Secondary School Students Perceptions of STEM in Western Nigeria

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ABSTRACT

As the world advances through more and more technological breakthroughs, there is no doubt STEM education is the platform to be laid down for the new generation to get by. Like many developing countries, Nigeria is making effort in the development of STEM education. At middle school or secondary schools students begin to ponder about their career options. Secondary students seem to be shying away from STEM. The efforts made by the government with several programmes have not been effective enough. The aim of this study is to investigate secondary school student perceptions of STEM.

This study was carried out in the south-west geo political zones of Nigeria. In this research a quantitative approach was employed by using a standard questionnaire to collect necessary data from students of age bracket 14 – 17. SPSS was used to analyse data. Descriptive – analysis, T-test and Annova test was carried out on the data collected. The results shows that students have high perception of STEM. It was also found out that age, gender and state of respondents is not a major factor influencing student's performance in STEM subjects.

Keywords: STEM, Secondary School, Science, Technology, Engineering and Math Education, Nigeria.

ÖZ

STEM (Fen, Teknoloji, Mühendislik ve Matematik) eğitiminin yeni nesle ulaşması gelişen teknoloji ile daha kolay bir hale gelmiştir. Gelişmekte olan pek çok ülkede olduğu gibi, Nijerya'da da STEM eğitimi için yoğun çaba sarf edilmektedir. Yapılan araştırmalarda, ortaokullarda okumakta olan öğrencilerin STEM konusunda çekingen bir tavır gösterdikleri ve devletin yeteri kadar etkili bir planlama yapamadığı görülmektedir. Bu çalışmanın temel amacı Nijerya'da öğrenim görmekte olan ortaokul öğrencilerinin STEM'e yönelik algılarının incelenmesidir.

Bu çalışma Nijerya'nın güney-batı bölgesinde sürdürülmüştür. Araştırmada nicel araştırma yöntemi kullanılmıştır. Çalışmanın araştırma grubunu, 14 – 17 yaş aralığında olan ortaöğretim öğrencileri oluşturmuştur. Çalışma sonucunda elde edilen veriler SPSS yazılımı kullanılarak analiz edilmiştir. Araştırmada betimsel analiz, T-test ve Anova analiz yöntemleri kullanılmıştır. Çalışma sonucunda öğrencilerin STEM'e yönelik algılarının yüksek olduğunu görülmüştür. Ayrıca çalışma sonucunda, öğrencilerin cinsiyet ve yaş farklılıklarının STEM'e yönelik algıları üzerinde önemli bir etkiye sahip olduğu belirlenmiştir.

Anahtar Kelimeler: STEM, Orta Öğretimde Fen, Teknoloji, Mühendislik ve Matematik Eğitimi, Nijerya

DEDICATION

This study is dedicated to my family.

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Chapter 1

INTRODUCTION

Nigeria commonly referred to as the Giant of Africa which has a population of about 184 million people. The three major tribes are Yoruba, Hausa and Igbo. The northern part is dominated by the Hausa, the Igbos in the east and south, and the Yorubas in the western part of the country. Educational system in Nigeria is the same throughout the country, despite the high level of cultural differences. Up till date, the educational system of Nigeria remains the 6-3-3-6 system. The system span through 6 years in primary school, 3 years in junior secondary school, three years in senior secondary school, and 4, 5 or 6 years of tertiary education (Uwakwe et al., 2008).

STEM is the acronym for Science, Technology, Engineering and Math. There have been several efforts made by various authors to define STEM. In terms of subject specific fields STEM can be defined as an educational program developed to prepare primary and secondary students for higher studies in the near future (Margaret, 2006). Tsupros (2009) defined STEM education as an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons. The aim of STEM education is inquiring young minds that can tackle technological problem of the near future. There is no doubt that STEM education would be one of the basic features or needs of 21st century learning. Students need solid education in STEM or at least awareness of STEM areas to progress or fit in the to the job market of today. The demand for interactive and productive task skills, information interpretation, team collaboration skills, logical reasoning as requirements for application is on the increase. Most jobs nowadays have been automated and there are more jobs on the line that are still very likely to be automated. New technologies always tend to create more jobs. Computer typesetting has put lots of printers out of use and even typesetting is being replaced by web designing and e-book publisher. Web application like the Gmail has put a lots of Microsoft exchange server users out of work. Jobs like newspaper reporter, cashier, receptionist, telephone operator, mail carrier, travel agent, telemarketer, data entry associate and typist are already at risk according to (Walsh, 2014).

In the future, STEM will lead to one of the safest jobs due to less skilled job competition and also will lead to innovation and productivity George et al., (2011). All these are needed for a country that hopes to meet up with the demand of STEM career jobs. It is important to know that STEM is not for everyone but there is need to increase the number of students in STEM areas due to the surplus in STEM jobs. Essentially, all students should have the basics of STEM education at a certain level of education. Hence in the light of Nigeria's vision 2020, there is a great need to address student's perception of STEM education. Even at the tertiary level, it is not uncommon to find students that say they don't like mathematics or anything that has to do with calculation. Mathematics has been known to form all other basis of STEM education. Psychologically, mathematics has been known to sharpen the mind of students and helps them understand other subject better (Shanks, 2010).

The continual growth of a developing country, like Nigeria, is based on its innovation and technological advancement. The impact of STEM in the world as a whole and in Nigeria, as well has been enormous as its becoming inevitable to set students focus on it. Architecture, Urban Planning, Medical Research, Nuclear power, Sustainable energy, Robotics all has to do with Maths, Chemistry, Physics and Biology. These fields are the focus of developed countries, because the knowledge of STEM has enabled the provision of healthcare delivery, clean water, increased crop harvesting and improved new materials for construction in industries, roads, automobiles, and houses (Ugo and Akpoghol, 2016).

Technology has been said to imitate nature (Yahya, 2006). Everything that has ever been invented must have been inspired by a lookalike in nature. This is how STEM should be taught to students. If the students know that what they are being taught in classes is just a reflection of the things they usually see in nature it would spark their interest the more. Benyus (1998) highlighted some examples of how technology has been imitating nature as follows:

- The dragonflies imitates helicopters,
- Radar stems imitates bats mode of movement. Transmitting high frequency so as not to hit an obstacle as they move since they rely more on their hears than their eyes.
- Scientist can now combine chemicals to give off light without heat, imitating the light-emitting algae.

To improve on these inventions and to create new ideas with student that possesses critical thinking, problem solving abilities is what STEM education aims to achieve.

