

## PROMOTING SCIENCE SUBJECTS CHOICES FOR SECONDARY SCHOOL STUDENTS IN TANZANIA: CHALLENGES AND OPPORTUNITIES

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### ABSTRACT

*Development of science and technology especially in developing nations demands the preparation of skilled individuals in science disciplines from lower levels of academic and skill training. This fact calls for the need to promote effective science teaching and learning in secondary schools. The purpose of this study was to examine the status of science teaching and learning, challenges facing the science learning in schools and opportunities for improvements. The study was conducted in four districts in Morogoro Region, Tanzania. Specifically, the study intended to identify the pass rates in science subjects, teachers' professional development, science teachers' teaching strategies, students' level of satisfaction with the teaching and students' readiness to take science subjects in their high schools. The study was conducted in twenty four secondary schools using a sample of 471 students and 66 teachers. The data from students and teachers were collected through a structured questionnaire and focus group discussions. The results revealed poor quality of science classroom teaching and a serious decline in interest of students in science subjects. It was therefore concluded that, teacher-students interaction and relationship in classroom teaching and learning of science need improvement. It is suggested that, future research can observe on the influence of social factors in the decline of interest in science subjects among secondary school students in Tanzania.*

**Keywords:** Students, Challenges, Opportunities, Science Subject, Tanzania

### INTRODUCTION

In an increasingly globalized world, studying science subjects in secondary schools is very important regardless of the challenges facing the science learnig. These challenges facing individuals who are engaged in science studies are from time to time influenced on science education practices in schools (Fraser & Walberg, 1995; Levy & Murnane 2005; Stewart, 2010; Wilmarth, 2010). These challenges include: the evolution of societal needs, changes in the purposes of science education, changes in new theories of learning, rapid change in technology, changes in scientific innovations, changing labour force demands, the changes in science as a discipline itself and the evolution of the market forces in science careers. Tanzania as a developing country faces many of the same challenges which have increased the need to redefine science education practices, so as to make the science learning more functional for learners and more effective in catering the needs for those who choose to pursue the formal study of science beyond secondary education (Chonjo, Osaki, Possi, Mrutu, 1996; Osaki, Hosea & Ottevanger, 2004).

Examining how science education can be best promoted in secondary schools is an issue that has received limited responses and is consequently poorly understood in sub-Saharan Africa including Tanzania (Ogunniyi, 1986; Organization for Economic Co-operation and Development–Global Science Forum, 2006; Osaki *et al.*, 2004). This study draws on a pragmatic world view in exploring the current on-going school climate and its influence towards promotion of science subject choice as career pathways for secondary school students in Tanzania. The study identify the challenges and opportunities towards the recommended practice in improving science classroom teaching and learning for secondary school students in Tanzania.

## Science Teaching and Learning in Schools

School climate is one of the major factors that influence students' interest in science subjects in many countries. This has been evidenced through the dramatic decrease of the number of students studying science subjects in secondary schools. There is also a serious concern on the reason why many students who do core science subjects in secondary schools opt not to take science programmes and science related specializations in their higher learning. As if that is not enough, many graduates who graduate in science fields choose not to pursue science related occupations regardless of their good qualifications in science courses (Wynarczk, 2008).

Researches conducted in some developing countries by Munro and Elson (2000) indicates that, only 30% of students studied physics and 32% studied chemistry and mathematics at their higher learning in 1994. These percentages decreased to 25% and 26% respectively in 2005 as pointed out by research by Lyons (2005). The similar trend can be seen in France, Germany and other Developed countries where for instance, the students' enrolment number has been decreasing in different rates. Example the trend in some of the countries were as follows, Norway experienced decrease at the rate of 40% as from 1994 to 2003, Denmark is 20% as from 1994 to 2002, Germany 20% as from 1994 to 2001 and the Netherlands was 6% as from 1994 to 2001(OECD, 2007).

The reasons for the decrease in the number of students taking science subjects in developed countries vary from the reasons for students in developing countries, that is why this study sought to investigate the role of school academic environment in the observed drop in the number students taking science subjects in secondary schools in developing countries. According to the 2005 Euro barometer study on European reports, it was revealed that the reason as to why youth in schools are currently not interested in taking science subjects are complex, however, there is a firm evidence that indicates a connection between attitudes towards science subjects and the way in which science subjects are taught. Similarly, the studies by Lyon (2005) acknowledged that the decline of interest among young learners in science subjects in Tanzania is a result of how science is taught and learnt.

