2/5) of these students said they are interested in the laboratory practical aspects of science subjects. These were from school "L" the only school that had well equipped science laboratories. This implies that a majority of students have less intrinsic motivation for science.

The general impression is that, a majority of the students did not perceive interest in science or aspects of science as the reason for choosing science streams. This is contrary to many studies in developed countries (Lavigne, Vallerand &Miquelon, 2007; Ryan & Deci, 2000; 2009) which demonstrate that students' participation and persistence in science is mostly influenced by their intrinsic motivation and interest in science. According to Ryan & Deci (2009), teaching strategies (student/teachers interactions) that promote students' interest in science are more likely to lead to students' intrinsic motivation and that intrinsic rather than extrinsic motivation is important to ensure students' participation and persistence in Science, Technology, Engineering and Mathematics( STEM) fields.

Based on this understanding and findings of this study, it can therefore be deduced that, gaps in school and classroom factors such as scarcity of science teachers and insufficient learning and teaching materials such as science laboratories contributed to less interest in science among students. Related to students' interests, however, is the fact that although students did not perceive interest in science/ aspects of science as an influence of their choices, a majority of form III students in science streams as indicated on questionnaire data perceived that studying science will help them in future life. Instructional designers can build from this strength to create instructional environments that will get spark students interests in science subjects. A total of 38 form III students (post-choice) in science stream responded to a closed-ended item on questionnaires that was written as "I chose science stream because it will help me in life" and graphs below (figure 7& 8) show the degree to which students perceived studying science would help them in future. As the graphs indicate there were no significant differences between genders for urban schools while in rural schools females scored low in this measure (the degree of agreement that science will help them in life)

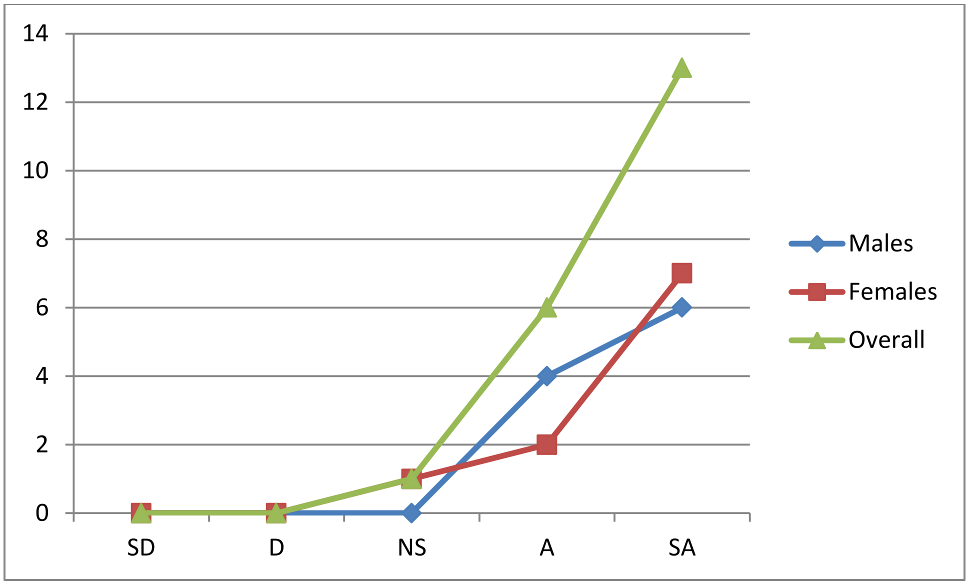


**Figure 7: A graph showing the degree to which students in urban schools perceived that studying science would help them in life**