Nigeria is a developing country, it is relatively behind in technological advancement. The use of ICT as a teaching tool in schools is essential to student effective learning. ICT Is the fastest growing sector of the Nigerian economy (Shittu, 2016). However, the use of ICT has not been reflecting as expected in the Nigerian classes, rather all attention is being focused on telecommunications and media. This is a challenge to teachers and administrators to make use of ICT by adopting blended learning in their various works. Blended learning or flipped classroom is the integration of traditional face to face classroom with online learning (Hameed, Badi and Cuklen, 2008).

Through the years the Federal Government of Nigeria have being coming up with several different policies and programmes in order to improve STEM education with programs like STAN (Science Teacher Association of Nigeria) and STEP-B project (Science and Technology Education Post-Basic Project) in which the main goal is to encourage and improve science in Nigeria. STEP-B project is a science project sponsored by World Bank to support Science and technology education at the post-basic level. On the other hand, STAN is a non-profit organisation developed to improve teacher abilities and competence. Their membership stems from various education, polytechnics and universities across the country (Okpala, 2011).

Secondary school in Nigeria is divided into three sections which are science class, commercial class and art class. Students of science classes are exclusively taught physics chemistry and biology and further mathematics. Commercial students take accounting, commerce and government. On the other hand the art students take literature, music and history courses. As the governing body of West African school examination, (WAEC, 2014) changed its curriculum in 2014 and consequently, the secondary schools have to incorporate these new additional courses into their curriculum. The curriculum was changed in order to take on new STEM focussed subjects. These new curriculum was changed with the addition of 39 new subjects. The focussed subjects of STEM are:

1. Auto mechanical work: It enables or provides students an opportunity to develop necessary knowledge and skills in the repair of electronic systems
2. Auto body repairs and spray painting: Students learn the basics of repairing vehicles.
3. Auto electrical work: Knowledge includes testing and repair of batteries, charging and starting systems, and electrical accessories.
4. Basic metal work: This coursework help student develop skill in basic design and practical work. It helps to develop creative thinking which can be expressed and developed through planning, manufacturing and working on metals.
5. Welding and Fabric: It enables students develop strong safety practices in the usage of welding, fabricating and other weld related equipment in theory.
6. Refrigeration and Air conditioning: Students would understand care maintenance and running of AC single and Polly phase motor, starters and transformer.

Clearly these additional courses are STEM related or STEM focused topics which indicate that new curriculum is directed towards STEM. Science education is vital to our life, the future of our country and hence, the future of our children. STEM is in our everyday life directly or indirectly. The sun, the moon, the stars, lands, oceans, winds, plants, food, weather and even the natural disasters like the hurricane, tsunami, torpedo, earthquakes are some of the things that makes up the balance of our natural world (Shah, 2011).

According to a Nigerian website, the most common jobs in demands in Nigeria are aerospace engineers, petroleum engineers, hackers, programmers, application programmers and skincare specialist (Okuku, 2017). The jobs listed here are STEM jobs and hence the need for more effort on STEM education implementation in order to spark more students interest. It is important to prepare the young minds for the jobs for the near future. Already there are vacant jobs that are not being duly filled owing to lack of specialty in the required area. It is not a problem of STEM surplus jobs, but student’s attitude towards STEM. Most students shy away from STEM subjects or topics and prefer to go with the easier and understandable courses as they think. This is because students don’t have a solid background in these areas.

A lot of factors influence student attitudes in STEM class. One of them is the class size factor. Class size has its benefits and issues. Students tend to participate in class for different reasons. Laboratories can barely contain students in large cases Yelkpieri et al., (2012) found out that large class size adversely affects students learning. STEM subjects require serious concentration and carefulness when students are working in the laboratory. When there is a large class size students tend to forget their priorities in the first place and are influenced by peers. With large class size there is probability of accidents in laboratories. The teacher–student ratio in Northern Nigeria is around 1:100 as highlighted by Sa’ad (2010) due to the high population in the region.

The work load of a STEM teacher can as well be a deciding factor. It is not uncommon in Nigerian secondary schools that teachers teach more than one subjects. This can inhibit students-teachers relation as the same teacher would have to assess performance of the various students. According to Ugo and Akpoghol (2016) teaching methods, resource utilization, work load factor as determinants in improving STEM education. Language is also a factor in the development of STEM in Nigeria. As highlighted by Babaci-Wilhite (2012) using local language to teach would improve science literacy in Africa.

1.1 Problem Statement

ICT is indispensable in the implementation of STEM. The use of ICT among teens is rampant nowadays, but unfortunately this use of ICT is not reflecting as can be expected academically. In order to effectively implement STEM, ICT has played lot of roles from quality lessons through better collaboration among teachers and students to the numerous online learning methods. Ojugo, Osika, Iyawa and Yerokun (2012) found out that ICT supports learning with technology literacy, great commitment from teachers and increases motivation for learning.

Considering infrastructures like the laboratories, blended learning classrooms effectively in place, a STEM student with little or no motivation and aspiration for STEM classes is still likely to underperform. Hence, the need to address student's perception of STEM is a crucial issue. The studies above did not address the issue of core STEM subjects on how it affects students. Tackling the drawbacks to STEM education should start at the grassroots by fixing the problems at the elementary, junior and senior high school levels (Ejiwale, 2013).

However, previous researches do not concentrate on the STEM subjects, but rather the infrastructure put in place to implement properly STEM education. Instead of focusing on infrastructures and teacher problems this research aims to understand and tackle directly student perception towards STEM subjects. This research is very important as it will help teachers and parents understand the student's area of weakness and strength, issue of students going fully into STEM classes and understanding how well they fit into each area of STEM.

1.2 Aim of Study

The main aim of this study is to investigate the perceptions of south-western Nigerian Secondary School students about STEM.

1.3 Research Questions

This study intends to achieve the above aim through the research questions below.

1. What are the perceptions of secondary school students towards STEM?
    a. What are the perceptions of secondary school students towards Math?
    b. What are the perceptions of secondary school students towards Science?
    c. What are the perceptions of secondary school students towards Engineering and Technology?
    d. What are the perceptions of secondary school students towards 21st century skills?
2. Is there any relation between secondary school students gender and general perceptions towards STEM?
    a. Is there any relation between secondary school students gender and general perceptions towards Math?
    b. Is there any relation between secondary school students gender and general perceptions towards Science?

c. Is there any relation between secondary school students gender and general perceptions towards Engineering and Technology?

d. Is there any relation between secondary school students gender and general perceptions towards century skills?