Speaking in the Parliament session in 2008, the then minister for Education and Vocational Training Prof. Jummanne Magembe noted that, there was a drop in science subject choice for students in secondary schools especially for those going for Advanced Secondary Education in Tanzania. This was specifically in mathematics, biology, physics and chemistry where by the decrease was said to range from 30% in 2005 to 25% in the year 2009 (NECTA, 2005; 2009). Studies reveal that the teaching and learning of science is more theoretical than observational, experiential and experiment based, this situation affects the interest of students to take these subjects in their higher studies (Speering & Rennie (1996).

To rectify the drop in number of students taking science subjects, the science teaching should focus on the contemporary needs and experiences of the learners and that it should be a constantly changing and developing discipline so as to localize the content to the learners' context (Tytler, 2010). To rectify the drop in number of students taking science subjects, the science teaching should focus on the contemporary needs and experiences of the learners and that it should be a constantly changing and developing discipline so as to localize the content to the learners' context (Speering & Rennie, 1996).

The teaching of science in a non-foreign expert, and unsystematic way of teaching are still in its infancy or are issues which are not taken care in teaching. In fact the science courses seem more relevant to those students with science career aspirations and not to the majority for whom secondary science is terminal (Lyons, 2005). Example, science education in Africa has been criticized from several points of view. Lacks of relevance to African cultures, being a collection of facts from 'western' science with little or no adaptation and less critical, and fact-transmission oriented pedagogy, are some. Of those it was recognized long ago that science education in Africa did not take into account the intellectual and cultural milieu of the children this cause the decline of interest in science subjects due to evaluation that the science subjects are less relevant to students' daily life (Munro & Elsom, 2000).

## Teaching and Learning of Science Subjects in Tanzania Schools

Tanzania has been reviewing its education curriculum on various occasions in order to bring meaningful learning at different levels. The changes took place in different years and in various phrases. Example in 1976, 1995 [Unified science which was just piloted in some schools for one year and abandoned], 1997, 2005 and lately in 2007 (URT, 2009). In an effort to improve science teaching and learning in secondary schools the government of Tanzania introduced several projects including School Science Project and School Mathematics Project. The focus of these projects was to improve the teaching strategies and adequate use of available teaching materials in the school and students' learning environment. The teaching materials and strategies for these projects focused on experimental approach for teaching and learning. These programme also focused on laboratory activities and a great deal of outdoor activities (Osaki, 2007).

However, the School Science Projects and School Mathematics Projects were later abolished after the pilot study due to the massive failure of students who were in those projects. The failure as advanced by Osaki (2007) was because the implementation and examination did not focus on what the student were actually learning in their science classes. By considering the results observed from this project, it can be argued that the school teaching and learning environment is influencing the results for students who opt to take science subjects, hence, contributing to the drop of students' interest in science subjects. This observation is in line to what Kupermic, Leadbeater and, Blatt (2001) who emphasized that, school climate is the social learning setting or learning environment in which students have different experiences, depending upon the protocols set up by the teachers and administrators.

In fact all scholars agree that the school climate can create a fabric of support that enables all members of the school community to teach and learn at optimum levels. The study by Manoni (1981) revealed that negative attitudes towards a course of study would always affect performance which in turn might discourage further engagement on the course. Normally students are to be motivated to arouse the interests to the field of study, i.e. the science studies, by instilling to them with positive evaluative affection towards performing the best in opting and learning of science subjects (Reeve, Nix & Hamm, 2003). The observation pointed out in this research give predictive reasons for the situation in secondary schools in Tanzania due to decrease in the number of students taking science subjects and the high failure rate in science subjects observed in secondary schools.

With respect to the capacity of the educational system to meet Tanzania's national development goals, findings of the study by UNESCO (2009) reveal acute shortages of science teachers and other resources such as text books and teaching aids in secondary schools across the country. The need is particularly acute in science, mathematics and technology education. For example, where as the figures for secondary-school mathematics teachers for Masasi District in Mtwara Region and Dodoma Municipal show that urban areas may fare somewhat better than rural ones, the difference is minor when considering the depth of the need in case of science teaching facilities and qualified teachers in mathematics and science.