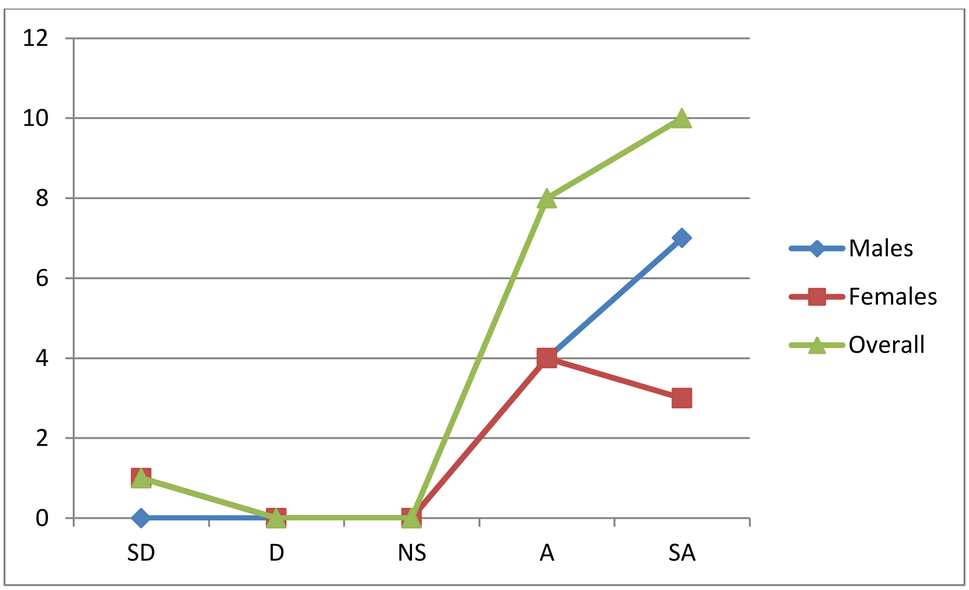


**Figure 8: A graph showing the degree to which students in rural schools perceived that science would help them in life**

Further studies on students' science interests are needed in Tanzania to discover gaps in students' interest. This will enable policy makers and science educators to invest in strategies that will get students interested in science and mathematics.

With regard to the theoretical framework where the researcher characterized subjects choices as lying in a continuum between the "Right Extreme" (RE) and the "Left Extreme" (LE), Although subject choices was an interplay of several factors, it appears that students' were largely extrinsically motivated (LE) than were intrinsically motivated in science subjects(RE). This implies that there is need to improve students' intrinsic motivation of science for better performance to be realized.

***g) Gender and stream choices***

Although gender issues have been discussed as they arose in each of the factors above, I decided to include this theme to provide a brief picture of how gender manifested itself in relation to this study and how serious it can be. The question of gender emerged in this study with mixed results calling for further research and attention on gender and science education. Data from examination scores indicate that girls overall performed poorly in all schools compared to boys. This supports findings from studies such as those of Alfayo (1993) and Msegeya in Tanzania, Kagume (2010) in Kenya and Efiong (1986) in Nigeria that have concluded that boys outsmart girls in science and mathematics performance. The same pattern in girls' performance has been reported in developing countries too (Lavigne, Vallerand &Miquelon, 2007, Francis, 2000). However, girls' poor performance compared to boys did not limit their chances to join science streams because there was a tendency in schools to encourage girls who had at least better results compared to other girls to join science streams. During interviews, heads of schools considered this a strategy to balance gender during subject streaming. This implies that even if girls' participation will be improved in terms of numbers, still more efforts are needed to improve girls' performance in school science in order to ensure their persistence in science fields.

These special considerations for girls are much appreciated; however, such programs as special entry in streams and even universities for girls with performance lower than that of boys may represent part of the hidden curriculum that perpetuates further gender stereotyping and poor performance among girls. There was no significant difference between boys and girls in terms of career aspiration.  Both boys and girls who had formed clear links between science subject choice and career goals wanted to be either engineers or doctors. This appears to contradict the findings of  Towse et al. (2000) that girls like caring careers such as nursing while boys like controlling careers such as medicine and engineering. My findings however, are not enough to conclude this because the small-number of students who talked about career goals. Also since interview data indicate that a majority of students had less knowledge of available careers, it is difficult to conclude that both girls and boys like controlling careers than caring careers. I advocate for more studies on gender and science education.

**Support, guidance and information students get before making choices**

To better understand this  theme, questions were set to discover what information about streaming/subject choices students get, from whom and when they get that information.  Other questions were designed to find out if there were any policy that guide subject streaming in schools and if there were any special programs in schools for advisory services.

As noted earlier, a majority of students had less knowledge of available careers as well as the relationship between subject choices and available careers. To gather more information on this, during interviews the researcher asked students where and when they got information. This helped to assess the role of schools and/ teachers in guiding, supporting and informing students.