3. Is there any relation between secondary school students age and general perceptions towards STEM?

    a. Is there any relation between secondary school students age and general perceptions towards Math?

    b. Is there any relation between secondary school students age and general perceptions towards Science?

    c. Is there any relation between secondary school students age and general perceptions towards Technology?

    d. Is there any relation between secondary school students age and general perceptions towards 21st Century skills?

4. Is there any relation between students states and general perceptions towards STEM?

    a. Is there any relation between students states and general perceptions towards Math?

    b. Is there any relation between students states and general perceptions towards Science?

    c. Is there any relation between students states and general perceptions towards Engineering and Technology?

    d. Is there any relation between students states and general perceptions towards 21st century learning?

1.4 Significance of the Study

The 21st century scientific and technological innovations are essential as the world face the ups and downs of a knowledge-based and a globalized based economy. To succeed in this new information-based and highly technological society, there is need to develop highly skilled, problem solving students that can aim high and achieve beyond just what is needed in the class.

This study will help teachers and administrators to consider some important criteria on how to handle the decision of student to choose science, art or commercial class from their junior secondary schools. Also, this research would educate parents not to be over persuasive in choosing for their children what to study and what not to.

Furthermore, this research will give clarity to the Nigeria ministry of education to understand that implementation of ideas is not just enough, but to understand that the teachers that would be in charge of teaching the students' needs to be diligent determined and dedicated.

1.5 Limitations

This research was conducted in all 7 south western states of Nigeria. This study was conducted within the period of June 2016 to November 2016. Only the state schools were considered in this research. The number of schools contacted in each state varies because of limited resources.

1.6 Definition of Key Terms

ICT- ICT (information and communications technology - or technologies) is a term that describe set of technologies tools and resources used to communicate information (Wikibooks, 2015).

STEM: An integration of Science, Technology, Engineering and Math (Edutopia, 2011)

Chapter 2

LITERATURE REVIEW

This chapter aims to review and analyse, the efforts made by various authors that have been put into the development of STEM education and investigating students perceptions towards STEM education. Been a relatively new term or idea of STEM is not a definitive term as different countries are approaching it in a different manner at different levels of student education.

2.1 STEM Definition

Various educators have tried to define STEM in different context. There is not one general acceptable definition of STEM. One of the definitions is that "STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, and engineering" (Tsupros et al., 2009).

STEM aims to foster inquiring or inquisitive minds, logical reasoning, and collaboration skills. This definition of STEM addresses each subject independently. Educators have broken STEM down into seven standards of practice which are to learn and apply content, to integrate content, to interpret and communicate information, to engage in inquiry, to engage in logical reasoning, to collaborate as a team and to apply technology appropriately.

Another definition of STEM is that “STEM is a curriculum based on the idea of educating students in four specific disciplines of science, technology, engineering and mathematics in an interdisciplinary and applied approach” (Stephen, 2014). The term curriculum refers to teaching content in one subject area. In other words it refers to integrating different discipline into one subject area, teaching from variety of perspectives, strategies and resources in order to develop minds that can tackle real life problems. STEM can be taught separately, but it must be integrated into one platform based on real world applications. This approach tends to be realistic, interactive and help students develop a good team spirit. However, integrated curriculum requires careful planning and hence, takes time. Since teaching is not autonomous student have to develop their own learning experience which may cause students to lose sight of main concepts of the lesson. The teachers of an integrated curriculum would require flexibility, compromise and commitment to teaching and the interactiveness of their students.

2.2 Students Perceptions towards STEM

There has been several works done on student perceptions towards STEM subjects from language factors to class size, teacher problem, and ICT integration in class and so on.

STEM is becoming an indispensable part of our life while more technological breakthrough is being made. Students attitude towards STEM education or science studies can be attributed to a lot of problems. One of these is the language factor. Babaci-Wilhite (2013) argued in her work that a contextualised dimension of learning should be seen as human right in education. In other words, local learning and local knowledge using local language should as well be incorporated in the learning of science subjects. Science education has struggle to explain various scientifically concepts through the use of a foreign language. Learning scientific concepts would be much easier, if students learn locally in their native language. The least that can be done is to explain basic concepts in a native language. Language is a very important factor as it helps preserve as well as develops local knowledge, culture and trends in of a community.

ICT is impacting and changing everything done in today's daily life. Education is not left out of this immense impact of ICT. The use of ICT in classes brings excitement and therefore sparks students interest in learning, brings about better communication with teacher and students anywhere anytime. Constructivism as a learning method can enhance the integration of ICT in classes. It is a learning theory based on the concept that leaners construct their own learning. Piaget (1983) is of the opinion that learning comes from experience and not just immediately information is disseminated. ICT supports learning, increases motivation for learning, increases their engaged learning and interdependence that allows them to develop skills that are associated with time and resource management, concentration, self-discipline, attention to defined task and ability to follow instructions. Ojugo, Osika, Iyawa and Yerokun (2013). However, more access requires greater personal responsibility which is lacking in some students. More so, modern science relies more on the effective use of ICT. Students need to know how to use ICT properly in order to be effective in STEM classes. Teachers and students have more time for critical thinking as ICT has taken care of the difficult manual processes.

It is inevitable that student performance will not be affected with variation in class size. STEM classes particularly should pay attention to this issue as it becomes more difficult for to carry students along with a large class size. The first issue is what number makes a large or small class. The teacher–student ratio in Northern Nigeria is around 1:100 as highlighted by (UNESCO, 2000) due to the high population on the region. However, national policy on education specify 20 pupils in primary, 20 in primary and a maximum of 40 students in secondary schools (NERDC, 2002). These numbers would be different for urban areas which are more populated. However, due to the few number of schools in rural areas class sizes can be inevitably high. Student in a large class sizes easily suffer discipline problems. Certainly, class size has effects on students feelings and achievement. Large class size ensures enough competition which is a quite effective way to recognise brilliant students. More importantly small class size is essential to the effectiveness of a STEM classroom. Olatunde (2010) carried out a research in secondary schools of South western Nigeria by the results showed that the performance of students in large classes was very low (23%) compared to those students in smaller classes (64%). Owoeye and Yara (2011) also found out in her study that large class size is not conducive for serious academic work. Yusuf, Onifade and Bello (2016) in a study found out that class size has a highly significant impact on students' attitudes towards their learning in secondary school in a south-western Nigeria state. Specifically, the study found out that class size affects students' attention, punctuality, motivation and participation. Class size has been attributed to rather an administrative problem.

2.3 STEM Education in Nigeria

Nigeria strived to be amongst the countries that uphold the Millennium Development goals (MDGs). World leaders came together in 2000 to adopt a UN millennium Declaration committing their nations into majorly helping least developed countries (LDC) eradicate extreme hunger.