Speaking at the Conference for Science and technology in 2010, the president of the United Republic of Tanzania emphasized that, "Dealing with the shortage of science teachers alone is not enough for quality science education. There is need of providing teaching aids and text books. The existing shortage of 9,486 science laboratories and 35,840 housing units for teachers, demands a staggering USD 1.2 billion budget over the next five years. To this cost, adds the requirement of 13.5 million additional science text books". This serious statement from the Head of the state implies the presence of difficulty learning environment especially for science subjects in secondary schools.

Hence that is why this study focus o examining the on-going science teaching and learning process in the mention kind of learning environment in secondary schools and the opportunities which can be useful in overcoming the challenges.

## Drop Rates and Pass rates in Science Subjects for Secondary School Students

Different studies indicate that drop out from science subjects and the lack of teachers as well as teaching facilities are the most sited reasons. According to the Best (2010), the failure in National

Examination results which has been reported in different sources is only a single door for explaining the situation. This recorded evidence goes hand by hand with the serious dropout from science subjects as indicated in table 1. The trend in the drop out from science subjects is more serious in Physics and chemistry subjects as compared to mathematics and biology the subjects which are compulsory to all students.

**Table 1. Trend of science subjects drop rate and Pass rate in 2010 Form four National Examination results**

Subjects	Year	Students Registered	Students dropped science subjects	Students sat for final Exams	% of Students dropped science	Students passed Exams	% of Students passed final Exams
Mathematics	2010	350,904	0	350,904	0	56,467	16.1
Biology	2010	350,904	1910	348,994	0.54	106,393	30.5
Chemistry	2010	350,904	212,104	138,800	60.4	60,908	43.9
Physics	2010	350,904	257,785	93,119	73.5	41,559	44.6

Source: Best (2010)

### STATEMENT OF THE PROBLEM

Attitudinal data from many sources indicate that it is common for many school students to find little of interest in their studies of science and to quite often express an active dislike of it. In comparison with a number of other subjects, too many students experience science subjects as disciplines which are dominated by the transmission of facts, as involving content of little relevance, and as more difficult than other school subjects. This experience leads to disinterest in science and technology as personal career possibilities, and only a mildly positive sense of their social importance (Tytler, 2010). Science education researchers have given increased attention to how various aspects of the Nature of Science can be taught, but school science curricula remain too loaded with content knowledge for these aspects to be sufficiently well-emphasized by teachers. (UNESCO, 2009).

The teaching process and the teachers effectiveness in teaching is therefore expected to be emphasized so as to overcome the challenges in science learning at school level.

Considering the current nature of learning environment where there are inadequate teaching facilities and poor science teachers' professional development in Tanzania this study focused at examining students responses in line to challenges occurring in the teaching processes in schools and the opportunities for improving the revealed situation.

### OBJECTIVES OF THE STUDY

- To identify students passing rates in science subjects in the selected schools.
- To examine the status of teachers' in –service training and the teaching, and learning strategies used by science teachers in selected schools.
- To assess students' level of satisfaction in science subjects teaching and readiness to take science subjects in their high school studies.
- To highlight the challenges and opportunities towards promotion of science subjects choice as career pathways for secondary school students in Tanzania.

### METHODOLOGY

The study was carried out in Morogoro and involved four Districts and 24 schools which were randomly sampled. The Districts included in the study were Mvumero, Ulanga, Kilosa and Morogoro. The study employed both quantitative and qualitative research approaches. With quantitative approach, the cross sectional survey research design was used. The sample of the study included 471 students and 66 teachers as indicated in Table 2.