*Students (post-choice) in science stream*

Data from questionnaires indicate that 76% (29/38) of students (post-choice) in science streams reported that they got information about streaming from peers in higher classes and a majority reported that they got this information as soon as they started their form I (about a year before). Only 18% (7/ 38) mentioned teachers indicating that teachers were less concerned with guiding and informing students on subject streaming. 18% (7/38) students had at least made a clear link between subject choices and their career goals. The majority of these students (5/7) reported that they got advice from parents, guardians or relatives who had good educational backgrounds. From this observation firstly, teachers have little involvement in career advisory services to students. This may be attributed to either teacher's failure to take time for students' advisory services because of heavy class loads and low motivation or guidance and advisory services are not taken seriously as part of teachers' job descriptions. Secondly, this is a sign that students' formation of clear links between career goals and subject choice is affected by their socio-economic backgrounds (parents' or relatives' educational backgrounds). This implies that students from families with poor educational backgrounds are more likely to be disadvantaged if teachers in schools do not provide career advisory services. This many contribute to the creation of further social disparities. There was no difference between genders in relation to linking subject choice and career goals. However, there were variations between schools.

*Heads of schools*

All 4 heads of schools reported that there were no special programs for guidance and support about streaming in their schools. The head of school "K" reported that in her school they don't offer counseling for academic issues but they had a special counselor for students' social affairs. In school "L", the head of school reported that they form subject clubs and students are free to have membership in any subject club they want. He believed that during these clubs that meet once a week, teachers including science teachers encourage students to work hard on those subjects. He was not sure, though, if this was related to streaming advising. 50% (2/4) of heads of schools believed that providing guidance and support services was a great idea but their schools could not offer it simply because they did not have enough science teachers. One head of schools emphasized that:

> *"I have only two science teachers employed in my school, the remaining three teachers are part time teachers that the school finds using its money and they may leave anytime to university. I'm afraid to give them other work load of counseling"*

During interviews, 75% (3/4) of heads of schools believed that advisory services were important but not a priority for their schools. They believed that the best way to improve students' participation in science and mathematics is to improve students' performance by providing enough science teachers, science laboratories and science teachers' motivation. The head of school "L" said that science laboratory practical motivate students to do science in her school. With regard to policy that guides subject streaming in schools, all four heads of schools reported that there were no policy documents that guide subject streaming in schools. During interview the head of school "K" said that:

> *"No policy document that guide streaming, every school has its own style"*

*District Educational Officer*

Interview with the District Education Officer also confirmed what the heads of schools reported. The District Education Officer said that there was no policy document about subject streaming at form III level. However, she said that the district office encourages the heads of schools to motivate science students depending on their school resources and contexts.

*General trends and implications*

Generally, each school had its own way of handling matters related to subject streaming. This is a dangerous risk to take because schools seem to neglect these matters. According to Siann et al. (1998), guidance, support and information services are very important and enable students to make informed subject choices. It is important for the Ministry of Education in Tanzania to review streaming processes in schools because students complained that structural arrangements such as how subjects are categorized to make streams restricted options to make subject choices. There were cases where teachers did streaming for students basing on their examination scores. All these could be avoided if there was a policy that guided subject streaming in schools. Regarding information sources, a majority of students reported that they received information about streaming informally through peers (fellow students in higher classes), parents and rarely from school teachers. Related to support, guidance and information services, was the knowledge of available careers. Findings from this study indicate that a majority of students had less knowledge of available careers and had not formed clear links between subject choice and career goals. This appears to support the findings of Siann et al.

(1998) and Mabula (2012). There was variation between schools with students in urban schools having more knowledge of available careers than those in rural schools. This is not surprising since in urban areas there are more people working in variety of career occupations than in rural areas where only teachers, clerks, doctors and nurses are popular. In the latter case, students are less likely to acquire knowledge of available careers through common informal interaction. This is where the question of social disparities comes in and the provision of advisory services in schools is the best way to deal with it.

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Understanding the factors that influence students' choices of science subjects is an important step toward solving the problem of poor student participation in Science, Mathematics and Technology (SMT) fields. From the findings of this study I would like to give both macro and micro level recommendations.