Some of the goals of MDGS complements STEM education and are:

1. Achieve universal primary education: Primary education is often overlooked but forms the basis of every other form of education in Nigeria. STEM education cannot progress without its basics.
2. Promote Gender Equality and empower Women: The female gender often seems to shy away from subject such as mathematics and engineering. The society does not encourage a lot of women to pursue careers in this line. When women are educated STEM they have an equal or even higher chance of getting their dream jobs.
3. Improve Maternity Health: To improve maternity health, high qualified doctors that improve themselves with continued research is paramount.

It is clear from the MDG goals that its goals are in line or consistent with developing STEM education (Omole, 2000). The Universal Basic Education (UBE) scheme is a free universal educational scheme in Nigeria is designed to address education programmes for the acquisition of functional literacy, and life skills for adults. It is at this level of formal education that STEM education should be emphasized. Schemes like the Benignant STEM Innovation implemented by a Nigerian born aerospace engineer, (Ajuogu, 2016) aims to empower young people in science and technology. STEM workshops are provided and available where interested student can get hands-on activities in order to encourage and boost their interest are provided.

2.4 Globalisation and STEM Education

Globalisation is a process in which the people and countries of the world are being brought closer and closer together, economically and culturally, through trade, information technology, travel, cultural exchanges, the mass media and mass entertainment (Carter, 2014). Technological infrastructure like telecommunications, information systems, microelectronics machinery and computer-based transportation enhanced the idea of globalisation.

Social media, electronic mail, electronic money transfer makes it easy disseminate, receive and process information. Technological infrastructure like this has to do with knowledge and ideas. The two main bases of globalization are information and innovation which are in turn highly knowledge intensive (Ram, 2001). Knowledge is the bases of information and innovation and the classroom is where it starts.

However, STEM education particularly has not been properly implemented in most countries. Since globalisation cannot be defined in terms of just how one country performs but an inter-collective effort amongst countries, nations and continents it is becoming a big problem to achieve the effectively the goals of globalisation.

According to Stewart, (2016) the economic growth of one nation comes at the expense of another in globalisation. This might be true but in turn it is indirectly challenging and positively affecting the lesser nation's economic and technological infrastructure development which invariably would lead to more focus on STEM education. The principal role of education has been the development of a whole individual which requires completing basic primary and seldom secondary school. But in the present globalised world education needs to respond to the additional demands from the technological world. This is one of the most important reasons for STEM education.

2.5 Related Researches

STEM education development can be addressed from the student or teachers point of view. Student perception of STEM is as important as that of teachers. It's not just enough what a teacher brings to class but their level of confidence and which in turn depends on their access to appropriate resources. Nadelson et al., (2013) in their work found out that exposure of teachers to STEM profession and work increases motivates them and increases their teaching capability towards STEM in K-5 classes. Also, additional course work in STEM is likely to positively and significantly influence teacher confidence. Teaching STEM topics requires confidence. However, there is no confidence without knowledge (Harlen and Holroyd, 1997). Omorogbe and Ewanisha (2013) highlighted the challenges in the effective teaching of Science in Nigeria. Some of which are teacher competencies and skills, in-service training courses, salary of teachers and teachers academic and professional qualification. These factors can be a great motivator for teachers depending on their level of implementation. Students that are taught by certified teachers are found to perform better than student that are taught be uncertified teachers (Molnar, 2002). Professional qualification on the other hand is as well important. It is not uncommon to find an engineering degree holder teaching mathematics or even chemistry in Nigeria. Despite professional and academic qualifications a teacher that is not getting a reasonable salary will not be motivated enough to teach effectively.

There have always been the problem of integrating the T (Technology) in STEM effectively. Teachers are finding it hard to understand how to use or integrate technology when teaching STEM. El-Deghaidy and Mansour (2015) found in their study that teachers are underprepared in their use of technology in STEM classes. Also, they found out that science teachers do not have thorough understanding of the nature of science and technology and when and how to integrate STEM.

(Christensen, Tyler-Wood, 2011) found out in their research that university teachers attitudes towards teaching STEM is not encouraging. Middle school students appear to possess more positive perceptions towards science.

Chapter 3

METHODOLOGY

3.1 Research Design

Survey is one of the most important areas of measurement in applied social research. A survey can be anything from a short paper-and-pencil feedback form to an intensive one-on-one in-depth interview (Trochim, 2006). There are two types of survey, quantitative and qualitative survey that can be employed in social research. In this research, a Questionnaire was used and likert scale response was developed for the respondents.

This study employs quantitative approach to ensure concise, clear and thorough research. Quantitative approach is used to quantify a research problem by way of generating numerical data or data that can be transformed into useable statistics. It is used to quantify attitudes, opinions, behaviours, and other defined variables and generalize results from a larger sample population (Wyse, 2011).The nature of the questionnaire used in this study aims to reflect the student's perceptions on STEM. The participants are students from secondary schools that were carefully monitored and guided by an instructor when filling out the questionnaire to ensure reliable result. The questionnaire used in this study is developed by Faber et al., (2013) in their study titled ''The Development of Upper Elementary School and Middle/High School Student Surveys''.

3.2 Population and Sampling

Sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample it may fairly generalize the results back to the population from which they were chosen (Trochim, 2006). 20 schools were visited in the western region of Nigeria for this study. A meeting was setup with each school and the researcher had conversation with the administrative department. There were also agreements, terms and conditions on how the study would be taken. The principal and administrative department were informed on the aims, purpose and importance of carrying out the research in the school, if the respective school consent to it. Out of the 20 schools, 6 of them couldn't participate due to the unclear expression of their administrative department. The south western region of Nigeria consists of 7 states which are Lagos, Oyo, Ogun, Ondo, Kwara, Osun, and Ekiti. These states represent the Yoruba tribe of Nigeria and as expected all speak the same language but with slightly different dialect. This ensures ease of communication with the school administrators.

3.3 Data Collection

"Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes" (Knatterud et al., 1998). A well-structured questionnaire was used and which is relevant to the study's objective and research questions in the process of collecting data. One of the purposes of the study was to study the students' awareness and interpretation of STEM and consequently, their attitude towards it. The data was gotten from both public and secondary schools and through document analysis such as public records and published information. 3 schools from Lagos state. 2 from Ogun state, 2 from

Oyo state, 2 from Ondo state, 1 from Kwara state, 2 from Osun and 1 from Ekiti state. Table 1 shows the demographic information of the number of schools in south-west Nigeria that participated in this study.

Table 1: Number of Schools in South-West Nigeria that Participated in this Study.