Table 2. Selected sample for the Study

District	No. of schools	No. of teachers		No. of students		%
		Expected	Obtained	Expected	Obtained	
Mvumero	6	18	16	120	120	25.5
Ulanga	6	18	16	120	114	24.2
Kilosa	6	18	21	120	117	24.8
Morogoro	6	18	13	120	120	25.5
<b>Total</b>	<b>24</b>	<b>72</b>	<b>66</b>	<b>480</b>	<b>471</b>	<b>100</b>

Source: Field Data, June-October, 2011, Morogoro Region

The questionnaire and focus group discussion were used in data collection. Apart from that documentary review was conducted to obtain the previous years' students' performance in science subjects. Data obtained through questionnaires were coded and total scores by major sections or items representing various clusters were computed. Frequencies and percentages through statistical package for social sciences (SPSS) version 15.0 were employed in the analysis of data (Pallat, 2005).

## RESULTS AND DISCUSSION

### Students Passing Rate in Science Subjects in Selected Schools

To respond to the demand of the first objective of the study, the documentary review was conducted to see the performance of students in science subjects in schools selected for the study, the results in three subjects namely physics, chemistry and biology were examined as indicated in table 3, table 4 and table 5.

Table 3. Physics Results for the Selected Schools in Morogoro Region

District	School	2009					2010				
		A	B	C	D	F	A	B	C	D	F
Mvumelo	Doma	0	0	0	16	28	0	0	0	21	35
	Unguu	-	-	-	-	-	0	0	0	0	14
	Kikeo	-	-	-	-	-	0	0	0	0	9
	Maskati	-	-	-	-	-	0	0	0	0	0
	Bunduki	-	-	-	-	-	0	0	0	0	30
	Mgeta	-	-	-	-	-	0	0	0	9	5
	S/ kombani	-	-	-	-	-	0	0	2	0	4
	Sofi	-	-	-	-	-	-	-	-	-	-
Ulanga	Usangule	0	0	0	14	16	0	0	1	17	14
	Malinyi	0	0	0	4	55	0	0	1	10	70
	Isongo	0	0	0	3	21	0	0	1	6	44
	Kibungo	-	-	-	-	-	0	0	0	0	19
	Ukwiva	0	0	0	1	18	0	0	0	2	12
Kilosa	Sekwao	0	0	1	3	13	0	0	2	4	27
	Parakuyo	-	-	-	-	-	0	0	0	7	13
	Magubike	-	-	-	-	-	0	0	0	5	17
	Iwemba	-	-	-	-	-	-	-	-	-	-
	Rudewa	-	-	-	-	-	0	0	2	15	30
	Kisaki	-	-	-	-	-	-	-	-	-	-
Morogoro	Mvuha	-	-	-	-	-	0	0	0	0	56
	Lundi	-	-	-	-	-	0	0	0	0	7
	Matombo	0	1	1	3	6	0	0	0	3	4
	Fatemi	-	-	-	-	-	0	0	0	1	42
	Bwakilaihini	-	-	-	-	-	-	-	-	-	-

Table 4. Chemistry Results for the Selected Schools in Morogoro Region

District	School	2009					2010				
		A	B	C	D	F	A	B	C	D	F
Mvumelo	Doma	-	-	-	-	-	0	0	0	0	8
	Unguu	-	-	-	-	-	0	0	0	0	14
	Kikeo	-	-	-	-	-	0	0	0	0	7
	Maskati	-	-	-	-	-	-	-	-	-	-
	Bunduki	-	-	-	-	-	0	0	0	0	30
	Mgeta	-	-	-	-	-	0	0	4	7	3
	S/ kombani	-	-	-	-	-	0	0	2	0	16
Ulanga	Sofi	-	-	-	-	-	-	-	-	-	-
	Usangule	-	-	-	-	-	0	0	0	1	17
	Malinyi	0	0	8	4	46	0	0	2	16	75
	Isongo	0	0	2	6	16	0	3	7	12	29
	Kibungo	-	-	-	-	-	0	0	0	0	7
Kilosa	Ukwiva	-	-	-	-	-	0	0	0	1	19
	Sekwao	0	0	1	3	20	0	0	5	2	26
	Parakuyo	-	-	-	-	-	0	0	3	6	11
	Magubike	-	-	-	-	-	0	0	1	6	15
	Iwemba	-	-	-	-	-	0	0	3	1	4
	Rudewa	-	-	-	-	-	0	0	2	10	35
	Kisaki	-	-	-	-	-	-	-	-	-	-
Morogoro	Mvuha	-	-	-	-	-	0	0	0	1	55
	Lundi	-	-	-	-	-	0	0	0	0	31
	Matombo	0	0	2	15	79	0	0	2	26	93
	Fatemi	-	-	-	-	-	0	0	0	2	44
	Bwakilaihini	-	-	-	-	-	0	0	0	0	3