## Recommendations to the Ministry of Education and Vocational Training (MOEVT)

Efforts should be made by the Ministry of Education and Vocational Training to improve secondary students' performance in science and mathematics. This is because a majority of students perceived performance as a main factor influencing their choice of science subjects. Students' performance was also related to students' self-efficacy in science which also rated high as a factor influencing students' choices of subjects. Improving the classroom teaching and learning environment by ensuring that there is enough motivated science and mathematics teachers, science laboratories and other learning and teaching materials such as textbooks will be very important in order to achieve that goal.

Special attention should be paid to female performance and participation in science and mathematics because these findings have identified this as a serious problem. I advocate for holistic and long term strategies that will deal with social, cultural and political factors that affect girls' education. In my own view, current strategies such as special entry programs/offers for females even when they have done poorly relative to males represents part of the hidden curriculum that perpetuates further gender stereotypes in schools and society in general.

Therefore, while teachers continue with that, there should be long term plans to improve girls' performance.

The government also should work with schools to review subject streaming processes in schools. This should involve setting structures that will make subject streaming processes align with the demands of future careers and higher education programs. Such structures should also take consideration of students' freedom of choosing streams as well as encouraging more students in science streams. This should go hand in hand with developing policy documents that will guide subject streaming in schools to replace the current rule of thumb practices. Among other things, this policy document must consider how schools can initiate programs that will provide support, guidance and information to students to ensure that students make informed decisions.

**Recommendations for teacher education programs**

Teacher education programs in teacher colleges and universities, schools of education that train science teachers will need to consider the problem of students' participation in science and mathematics as a serious problem. The curriculum and extra-curricular activities in these programs should equip student teachers with an understanding of the nature of the problem as well as strategies to solve the problem in schools. Considering that students' choice of science subjects is related to performance, motivation and interest in science, teacher education programs will need to ensure that students have a mastery of teaching strategies that will improve students' performance, motivation and interests in science. There is also a need to equip teachers with the necessary knowledge and skills to integrate career advisory services during classroom teaching because schools don't have school counselors.

**Recommendations to the heads of schools and teachers**

The heads of schools should exercise instructional leadership by working with teachers to improve students' performance in science and mathematics. Regarding guidance, support and information to students about subject choices, teachers can initiate extra-curricular activities such as debates that will bring teachers and students together to discuss issues related to subject choices as well as the link between schools subjects and higher education and/or career opportunities. The heads of schools, school boards and the school community should work together to search for ways such as housing offers to retain science and mathematics teachers in their schools. In the current situation where science and mathematics teachers are very scarce, heads of schools should find strategies to combat an increasing science and mathematics teachers turn over which is further fueled by the growing number of private schools.

**Recommendations for future research**

Further research is needed to study the relationship between performance and self-efficacy as well as the effects of students' family socio-economic status on students' choice of science stream and/or participation in Science, Mathematics and Technology (SMT) fields. Attention should be paid to girl's performance and participation in STEM. Also, further studies will be needed to study how career support and guidance can motivate students' choices of science streams. Also, future research will be needed to study students' interest in science because findings from this study show that students had less interest in science. Finally, future research should take into consideration language issues during research. This is because although secondary schools use English as a media of instruction, the researcher discovered that some students were still struggling with English language even at their third year of secondary education.

**Conclusions**

The main purpose of this study was to explore secondary students' perception of the factors that influence their choices of science streams in Tanzania. Based on the theoretical framework, it was also deemed necessary to assess kinds and level of support, guidance and information students receive before making choices in order to determine the influence of future career on science subject choices in low resource contexts. This formed another purpose of this study. A main argument in this study was that despite resource constraints surrounding science classrooms in Tanzania, there are students who choose science subject streams. This being the case, it becomes very important to know the factors influencing these students' choices of science streams for educators to be able to design settings that will motivate more students to join science streams.

Overall, findings from this study indicate that, students' motives to choose science steams are the result of interplay of many factors: social, economic, cultural and political. Students perceived self-efficacy in science, their examinations scores (abilities), and external future rewards associated with science subjects as main factors that influenced their choice of science streams. With regard to science careers, a majority of students perceived that science, as a career, was important but not sufficient to influence their choices of science streams. Data from this study indicated that a majority of students had little information about available careers and as a result, were not able to establish links between subject choices and available careers. There were variations between and within schools with rural students and females lagging behind in many aspects related to choice of science streams.