State	Lagos	Osun	Oyo	Ogun	Ondo	Kwara	Ondo	Ekiti
Schools	3	2	2	3	2	1	2	1
Students	18	10	10	10	10	10	5	5

Out of 80 questionnaires that were let out randomly for the study, 69 STEM students reported back. A total of 10 STEM students from Ogun state, 5 of which were male and 3 were female. For this study, there were 18 participants from Lagos comprising of 12 male and 6 female. In Oyo state a total of 10 students participated, 7 of which were males and 3 female. Ondo state has a total of 10 participants, 6 were males and 5 female. Ekiti states has 5 participant, with 4 males and 1 female and Kwara has 5 students, 4 males and 1 female.

Table 2: Statistics of Respondents by Gender

Gender	Frequency	Percentage
Male	50	72.5
Female	19	27.5
Total	69	100

Table 2 shows that 72.5% of the respondents were male and 27.5% were female. According to the U.S. Bureau of Labour Statistics, women make up 47% of the total

U.S. workforce, but are much less represented in particular science and engineering occupations (Camera, 2015). Table 4 shows the age, state, schools of the respondents and their respective samples.

Table 3: Statistics of Respondents by Age

Age brackets	N	Percentage
14 – 15	59	85.5
16 – 17	10	14.5
Total	69	100

As shown in Table 3 59% of respondents are between 14 and 15 years. Only 10 per cent of respondents are between 16 – 17 years. Basic education in Nigeria starts at the age of six and therefore, a child is expected to finish secondary school at the age bracket of 14-15. Hence, the high number in the age brackets of 14 – 15.

3.3.1 Questionnaire

The questionnaire was structured around the four core STEM subjects Maths, Science, Engineering/Technology and 21st century skills. The first section of the questionnaire focuses on mathematics, the second on science, the third part is on engineering and technology and the last part focused on the 21st century skills. The Math section has 8 questions, Science section has 9 questions, 9 questions from engineering and technology section, 21st century skills section has 11 questions to it. All the questions in these sections are directly related to the study. The questionnaire was selected from the works of Faber et al (2013). Each section of the questionnaire has 8 directly related questions. The options from the questionnaires agree, strongly agree, disagree, strongly disagree were represented by 1, 2, 3, 4 and 5 respectively so as to make it easy for respondents to choose from.

3.4 Method of Data Analysis

Data collected from respondents was primarily presented by use of quantitative methods. The results obtained in the questionnaire were computed and analysed using descriptive statistics (SPSS).

3.5 Reliability and Validity of Data

"Reliability is the consistency or repeatability of measures" (Trochim, 2006). In order to achieve a reliable result, the instrument which is used must be valid as there is a very close relationship between validity and reliability.

Cronbach's alpha as a measure of reliability was conducted for this study and the results come up as shown in the Table 4.

Table 4 : Reliability Statistics of Respondents

Cronbach`s Alpha	N Items
0.631	7

Cronbach's alpha of this value 0.631 is considered satisfactory and sufficient (Marnburg, 2014).

"Validity in data collection means that your findings truly represent the phenomenon you are claiming to measure" (Seliger & Shohamy, 1989). In this research it refers to the measure of truth or falsity of answers given in the questionnaire by the students. A lot of factors could affect the internal validity and external validity of the measuring instrument and even the interview used in the survey to gather data about student attitudes, awareness and interpretation of STEM. Science students from junior secondary school (JSS1) to senior secondary school (SSS3) were chosen at random as participants with the help of teachers and administrators. A lot of participants admitted that they have not heard the word ‘STEM’ and some say they have during interviewing some participants revealed that a lot of them are not aware of the acronym STEM but after breaking it down to some participants gave a positive answer to being aware of STEM education. From observation this shows some participants don’t just want to admit they never heard STEM before or they actually have heard it but not very often.

Participants may not readily accept that they don’t have a tablet or use tablet for study for the fear of what might be said but it has been indicated in the questionnaire to leave questions that may make them uncomfortable.

External Validity on the other hand is the extent to which you can generalize your findings to a larger group or other contexts. In this study the sampling method used is the non-probability sampling method. Consequently this would have limited insight to this study as a random sampling can be used by other researchers.

Chapter 4

FINDINGS AND DISCUSSIONS

In this chapter, the results of the data taken from the respondents were analysed and discussed. The aim of this chapter is to tackle and provide answers as satisfactory as possible to the research questions in Chapter 1.

4.1 Students Perceptions on STEM

Each question answered from the questionnaire by the participant is analysed with respect to age, groups, gender, and state frequencies, mean and standard deviation. Table 5 below will be used to give clear meaning to the analyses.

Table 5 : Student Perception of STEM

	N	Mean	SD
Perception	69	145.99	11.2033

There are 37 questions in the questionnaire each with a 5 scale response. The minimum value is 37 and the maximum value is 187(35 * 5). The average of the maximum and minimum number is 111. As seen from the Table 6 the mean for the total perception of STEM is 145.99. Out of 100 the percentage is 78.91%. This indicates a high perception of STEM.

4.1.1 Student Perceptions on Math

The frequencies and percentages of the questions in the questionnaire are shown in the tables. There are eight questions in this section. The Table 6 shows analysis of the respective question.

Table 6: Student Perception on Math

	SD		D		N		A		SA		Mean
	N	%	N	%	N	%	N	%	N	%	
Math has been my worst subject.	16	23.2	45	65.2	8	11.6					1.88
I would consider a career in Math.	1	1.4	19	27.5	11	15.9	36	52.2	2	2.9	3.27
Math is hard for me.	13	18.8	33	47.8	15	21.7	8	11.6			2.26
I can do well in Math.			11	15.9	19	27.5	33	47.8	6	8.7	3.49
I can't do a good job with math	10	14.5	27	39.1	14	20.3	9	13	9	13	2.7
Advanced work in Math	1	1.4	3	4.3	8	11.6	42	60.9	15	21.17	3.97
Good grades in Math	1	1.4			17	24.6	13	49.3	17	24.6	3.99
I am good at Math	3	4.3	6	8.7	20	29	25	36.2	15	21.7	3.62

Out of the total 69 participants 61 (45 disagree and 16 strongly disagree) students disagree that maths is their worst subject. This represents a total of 88.4% of those who disagree. No student admit that maths is their worst subject. This indicates a strong ambition for maths subject but not necessarily good grades in maths.

Math career includes various kinds of jobs that use mathematics directly or indirectly to solve problems. Some of them are Architect, Astronaut, Engineer, Animator, inventory control specialist and even teaching. This explanation was made known to the respondents before answering the question. Table 7 above shows the statistics of students that would like to choose a career path in math. A total of 20 students disagree and 38 students agree to a career in math.