Table 5. Biology Results for the Selected Schools in Morogoro Region

District	School	2009					2010				
		A	B	C	D	F	A	B	C	D	F
Mvumelo	Doma	-	-	-	-	-	0	0	0	0	8
	Unguu	0	0	0	0	4	0	0	0	0	14
	Kikeo	0	0	1	9	-	0	0	0	0	7
	Maskati	-	-	-	-	-	-	-	-	-	-
	Bunduki	-	-	-	-	-	0	0	0	1	20
	Mgeta	-	-	-	-	-	0	0	5	7	4
	S/ kombani	-	-	-	-	-	0	0	1	0	11
Ulanga	Sofi	-	-	-	-	-	-	-	-	-	-
	Usangule	-	-	-	-	-	0	0	0	2	15
	Malinyi	0	0	6	4	40	0	0	2	13	68
	Isongo	0	0	1	7	19	0	1	5	9	20
	Kibungo	-	-	-	-	-	0	0	0	1	9
Kilosa	Ukwiva	-	-	-	-	-	0	0	0	3	21
	Sekwao	0	0	0	4	17	0	0	1	5	39
	Parakuyo	-	-	-	-	-	0	0	2	7	21
	Magubike	-	-	-	-	-	0	0	0	6	19
	Iwemba	-	-	-	-	-	0	0	0	1	12
	Rudewa	-	-	-	-	-	0	0	0	11	31
	Kisaki	-	-	-	-	-	-	-	-	-	-
Morogoro	Mvuha	-	-	-	-	-	0	0	0	1	50
	Lundi	-	-	-	-	-	0	0	0	0	31
	Matombo	0	0	1	7	70	0	0	1	18	89
	Fatemi	-	-	-	-	-	0	0	0	6	53
	Bwakilaihini	-	-	-	-	-	0	0	0	0	7

Source: School Examination Records, June-October, 2011

The results in table 3, table 4 and table 5 shows a serious drop of students from science subjects in 2009 the situation which is indicated by the dash (-) sign. This implies that many students opted not to take science subjects due to various reasons. The reasons which were explained by students during interviews are such as absence of teachers, books and teaching facilities. In some schools such as *Sofi, Iwemba and Bwakilahini* the condition was more serious whereby no any student managed to take science subjects due to absence of science teachers.. In 2010 many students took the science subjects as compared to the year 2009, this feature indicate improvement in terms of number of students who took science subjects but the performance remained poor the fact which can be linked to facilities and teacher- student classroom interaction. Considering the performance, most of students in the year 2010 got “D” grades and “F” grades. Generally the results in the three science subjects examined ranged from very few “C” grades to many “F” grades.

In an attempt to find out the reasons for the high failure rate many students said that, the massive failure in science results were contributed by the teaching styles where by most of science teachers used lecture method in teaching and most of practical aspects in these subjects were taught theoretically. In fact teaching was fast with an intension of finishing syllabi rather than involving students in learning with an intension of helping students to effectively grasp the science concepts. One student at one of the studied secondary school in Morogoro rural pointed out the following statement;

*...It is difficult to pass in science subjects at our school this is because of the difficult learning environment. First of all science subjects are too difficult to understand because they cover many concepts ,apart from that, science books are lacking, no science facilities, but also many of our science teachers are too fast in their teaching and don't care even if we ask questions.*

The facts pointed out by this student emphasize that, together with other challenges which the country is facing in terms of teaching facilities and inadequate number of teachers, the classroom teaching process and teacher-student interaction during the actual teaching need to be revisited. It show with the explanation from the student that, there is weak teacher-student classroom interaction and relationship the process which probably reduce students' interests in science subjects the situation which results failures for many students who decide to take science subjects. This observation is supported by Thomson & Fleming (2004) who noted that, “In most cases students in schools are opting not to take science subjects due to protocols set up by teachers and administrators, these actions cause fears to students in learning and hence discourage students from doing science courses which in fact are more or less demanding”. Speering & Rennie (1996) emphasize also that, science concepts taught without considering the learners' social environment the process which ends up discouraging learners who wish to take science courses, hence drop out from science subjects.

