International Journal of Research and Review
Vol.7; Issue: 11; November 2020
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Relationship between Attitude and Choice of Mathematics Related Courses among Female Students in Technical Training Institutes in Western Region of Kenya

Achuodho Hamphrey[1], Dr. Pamela Raburu[2], Dr. Benard Mwebi[3]

[1,2,3]School of Education Jaramogi Oginga Odinga University of Science and Technology, Kenya

Corresponding Author: Achuodho Hamphrey

ABSTRACT

Advancement in technology has influenced rapid development in developed countries across the globe (Kenya vision 2030, 2013). Developing countries are making efforts to emulate the developed countries and Kenya's vision 2030 is aimed at making Kenya an industrialized nation by 2030. Kenya has therefore embarked on training manpower at all levels of education, including post-secondary education. However, female students continue to lag behind male students in Science, Technology, Engineering and Mathematics (STEM) courses, with majority tending towards occupations such as nursing, secretarial jobs and social work. The purpose of this study was to investigate relationship between attitude and choice of mathematics related courses among female students in Technical Training Institutes. Parson's Trait Factor Theory of career development informed the study. The study employed concurrent triangulation research design within the mixed method research approach using a target population of 1440 female students and 15 deans of students from 15 Technical Training Institutes in Western Region of Kenya. The sample size comprised of 302 female students (Krejcie and Morgan, 1970), 4 female student representatives taking mathematics related courses (purposive sampling), 4 female student representatives not taking mathematics related courses (purposive sampling) and 4 deans of students of the sampled TTIs (purposive sampling). Questionnaires and interview schedules were used as the main data collection instruments for the study. Validation of the instruments was ensured with the assistance of expert lecturers from the Department of Psychology of Jaramogi Oginga Odinga University of Science and Technology (JOOUST) and reliability was ensured through Cronbach's alpha and a reliability coefficient 0.723 was reported. Quantitative data was analyzed using descriptive statistics and inferential statistics while qualitative data was analyzed using thematic analysis. The study found a strong positive relationship ($r = .622$) between attitude and choice of mathematics related courses which was statistically significant ($p < 0.05$). Mathematics teachers should teach students' study habits, raise student's confidence in their mathematical abilities and provide more hands on activities during mathematics class. The Ministry of education, teachers and parents should ensure that students obtain the right attitude towards mathematics as this will help in improving their performance in math related courses and dislodge the negative attitude that is characterized by failure in career.

Keywords: *Attitude, mathematics, female students, Technical Training Institutes*

1. INTRODUCTION

Students are constantly making decisions which affect their social as well as academic lives at the institution level and their decision making is greatly influenced by such affective factors as interest, attitude among others (Muhammed & Dino, 2013). For instance, in Pakistan students are discouraged from taking mathematics during their primary school years leading to a dislike for mathematics when enrolling in

higher levels of education (Farooq & Shah, 2008). Program for International student assessment (PISA) studies from across 60 countries also support the notion that students with high levels of self-concept in mathematics perform better than their counterparts with lower levels of mathematical self-concept (OECD, 2013; PISA, 2012; Thien & Ong, 2015). Studies by UNESCO carried out in Africa further support the argument that a positive attitude towards mathematics enhances scientific, technical and vocational education among girls (UNESCO, 2012).

Similarly according to the European commission (2010), in mathematics and science, the gender gap in mathematics observed in all European countries might be partly explained by the tendency of females to participate in higher-level school programs than their male counterparts. In addition European commission (2010) indicates that International assessments of student achievement in reading, mathematics and science report some consistent gender patterns. The most visible and clear gender difference is the advantage of girls in reading. This advantage is consistent across countries, different age groups, survey periods and study programs. In mathematics, boys' advantage emerges in the later school years and is especially noticeable among students in the same study programs/streams and year groups.

A Spanish report shows that in intermediate vocational training, there are some pathways that are exclusively feminine, such as the ones related to health, body image and the textile sector, with a feminine presence of more than 90 % (IFIIE & Instituto de la Mujer, 2009). On the contrary, other vocational pathways related to the automotive sector, electronics or computing reach a masculine presence of 80 % (IFIIE & Instituto de la Mujer, 2009). In Italy, girls outnumber boys in academic secondary schools, especially in pedagogy and social science courses (85 %) and in art schools (67 %), but boys predominate in technical schools (65.8 %) (ISTAT, 2009).

In Sub-Saharan African (SSA) countries like South Africa according to Masanja & Butare (2010), female continue to lag behind men in education in general and specifically in science, mathematics and technology (SMT) education, with women and girls tending to study programmes related to occupations such as nursing, secretarial jobs and social work. Programmes in engineering and pure sciences such as physics, chemistry and mathematics continue to be dominated by men and boys (Masanja & Butare, 2010). In Malawi, in spite of a number of gender equity policies and initiatives that encourage females to pursue careers within the fields of science, technology, engineering, and mathematics (STEM), females are under-represented in mathematics related fields (Mbano & Nolan, 2017).