Maths is objective in nature unlike other subjects which can be very subjective depending on one's opinion (Heller, 2013). Hence Difficulty here means concept and not computation. And due to some reasons like low IQ and lack of early childhood training many students tend to find maths difficult. "If the student didn't understand, I assumed there was something wrong with my explanation" Mighton (2013). A total of 44 students disagree that math is hard for them and just 8 students seem to agree that Math is hard. 15 students rather chose the neutral option. This could be due to early childhood training and this includes private teaching of students after lesson. 19 of the total participants go with neutral option but 39 students agree they are the type of students that do well in math. Students sometimes feel they do well in math but are not being assessed properly.

Math is not always a student's worst subject as can be seen from the table above. There are other subjects which students could loathe more. Subjects like art can be terrifying to some students. 18 students agree they can handle most subjects well but not math and 37 students disagree with this notion. Most students feel they can do advanced work in math with 57 of 69 participants agree while just 4 of them disagree. 17 students believe they can get good grades in mathematics. Every student wants to get a good grade in math. Interesting thing to notice here is how many students went with the neutral option. It can as well be considered they disagree or not confident enough to admit they are good at math.

A total of 40 students agree that they are good in math while just 9 students disagree they are good in math. 20 students chose the neutral option.

Table 7: Mean and Standard Deviation on Math

	Maths	Mean	SD
M1	Math has been my worst subject	1.88	0.58
M2	I would consider a career in Math	3.27	0.953
M3	Math is hard for me	2.26	0.902
M4	I can do well in Math	3.49	0.86
M5	I can't do a good job with math	2.7	1.25
M6	Advanced work in Math	3.97	0.80
M7	Good grades in Math	3.99	0.79
M8	I am good at Math	3.62	1.05

Table 7 shows the respective mean and standard deviations of the maths section question. There are 8 questions in the maths section of the questionnaire. M1 (M=1.88 SD= 0.58). A mean of 1.88 shows that most of the students in this study disagree and standard deviation of 0.58 means the response are tightly bunched together. The students probably have other subjects they loathe more than mathematics. In other words the values are not evenly distributed.

A mean of 3.27 from the question M2 (M=3.27 SD=0.953) means most of the students are not sure about this question or don't know what it means. Again the students tend to disagree with the question M3 as can be seen from the mean value. The small standard deviation 0.902 means the respondents tends to agree accurately with the results. M5 (M=2.7 SD=1.25) has a mean of 2.7 which shows the students disagree with this notion. M6 (M=3.97, SD=0.80), M7 (M=3.99 SD=0.79) and M8 (M=3.62 SD=1.05) all agree as can be observed from the mean.

Although lot participants believe maths is not their worst subject but they also agree with M4. The mean shifts a little from the neutral means the students are not sure but believe they can do better. It is the teacher's responsibility to see this problem and develop necessary solutions.

4.1.2 Students Perception on Science

The frequencies and percentages of the questions in the questionnaire are presented in the tables. There are 9 questions in this section. Table 8 below shows analysis of the respective question.

Table 8 : Student Perception on Science

	SD		D		N		A		SA		Mean
	N	%	N	%	N	%	n	%	N	%	
I can do well in science	1	1.4	1	1.4	5	7.2	40	58	22	31.9	4.17
A career in Science					1	1.4	30	43.5	38	55.1	**4.53**
Science after school					1	1.4	36	52.2	32	46.4	4.49
Science will help me			2	2.9			30	43.5	37	43.2	4.47
Future work in Science					2	2.9	27	39.1	40	58	4.55
Good Performance in science	1	1.4			6	8.7	25	36.2	37	53.6	4.40
Science will be important to me in life	1	1.4	1	1.4	4	5.8	30	43.5	33	47.8	4.30
I cannot do a good job with science	14	20.3	13	18.8	11	15.9	16	23.2	15	21.7	**3.07**
Advanced work in Science	2	2.9	7	10.1	7	10.1	31	44.9	22	31.9	3.92

As seen from the Table 8 above there is a great deal of number of students that like science with a total of 62 students that said they are sure of themselves in science subject. Again almost all participants (68 students) agree with a career in science which makes up 98.6% of the total number of participants. The trend continues with 98% of all participants say they agree to need science after school. 67 students agree that knowledge of science will help them in the future. 2 students disagree. This makes up 96.7% of those who agree and just 2% of those who disagree.

Table 9 indicate that students are quite interested in all aspects of science as the responses of the participants from the questions are consistent enough.

4.1.3 Student Perception on Engineering and Technology

The frequencies and percentages of the questions in the questionnaire are shown in the tables. There are nine questions in the Engineering and Technology section. Table 9 shows analysis of the respective questions.

Table 9: Student Perception on Engineering and Technology

	SD		D		N		A		SA		Mean
	N	%	n	%	N	%	N	%	N	%	
I like to imagine creating new products	1	1.4	1	1.4	7	10.1	40	58	20	29	4.11
I can improve things with engineering	1	1.4	1	1.4	12	17.4	30	43.5	25	36.5	4.69
I am good at building and fixing things	2	2.9	6	8.7	23	33.3	20	29	18	26.1	3.66
I am interested in what makes machines work			8	11.6	20	29	30	43.5	11	15.9	3.63
Designing products will be important for my future work	2	2.9	14	20.3	18	26.1	21	30.4	14	20.3	3.44
I am curious about how electronics work	1	1.4	1	1.4	7	10.1	40	58	20	29	3.62
I would like to use creativity and innovation in my future work	1	1.4	2	2.9	10	14.5	38	55.1	18	26.1	4.56
Knowledge of math and science will help me invent useful things			1	1.4	6	8.7	36	52.2	26	37.7	4.20
Successful engineering career			2	2.9	11	15.9	31	44.9	25	36.2	4.31

Table 9 shows the respective mean and standard deviations of the maths section question. There are 10 questions in the engineering and technology section of the questionnaire. I like to imagine creating new products has a mean of 4.2 which represents the students agree to imagining creating new product. The same goes for the question ‘’ I can improve things with Engineering knowledge’’ which has a mean of 4.11 and standard deviation of 0.75. However ‘’ building and fixing’’ has a mean of 3.66 with a standard deviation of 1.05. This value represents a drop in students that think they can build and fix things. This is because students are not trained to think in this manner. Robert and Wendy (1996) said the main limitation on what children can do is what they think they can’t do.