After listening to students, the research took time also to seek some comments from teachers on the rate of dropout for students in science subjects. In an interview with one teacher at one of the selected schools, the teacher made a comment that indicated the difficult teaching environment that limits their teaching capacity and degree of improvisation. He specified that;

*“Science teaching in Tanzania is currently facing a serious shortage of teaching facilities, this condition reduce the motivation in the teaching process due to difficulties in the process of teaching some abstract science concepts. In fact classroom teaching environment is so discouraging due to lack of teaching science teaching materials. This inadequacy is forcing us to teach all aspects of science in theory and leave out the more difficulty aspects which are difficult to teacher without a practical session. In line to that, there are so many changes in science teaching but no any in-service training is being provided to update us with the new approaches in science teaching”.*

Looking at the comments given by the teacher in the discussion, it is true to the fact that even science teachers are very discouraged with the teaching environment which reveals absence of science teaching facilities. Since the teachers' themselves are discouraged with the science learning

environment there is no doubt that students will lack guidance and counseling on how to study and succeed in science subjects regardless of the challenges. Furthermore, it seems that there is no improvisation in managing science teaching the situation which causes teachers to leave out difficult concepts. Specifically the teacher pointed out the need for in-service training which can help teachers to upgrade their skills so as to manage their current teaching challenges. All the changes in teaching of science limit teachers motivation in teaching and cause them to teach poorly in their science classroom as the results many students find science subjects difficult and hence dropout.

Examining the comments from both teachers and students it reflects what Speering and Rennie (1996) explained on the need to strengthen teacher-students interaction in case we want to increase motivations for science subjects in students. Apart from that, teaching science subjects theoretically increase the chance for students to regard science as too difficult and hence less relevance to students daily life as noted by Goodrum (2006). Therefore, the observed situation need to be rectified by giving teachers the necessary seminars and short courses and encouraging them to improvise so as to help students in developing interests in science subjects while the government and other stakeholders are working on other factors such as inadequate of facilities.

### Teachers' in-service Training for Science Subjects in Selected Schools

One of the factors which might hamper with the quality of teachers and the teaching process is the teachers' professional development. There are many changes in the Tanzania education system especially in terms of teaching strategies and techniques. All these changes require in-service training so as to update teachers on the changes made by the ministry in the syllabus and the teaching strategies. The second objective in this paper intended to examine the degree in which the teachers in selected schools attended in-service training in the past two years. The responses from the teachers involved in the study were as indicated in table 6.

**Table 6. In- service Training attended by science Teachers in the 2009 and 2010.**

District	Frequency of in-service training		Total
	Yes (%)	No (%)	
Mvumelo	2(3%)	14(21%)	16(24%)
Ulanga	1(1%)	15(23%)	16(24%)
Kilosa	1(1%)	20(30%)	21(32%)
Morogoro®	0(0%)	13(20%)	13(20%)
Total	4(6%)	62(94%)	66(100%)

Source: Field data June-October, 2011

Considering the teachers response from the selected schools, only 6%(4 teachers) of teachers involved in the study agreed to have attended in-service training in the past two years. This was opposite to the 94% (62 teachers) teachers who didn't attend any in-service training in the said time. It happened one of the visited district (Morogoro rural) in the visited school and noted that no any single teacher attended any subject specific in-service training. The fact that where by many teachers are teaching in our schools without updating their pedagogical competences is very dangerous to the teaching profession and to students learning. This is because there so many changes in the syllabus and modifications in teaching approach which are introduced by the ministry with intention that in-service teacher can attend in-service trainings and workshop so as to get induction in those changes but the opposite is true. Example recently the ministry of Education and Vocational Training changed the teaching approaches in schools from what is called "Content based to Competence based".

The assumption was that the teachers on post are going to attended short seminar so as to upgrade their skill the action which was not done. Mind that, all the form four National Examinations are currently considering the competence based approach and the students are examined considering this focus, hence how comes for students in schools are able pass while the demand of examinations are in new fashion in which the students were not oriented?.