From this study, the researcher believe there are many questions that need to be answered as well as many things to be done to improve students' participation in Science, Technology, Engineering and Mathematics (STEM). The researcher recommends improving the teaching of science and mathematics as well as the streaming process of subjects in schools. Efforts will be needed to establish and improve career advisory services so that students will be able to establish links between subject choices and available careers. With current science teacher shortages in Tanzania, integration of career advisory services during teaching and in the form of extra-curricular activities can help. The researcher also advocates for special attention to girls' participation in science subjects since findings from this study indicated unpromising patterns. Finally, the researcher provides suggestions for future research on the relationship between self-efficacy and students' performance; students' interests in science, poor performance and participation in STEM, especially for girls; and the effects of career choices and family socio-economic status on students' choices of science subjects.

# REFERENCES

Alfayo, R.M. (1993). Performance of girls in science subjects in Tanzania secondary schools with physics and mathematics taken as representative subjects: a case study of Mnja, Mrema and Shingachini secondary schools. Dar es Salaam: Dar es Salaam University Press.

Bandura, A., Freeman, W.H., Lightsey, R. (1999). Self-efficacy: The Exercise of Control, *Journal of Cognitive Psychotherapy*, 13(2), 158-166

Beukes, J.H. (1986). Motivation for Postschool Training and Job Entry: Factors that Influence the Choice of Standard 10 pupils. Research finding MN-115. Pretoria: Human Science Research Council

Francis, B. (2002). The Gendered Subjects: students' subject preferences and discussions of gender and subject abilities, *Oxford Review of Education*, 26, 35-48

Hulleman, C., & Harackiwiez, J. (2009). Promoting interest and performance in high school science classes, *Science*, 326, 1410-1412

Jones, B.D. (2009). Motivating students to engage in learning: The MUSIC model of academic motivation. *International Journal of Teaching and Learning in Higher Education*, 21(2), 272-285

Lavigne, G.L., Vallerand, R.J., & Miquelon, P. (2007). A motivational model of persistence in science education: A self-determination theory approach, *European Journal of Psychology of Education*, 22 (3), 351-369.

Maltese, A.V., & Tai, R.H. (2010). Eyeballs in the fridge: Sources of early interest in science. *International Journal of Science Education*, 32(5), 669-685

Maltese, A.V., & Tai, R.H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. *Education*, 22, 151-170

Msegeya, S. (2009). Factors affecting female students' enrolment in science subjects at advanced secondary education in selected schools in Kilimanjaro region, Tanzania. Dar es Salaam: Dar es Salaam University Press

Paavola, J. (2008). Livelihoods, vulnerability and adaptation to climate change in Morogoro, Tanzania. *Environmental Science & Policy*, 11 (7), 642-654

United Republic of Tanzania (2012). National Census Survey of 2012. Dar es Salaam: National Bureau of Statistics.

Ryan, R.M., & Deci, E.L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54-67.

Ryan, R.M., & Deci, E.L. (2009). Promoting self-determined school engagement. Motivation, learning and well-being. In K.R. Wentzel & A.Wigfield (Eds.), Handbook of motivation at school (pp. 171-196). New York: Taylor & Francis

Semali, M.L., & Mehta, K. (2012). Science education in Tanzania: Challenges and policy responses, *International Journal of Educational Research*, 53, 225-239

Siann, G., Lightbody, P., Nicholson, S., Tait, L. & Walsh, D. (1998). Talking about subject choice at secondary school and career aspirations: conversation with students of Chinese background, *British Journal of Guidance and Counseling*, 26(2), 195-207

Towse, P., Kent, D., Osaki, F. & Kirua, N. (2002). Non-graduate teacher recruitment and retention: Some factors affecting teacher effectiveness in Tanzania, *Teaching and Teacher Education*, 18, 637-652

# ANNEXES

**Annex 1: Questionnaires for students**

**This questionnaire contains items that are related to the reasons to why you joined in science streams. We would like to know more about your decision to join a science streams and the processes that you undergo before making choices. Your responses will be kept confidential. Please be honest**

STUDENTS POST-CHOICE (SCIENCE STREAM)

Gender (M/F)……………………………………

Choose the most correct response by **cycling** a number corresponding to a response

Why did you choose to join the science stream?