4.1.4 Student Perception on 21st Century skills

21st century skills requires students to be develop a mind of their own, problem solving skills, help others, make team work and so on. Each question of the questionnaire are analysed based on the frequency of response and their percentages computed consequently. There are 10 questions in this section. It was made sure the respondents understand the questions before answering it. The table below shows analysis of the respective questions.

Table 10: Student Perception on 21st Century skills

	SD		D		N		A		SA		Mean
	N	%	n	%	N	%	n	%	N	%	
I can help others achieve a goal					10	14.5	37	53.6	22	31.9	4.17
I can encourage others to do their best.			2	4.3	3	2.9	32	46.4	32	46.4	4.34
I can produce high quality work.			1	1.4	5	7.2	32	46.4	31	44.9	4.34
I can respect difference of my peers.					1	13	30	43.5	30	43.5	4.30
I can help my peers.			1	1.4	10	14.5	32	46.4	26	37.7	4.27
I can include others perspective when making decisions.			2	2.9	5	7.2	34	49.3	28	40.6	4.08
I can make changes when things do not go as planned			8	11.6	5	11.6	29	42	27	39	4.39
I can set my own goals			1	1.4	1	1.4	37	53.6	30	43.5	4.97
I can choose which one needs to be done first			1	1.4	5	7.2	32	46.4	31	44.9	4.34
I can work well with students in different background					4	5.8	34	49.3	31	44.9	4.39

As can be seen from Table 10 the mean of each question is within the range of 4 and 5. This represents a strong positive response from the respondent. Children tends Almost all of the respondents seem to agree positively with the “21st century skills question as the average mean of the responses is still within 4 as can be observed from table 10. Collaboration, communication, creativity and critical thinking are the set of skills that are vital to a 21st century child (Frog, 2016). Children naturally have these skills until they are thought differently. It is important to develop students in these skills.

4.2 Correlation between Student Gender and STEM

In order to determine the relationship if any between the variables of gender and STEM subject a t-test was carried out which include the group statistics and the independent sample test with the help of SPSS. The results are shown in the tables below.

Table 11 : Relationship between Students Gender and Math.

Gender	N	Mean	SD	SD error mean
Female	19	25.47	8.49492	1.94887
Male	50	25.06	12.51203	1.71856

Table 11 above shows the group statistics for math. Both the mean of the female and male gender response to math are almost the same. However the standard deviation of the male gender is much higher than that of female. This is probably due to the larger number of males in the group.

4.2.1 Secondary School Students Perceptions on Math Depending on Gender

An independent sample test was conducted on Mathematics section of the questionnaire. The results are shown in the table below.

Table 12: Secondary School Students Perceptions on Maths Depending on Gender

	N	Mean	S	SD	T	P
Equal variances assumed	19	25.4737	2.11787	67	0.668	0.506
Equal variances not assumed	50	25.060	2.35961			

As seen from the Table 12 above the gender is no major factor in achievement of mathematics in total. The sig 2 tailed returned a value of 0.5 which is greater than 0.05. This means that there is no statistically significant gender difference in mathematics. However, in contrast to the Math-total, Ttable 12 shows that the sig 2 tailed tests is 0.038 which is lower than 0.05 for students that can do well in math which indicate some relation in this aspect. The issue of gender gap in Nigeria has been attributed to a lot of reasons. Students in rural area tend to have more boys performing better in maths than girls. Awofala (2011) found out that there is no significant difference between the mathematics performance of male and female students in Cross River State, Nigeria. Also He found out that performance of male and female students differed only for those in single-sex schools and for rural schools.

4.2.2 Secondary School Students Perceptions on Science Depending on Gender

An independent sample test was conducted on the science question of the questionnaire. The results are presented in the Table 13 below. The result shows that there is no statistically significant gender difference in Science.

Table 13: Secondary School Students Perceptions on Science Depending on Gender

	N	Mean	S	SD	T	P
Equal variances assumed	19	38.2632	0.683	67	0.487	0.443
Equal variances not assumed	50	37.820	0.497			

It is clear from the table above that gender is not a major factor in students performance in science as. A careful look at each question also reveals that there is no statistically significant gender difference in Science. Owoeye and Agbaje (2016) also found out in their study there is no significant relationship in the student's gender and student's academic performance in Biology. However, they added that science subjects such as physics and chemistry tend to go in favour of the male gender.

4.2.3 Secondary School Students Perceptions on Engineering and Technology Depending on Gender

Engineer is a person who is interested in how and why things work. Technology is the system or tools use to understand or make things easier. The result of the independent sample test is presented in the table below.

Table 14: Secondary School Students Perceptions on Engineering and Technology Depending on Gender.

	N	Mean	SS	SD	T	P
Equal variances assumed	19	35.1053	3.58848	67	0.110	0.913
Equal variances not assumed	50	35.000	3.52831			

The significant two tailed test came out as 0.506 as seen from the Table 14 which is much higher than 0.05. This indicates there is no relation between gender and engineering and technology. It is not uncommon that the female gender are not proactive like the males when it comes to use of technology. Ziefle and Shaar, 2011) found out that Women's interest in technology was smaller towards an invasive medical stent. They also discovered it was irrespective of age.

4.2.4 Secondary School Students Perceptions on 21st century skills Depending on Gender.

The section comprises 10 questions. The results of the independent sample test are shown in Table 15 below.

Table 15: Secondary School Students Perceptions on 21st century skills Depending on Gender.

	N	Mean	SS	SD	t	P
Equal variances assumed	19	47.2105	67	3.77976	0.48	0.913
Equal variances not assumed	50	48.080	61.568			

As seen from the significant 2 tailed two tests table 16 above there is no statistically significant gender difference in 21st century skills. In other word the 21st century skills is independent of gender.

4.3 Correlations between student's Age and STEM

In order to determine the relationship if any between the students age and stem subject a t-test was carried out which include the group statistics and the independent sample test with the help of SPSS. The results are shown in the Table 16. The number of respondents between the ages of 14 – 15 is 59 and the number of respondents between the age of 16 – 17 is 10.

Table 16. Correlation between Age of Respondents and STEM

	Age	N	Mean(x)	DF	SD	F	Sig(2tailed) P
Math	14 – 15	59	25.1960	67	2.27545	0.049	0.969
	16 – 17	10	25.200	11.702	2.48551		0.972
Science	14 – 15	59	37.7966	67	3.10605	2.037	0.387
	16 – 17	10	38.800	10.367	4.70933		0.580
Eng/Tech	14 – 15	59	35.1017	67	3.45760	0.02	0.680
	16– 17	10	34.600	11.354	4.03320		0.718
21st century skills	14- 15	59	48.0508	67	7.00104	0.158	0.529
	16- 17	10	46.600	18.331	4.29987		0.387

The mean of students between the age of 14 and 15 is 37.8 and student between the age of 16 and 17 is 38.8. There seems to be no statistically significant age difference in Math subject as can be seen from the table. Khata et al., (2011) in their research found out that ‘’below 19’’ age group students had higher Mathematics GPA scores than the scores of “19 and above”. Also, students tend to understand mathematics easily at a younger age.