This observation is providing an alert to what Osaki (2007) observed in the School Science project in which he noted the massive failure in science subjects due to fact that, the emphasis of teaching strategies and the examinations brought to students in their national examinations did not focus on what the students were actually learning in their science classes. The observation from the teachers' attendance to in-service training is also supported by the study done UNESCO (2009) in masasi where by the under qualified human resource in the teaching profession was noted as the factor together with other factors contributing in students failure rate especially in science subjects. Munro and Elsom (2000) emphasized also that, students' decline of interest in science subjects in Tanzania is also contributed by the way in which how science subjects are taught in classless. All these facts suggests that, teaching of science subjects should be done properly by updating the teaching skills for science teachers so as to match with the changes in the country. This is possible through the use of in-service training and seminars for teachers in schools.

### Teaching and Learning Strategies used by Teachers in Classroom Teaching

This study intended also to identify the teaching strategies used by teachers in classroom in the selected schools. To properly document the intended classroom activities 471(100%) students were involved in the study and were required to identify the teaching strategies which their teachers' use in classroom. The response from students were recorded and analyzed as indicated in table 7.

**Table 7. Students responses on teachers' teaching strategies frequently used by their teachers in their daily classroom teaching.**

Classroom activity	Frequency and Percentages, N=471(100%)				
	Never	Always	Not always	Some times	Nearly every lesson
Coping notes from the teacher	8(2%)	9(2%)	6(1%)	72(15%)	376(80%)
Conducting experiments	366(78%)	41(9%)	12(2%)	36(8%)	16(3%)
Opportunity to express idea	161(34%)	49(10%)	193(41%)	40(9%)	28(6%)
Participating in class discussion	60(13%)	22(5%)	205(43%)	172(36%)	12(3%)
Performing group work	52(11%)	35(7%)	19(4%)	199(42%)	166(35%)
Carrying outdoor science activities	264(56%)	31(7%)	69(15%)	53(11%)	54(11%)
Teachers supervising classroom activities	127(27%)	43(9%)	181(38%)	75(16%)	25(10%)
Teachers' giving feedback	47(10%)	66(14%)	180(38%)	127(27%)	51(11%)
Listerning to explanations from the teacher.	3(0.5%)	10(2%)	8(1.5%)	74(16%)	374(79%)

Source: Field data June-October, 2011

The response from students on the different teaching strategies used by teachers revealed most of traditional methods of teaching being common teaching approaches used by teachers in the selected schools. The teaching cultures which involves coping notes, simply explanations without giving students chances for asking questions were sited as mostly used strategies of teaching in the rank of 376 (80%) and 374 (79%) respectively.

Either, teaching approaches which encourage active students participation such as outdoor scientific activities, experimentation and Teacher supervised classroom activities were rarely mentioned by students, opposite to that many students 264(56%), 366(78%), and 127(27%) respectively mentioned these strategies to be not commonly used.

Furthermore students noted that, group work and classroom discussion were the mostly used teaching strategies especially in large classes. In fact the biased method of teaching by the teacher encourages chorus answers and do not involve each and every individual in the learning process. In line with the

findings of this study there is high possibility for many students to drop from taking science subjects due to poor teaching strategies and depository teaching as pointed out by Speering and Rennie (1996).

Hodson (2003) emphasize in the same line by specifying that, the kind of teaching approaches and teacher –students in classroom has influence on students’ attitudes towards the courses and subjects in general. Thomson (2006) note the same line of results on students attitudes towards science subjects which was influencing by the teaching and learning process as well as teacher-students interaction in schools. The findings on this aspects increase the need for revisiting the teaching strategies currently used by teachers in schools.

#### Students’ Satisfaction and Readiness to Take Science Subjects in High Schools

With this study, the researcher thought that it was good to examine students’ level of satisfaction and readiness to take science subjects in their high school studies. This was necessary so as to test to their evaluation of the learning process in relation to career pathways they aspire to take. Under this objective the responses from students were as indicated in table 8.