Because I was sure I can do well in science

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because my parents wanted me to do so

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because I want to get a good job in the future

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because it is easier to do science subjects than other subjects

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because teachers told me to do so

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because studying science will help me in life

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because if I study science I will be very rich

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because I enjoy studying science subjects/ because science subjects are interesting

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because I will be respected at school and in the society

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because I did well in science subjects exams

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because my parents did science as well

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

Because my best friend(s) joined the science stream

1 Strongly disagree 2 Disagree 3 Not sure 4 Agree 5 Strongly Agree

PART B: Respond to the following questions by writing short notes (Interview guiding questions for students (post-choice) in science streams)

Where did you get the information that someday you will be required to make stream choices? When did you get this information?

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Who did you discuss with before making choices? You can mention as many as you can

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Who encouraged you to choose science stream?

…………………………………………………………………………………………………………………………………………………….

Did you get any advice before making choices? If yes who advised you?

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If given the chance to make a choice again, would you remain in the same stream? Why?

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Did you make the choice by yourself or the school did it for you basing on your exam scores in science subjects?

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What amount of time (days, weeks) were you given to make the choices?

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Is there any program (Guidance and support) that the school/ science departments offer to help students during the process? If yes, tell me more about it?

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**Annex 2: Questionnaires for science teachers**

**This questionnaire contains items that are related to your perceptions on the reasons to why students join into the science stream. We would like to know more about the processes that students undergo before making choices. Your responses will be kept confidential. Please be honest**

SCIENCE TEACHERS (HEADS OF SCIENCE DEPARTIMENTS)

Subject(s)…………………………………………………..
Gender……………

Respond to the following questions by writing short notes

Do you think classroom practices can lead to more students choosing science stream? Please explain

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Who do students discuss with before making choices? You can mention as many as you can

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What do you do as science teachers generally to encourage more students' participation is science subjects?

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Do students receive guidance and support before making choices? If yes who advise them?

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What are the processes that students undergo before making choices?

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**Annex 3: Interview guiding questions for the heads of schools and/or heads of science departments**

THE HEADS OF SCHOOL AND/ OR HEADS OF SCIENCE DEPARTMENTS

Interview guiding questions

1. When and who inform form II students that someday they will be required to make stream choices?

2. What do the school/ department do in general to encourage more students into the science stream?

3. Do students choose by themselves or t teachers/the school use exam scores (students' abilities in science) to place them in respective streams?

4. Is there any program (Guidance and support) that the school/ science departments offer to help students during the process? If yes, tell me more about it?

5. How many days are students given to make choices?

6. What other parties are involved during this process?

**Annex 4: Interview guiding questions for students**

STUDENTS (PRE-CHOICE GROUP)

Interviews guiding questions

1. Have you been told that you will be required to make stream choices at the end of this academic year? If yes where did you hear this information?

2. What stream are you planning to choose? Why?

3. Who do you plan to discuss with before making choices?

4. How often do teachers encourage you to start thinking of your choices?

**Annex 5: Focus group discussion questions for science teachers**

SCIENCE TEACHERS (FOCUS GROUP DISCUSSION QUESTIONS)

Group A. What is the kind and level of support do students receive before making choices? Why and how should it be improved?

Group B. What are factors that influence form II students' choices into the science stream? Why is it important to know them?

**Annex 6: Interview guiding questions for District Education Officer**

District Education Officer (DEO) for Secondary Education (Interview guide questions)

Is there any policy that guides students' stream choices?

Are there any programs that provide guidance and support for students before making stream choices in schools?

**Annex 7: Informed Consent forms**

**University of Massachusetts**
**Informed Consent Part I:**

**RESEARCH DESCRIPTION**

Research Description: You are invited to participate in a research study on the factors that influence 9th grade (form II) students' choices into the science stream and the role processes that students undergo before making choices play in Tanzania.