The science section shows that p > 0.05 which shows that there is no relation between students age and science. With science it can’t be denied that students understand better with constant practice. This idea should not be confused with age. However, age in this context does not represent a period of time but rather a certain time.

Engineering and technology also shows no major difference with respect to age differences as $p > 0.05$ as can be observed from the Table 16.

21st century learning is the purposeful development of young minds to be able to tackle problems, think critically, make a team, respect differences e.t.c looking at the mean differences of the age brackets there is a slight difference with age bracket of 14 - 15 having a mean value of 48 and 16 - 17 age bracket having a mean value of 46. As seen from the table age is not a major factor towards 21st century skills.

4.4 Correlations between Students States and STEM

The background of a student can have effect on a student mental ability to perform in some subjects. The states that took part in this study are 7 which represent the south western part of Nigeria. These states are Lagos, Ekiti, Kwara, Ondo, Ogun, Osun, Oyo. Education systems all over Nigeria is the same but the systems of education in this states are more closely related. The south west represents the Yoruba speaking part of Nigeria with slight different dialects and culture. This aids better communication and hence, similarities among the states. The total number of students from lagos states is 10, Ekiti, 5, Kwara, 5 Oyo, 10, Osun, 11, Ogun, 10, Ondo state, 10.

Table 17 : Relationship of the States of Respondents towards STEM

Maths	Sum of Squares	DF	Mean square	F	Sig (p)
Between groups	48,760	6	8127	1.640	0.631
Within groups	3307.154	62	4954		
Total	355.913	68			
Science					
Between groups	60.057	0.877	70.55	6	0.517
Within groups	707.7111	62	10.010	62	
Total	767.768			68	
Engineering					
Between groups	44,082	6	7.347 12.869	0.571	0.752
Within groups	797.860	62 68			
Total	841.942				
21st century skills					
Between groups	156.541	0.463	26.090	6	0.631
Within groups	2870.795	0.563	46.302	62	0.578
Total	3027.246			68	

As can be observed from Table 18 (p>0.05) there is no relation between states of respondents and the response to maths question. In other words the state of the respondents is not directly related to their response in the math section. The same goes for science section, engineering and 21st century skills.

Table 18: Descriptive Mean of the States of Respondents

States	N	Mean	SD	SD error
Lagos	18	148.83	14.038	3.3098
Ogun	10	146.80	8.2029	2.594
Osun	11	142.09	10.444	3.1491
Oyo	10	144.60	7.396	2.3390
Ondo	10	146.2	11.688	3.696
Ekiti	5	140.80	13.645	6.1024
Kwara	5	150.20	10.702	4.1789
Total	69	145.98	11.020	1.3487

Table 18 shows Kwara has the highest mean of all 7 states with a value of 150.200, Lagos state has the second highest with 148.83, followed by Ogun state with 146.8. A closer mean came to this value came from Ondo state with a value of 146.2. Oyo has a mean value of 144.60 and Osun with 142.09.

Chapter 5

CONCLUSION

From this research work it was found out that students perception of STEM are attributed to a lot of factors in south-west Nigeria. Asides from class size, teacher problems, infrastructures of a school, work load the common factors that are overlooked are students age, gender and state. This study focussed on these factors and found out that the factors of gender, age and state is not affected by students perception of STEM.

In this study students tend to disagree with the thoughts that maths is hard or their hardest subject. Science on the other hand has an overall positive result from the students as the results show over 90 per cent positive response from all science related question. It was study found out that students prefer science and would take a career in it. The study also revealed that female students do not take much interest in Engineering and Technology relatively. Positive response from the 21st century questions reveal that students want one another's best interest, would like to help each other. Students perception of STEM can help teachers and administrators develop STEM education effectively. This study can as well help parents see through the mind of their child and consequently, help the children pursue their dreams instead of forcing a career on them.

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APPENDIX

Appendix A: Questionnaire

STEM (Science Technology Engineering Math) Student Survey

Name ………………

Age …… School….. Gender…….. State…..

The table below represents each option respectively. Kindly use it to answer the questions that follow.

Example 1	Strongly Disagree	Disagree	Neither agree Nor disagree	Agree	Strongly Agree
I like engineering	1	2	3	4	5

There are no "right" or "wrong" answers! The only correct responses are those that are true for you. Whenever possible, let the things that have happened to you help you make a choice. Please fill in only one answer.

S/N		Strongly Agree	Disagree	Neutral	Agree	Strongly Agree
Q1	Math has been my worst subject.					
Q2	I would consider choosing a career that uses math.					
Q3	I can handle most subjects well, but I cannot do a good job with math.					

Q4	I am sure I could do advanced work in math					
Q5	I can get good grades in math.					
Q6	I am good at math.					
Q7	I am sure of myself when I do science.					
Q8	I would consider a career in science.					
Q9	I expect to use science when I get out of school.					
Q10	I expect to use science when I get out of school.					
Q11	Knowing science will help me earn a living.					
Q12	I will need science for my future work					
Q13	I know I can do well in science					
Q14	I can handle most subjects well, but I cannot do a good job with science.					
Q15	I like to imagine creating new products.					

Q16	I am good at building and fixing things					
Q17	If I learn engineering, then I can improve things that people use every day.					
Q18	I am interested in what makes machines work.					
Q19	Designing products or structures will be important for my future work.					
Q20	I am curious about how electronics work.					
Q21	I would like to use creativity and innovation in my future work .					
Q22	Knowing how to use math and science together will allow me to invent useful things					
Q23	I believe I can be successful in a career in engineering					
Q24	I am confident I can produce high					

	quality work.					
Q25	I can lead others to accomplish a goal.					
Q26	I am confident I can encourage others to do their best.					
Q27	I am confident I can respect the differences of my peers.					
Q28	I am confident I can help my peers					
Q29	I am confident I can include others' perspectives when making decisions.					
Q30	I am confident I can make changes when things do not go as planned					
	I am confident I can set my own learning goals.					
Q31	I am confident I can manage my time wisely when working on my own					
Q32	When I have many assignments, I can choose which ones need to be done first.					
Q33	I am confident I can work well with students from different backgrounds.					