**Table 8. Students’ Response on the level of Satisfaction with the teaching process and their Readiness to take Science Subjects in their High Schools**

Subjects	Level of satisfaction in Science Subjects and Readiness to Take Science Subjects in High Schools. N= 471(100%)			
	Strongly satisfied and ready to take	Satisfied but still undecided	Less satisfied and not ready to take	Not satisfied at all and not ready to take
Physics	75 (16%)	90 (19%)	195 (41%)	111 (24%)
Chemistry	68 (14%)	39 (8%)	40(9%)	324 (69%)
Biology	17(4%)	151 (32%)	90 (19%)	213 (45%)

Source: Field data June-October, 2011

Response from students about their level of satisfaction and readiness to take science subjects in their high schools reveals that, many students in science classes are not satisfied with the teaching process and hence are not ready to take science subjects in their high schools. This was evident in almost all the three subjects considered in this study. Most of students’ responses range from less satisfied and not ready to take science subjects to not satisfy at all and not ready to take the science subjects. This response is practical in physics, chemistry and biology.

For example 195 (41%) said are less satisfied with physics and are not ready to take it to high school while 111(24%) pointed to be not satisfied at all and are not ready to take this subject again in their high school. Considering biology subject 90 (19%) specified that are less satisfied while 213(45%) specifying that are not satisfied at all and are not ready to take the subject in their high school studies.

Looking on the response of students for the chemistry subject 40(9%) said are less satisfied while 324(69%) students claimed to be not satisfied at all. On the other side of the coin very few students appear to be satisfied and are ready to take science subjects in their high schools. The response on this side were 75(16%), 65(14% and 17(4%) for physics, chemistry and biology respectively. The possible explanation with this result is that, the teaching process, teacher-students classroom interaction, availability of learning materials and facilities are attached with this response.

Both classroom interaction and the teaching process contribute largely to this response due to facts that, the teaching strategies used by teacher in class didn’t consider the need for improvisation so as to overcome the challenges facing the learning of science subjects. Adams, Doig, & Rosier(1991) note that, the decline in interests in science subjects in these early years of secondary school is particularly of concern, since it is in these years that attitudes to the pursuit of science subjects and careers are formed.

Furthermore, Speering & Rennie (1996) identified a number of interconnected factors which are useful in explaining trend of responses found in this study, the factors include the diminished personal nature of the teacher-student relationship forced in part by fragmented timetable arrangement, a

change from an activity- based science program to one dominated by transmissive approaches and the nature of curriculum that allow little flexibility for tailoring to individual students' needs. In line to this recommendations, Goodrum (2006) and Rennie (2006) both of them emphasize that the decline of students' interests in science subjects is contributed by the students 'perceptions that, there is little relevance of science courses with their daily life. This fact can have contribution in the observed decline of students' interests in science subjects.

### **Challenges and Opportunities in Promoting Science Subjects Choice in Tanzania**

#### **Challenges**

- i. Together with inadequate teaching facilities in schools other critical challenges noted during this study which are hindering the promotion of science subject choice in Tanzania secondary schools are as follows;
- ii. Poor quality of science classroom practice which reduce the enjoyment and effective learning of science subjects by students.
- iii. Serious shortage of competent and qualified science teachers in many schools in Tanzania. This is influenced by the current employment criteria which demand a principal pass only.
- iv. Evidence of students developing negative attitudes to science subjects over the secondary school years
- v. Presence of many schools in the country with no even a single science teacher with students completing form four and subjected to science examinations some of them such as mathematics and biology said to be compulsory.
- vi. Lack of or no in –service training regardless of many changes introduced by the ministry especially in science strategies and emphasis.

#### **Opportunities**

- a. Educational Colleges has chance of initiating short courses for teachers in school in order to help them in updating their pedagogical skills.
- b. It is time for science people in the country and in different organizations and academic institution to come together so as to identify strategies which can motivate students in schools to take science subjects.
- c. Educational College has chance of increasing the training opportunities for science teachers so as to feed schools which are currently having no science teachers.
- d. It is time now for the ministry of education to collaborate with other Educational institutions in order to solve the problems of science teaching.

### **CONCLUSION**

The current ongoing trend in science teaching and learning in Tanzania schools is very dangerous to the nation development especially with the science and technological developments which our nation is crying for. It is time now to re-visit our science teaching as the nation in order to attract many students in science education so as to prepare our own scientists for the development of the nation..

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