I am interested in working with you to gain a better understanding on what you think of the factors that influences 9th grade (form II) students' choices in science stream, the kind and level of support and guidance students receive before making choices, the role of teachers in encouraging students' participation in science and mathematics and the processes that students undergo before making choices. It is my hope that the results of this study will inform policy makers, curriculum developers, teacher education institutions and teachers on how to improve, processes that 9th grade (form II) students undergo before making stream choices in Tanzania. This in turn, will improve students' participation and persistence in science and mathematics fields.

If you agree to participate, you will commit to working together for a few hours over the next several weeks. We will work together to decide when you are available to share your experience and perspective. I am interested in your experiences and what you have to say. Your participation in this study will allow for your contribution as educational stakeholder to be shared with the larger educational community.

Risks and Benefits: Although all studies have some degree of risk, the potential in this investigation is quite minimal. If at any time, you feel you do not want to answer a question – you don't have to. You are also welcome to discuss any concerns you have with me along the way and withdraw from the study at any time. The benefits of being in the study are the chance to have your opinions heard, and your experiences documented to possibly influence policy creation, planning and decision making approaches in the future.

Payments: You will not receive any payment for your participation in this study.

Data Storage to Protect Confidentiality: I will not use your name in my study in order to ensure confidentiality of data. Each subject will choose with the researcher a code name, which will be used throughout the research. There will be no identifying information about you. In addition, all the field notes and transcriptions from the audiotapes will be stored in a secure file in my home. The data collected will be used for a course project and possibly in presentations and publications.

Time Involvement: You participation will take a few hours or less over the next several weeks.

How Will Results Be Used: The results of this study may be used in any or all of the following ways: at conferences, presented at meetings, published in journals, articles or in book form.

**University of Massachusetts**

**ASSENT FORM**

I ________________________________ (your name) agree to participate in the study entitled " Factors that influence 9th grade (form II) students' choices into science streams in Tanzania: Examining the role processes that secondary students undergo before making choices play (a case of Morogoro region)"

Mjege Kinyota has explained to me why he is doing this study and I understand what is being asked of me. If I have any questions, I know that I can contact Mjege at any time. I also understand that I can leave the study any time I want to.

Name of Participant: ________________________________

Signature of Participant: ________________________________

Date: ________________________________

***Investigator's Verification of Explanation***

I certify that I have carefully explained the purpose and nature of this research to ________________________________ . S/he has had the opportunity to discuss it with me in detail. I have answered all her/his questions and s/he provided the affirmative agreement (i.e., assent) to participate in this research.

Investigator's Signature: ________________________________

Date: ________________________________

**University of Massachusetts**
**Institutional Review Board for the Protection of Human Subjects**
**Informed Consent Part II:**

## PARTICIPANT'S RIGHTS

Principal Investigator: Mjege Kinyota

Research Title: "Factors that influence 9th grade(form II) students' choices into science streams in Tanzania: Examining the role processes that secondary students undergo before making choices play (a case of Morogoro region)"

- I have read and discussed the Research Description with the researcher. I have had the opportunity to ask questions about the purposes and procedures regarding this study.

- My participation in research is voluntary and without financial compensation. I may refuse to participate or withdraw from participation at any time.

- The researcher may withdraw me from the research at her professional discretion.

- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue to participate, the investigator will provide this information to me.

- Any information derived from the research project that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.

- If at any time I have questions regarding the research or my participation, I can contact the investigator, who will answer my questions. His email address is mkinyota@educ.umass.edu

- If at any time I have comments, or concerns regarding the conduct of the research or questions about my rights as a research subject, I should contact the University of Massachusetts School of Education Institutional Review Board/IRB. I can reach the IRB by calling (413) 545-1056 or I can write to the School of Education, University of Massachusetts, 813 North Pleasant Street, Amherst, Massachusetts 01003.

- I should receive a copy of the Research Description and this Participant's Rights document.

- If video and/or audio taping is part of this research, I (   ) consent to be audio/video taped. I (   ) do NOT consent to being video/audio taped.

- Written, video and/or audio taped materials (   ) may be viewed in an educational setting outside the research, (   ) may NOT be viewed in an educational setting outside the research.

- **My signature means that I agree to participate in this study.**

Participant’s signature: ___________________________________ Date: _______________

Name: _____________________________________________________________