In Nigeria, the general public has misunderstood the national policy of inclusiveness into commercial and technical colleges which they view as inferior to university education and discourage their children from attending such institutions in favour of academically inclined institutions (Amaka, Favour & Laju, 2013). However, technical and vocational education is an important stream of the educational system in many societies due to its impact on diversified human resources development but in Nigeria, little or no attention is being paid to this aspect as witnessed by the under enrolment in the over 167 technical colleges in Nigeria (Amaka, et al., 2013). In Tanzania higher (university) education continues to register the highest growth among completing their studies while technical education has low student turnovers (Tanzania Education Sector Analysis, 2011). Additionally, mathematical courses attract very few students and their share in higher education has continued to drop 34% in the academic year 2003/04 which might ultimately hamper Tanzania's ability to keep abreast with rapid technological development and impact negatively on her economy (Tanzania Education Sector Analysis, 2011). This

shows that low enrolment of female students in Technical Training Institutes (TTIs) is a problem the African countries.

In Kenya, according to Government of Kenya Education System (2015) mathematics is compulsory at both the KCPE and KCSE examination levels. Kochung and Migunde (2011) observes that the choice of career is influenced by parents, friends and counselors mainly due to the fact that form four students make their career choices before taking their KCSE examination at a time where parents and peers still have much influence on their children's careers. The result of KCSE examination determines who joins university or lower post-secondary training institutions since admissions into various careers are determined by grades at the Kenya Certificate of Secondary Examination. Performance in mathematics at KCSE level is generally poor (KNEC, 2016), and students have over the years developed a negative attitude toward mathematics, which has a bearing on the choices form four leavers make when they enter post-secondary training institutions. Consequently, few female students take up mathematics related courses to pursue their career. For instance in Bungoma County, only 204 female students were admitted in the three technical colleges in the county compared to 978 male students in 2011. This is despite Science, Engineering and Technology (SET) bursary for female students taking science, engineering and technology courses in technical institutions (Bungoma County Education office, 2012). Similar observations have been made regarding other technical training institutions throughout the country. Further, Wataka (2013) reported the under-enrolment of female students in mathematics related courses in the technical colleges in Bungoma County.

Similarly, in Gusii Institute of Technology, Kisii County, Kenya, there is under-enrolment of female students in mathematics related courses like Automotive Engineering, Electrical and Electronics Engineering and Building technology compared to the non-mathematics related courses like Social work and community development, Dietetic management, fashion and design, Food and Beverages, and Guidance and Counseling which have registered high numbers of female students (Directorate of Technical Education, 2017). Gusii Institute of Technology was chosen because it is well developed to offer mathematics related courses and it is one of the TTIs in Western Kenya region to give justification for the under-enrolment of female students in mathematics related courses. Table 1 shows the enrolment of the students admitted each year in mathematics related courses at Gusii Institute of Technology Kisii County, Kenya between 2014 and 2017.

Table 1: Gender distribution of students enrolled in mathematics related courses in Gusii Institute Technical between 2014 and 2017

		2014		2015		2016		2017	
S/NO	**COURSE**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
1	ELTD	76	12	125	16	178	15	342	33
2	ELTC	66	2	98	15	122	8	224	9
3	ART(ELT)	13	0	12	1	23	0	80	7
4	MMD	27	2	36	2	62	5	58	6
5	MMC	21	0	26	0	45	3	39	4
6	MVD	43	5	33	5	56	2	60	8
7	MVC	26	2	27	2	42	3	59	11
8	BTD	59	1	142	4	116	6	165	4
9	BTC	14	0	34	0	51	0	77	5
10	CED	70	12	176	36	127	16	213	51
11	AED	0	0	0	0	26	3	28	2
12	PBC	28	0	70	0	76	0	72	0
13	CJ	1	0	2	0	2	0	1	0
14	ART MASONRY	9	0	4	0	4	0	18	2
5	ART PLUMBING	9	1	11	0	12	0	34	5
16	ART CJ	0	0	0	0	0	1	0	0
	TOTAL	462	37	796	40	948	62	1518	163

Source: *Directorate of Technical Education,* 2017

Table 2: Enrolment data of students taking mathematics related courses in 2017 for three Technical Institutions

Institution	Male	Female
Gusii	1518	163
Keroka	417	116
Siala	54	3
Total	1989	282

Source: *Directorate of Technical Education*, 2017

An analysis of the enrolment of mathematics related courses in Table 2 between 2014 and 2017 at Gusii institute of Technology indicates under-enrolment of female students in mathematics related courses. Table 2 also shows that for the four years analyzed mathematics related courses had a grand total of male students ranging between 462, 796, 948 and 1518 while female students had a grand total ranging between 37, 40, 62 and 162. That difference seems very high and there is a great need to find a solution to this problem leading to under-enrolment of female students in mathematics related courses, which may derail the Kenya's sustainable development goal of achieving gender equality and empowering all women and girls in all sectors. Additionally, Table 1.3 shows that the total enrolment of students taking mathematics related courses for 3 TTIs is 1989 male and 282 female in the year 2017 which give a percentage of 14% for female and 86% male. This trend suggests that female participation in mathematics related professions are likely to be affected and this gender imbalance presents a missed opportunity which should be seriously looked into. For Kenya to realize development that will lead to the attainment of vision 2030, the study of science, mathematics and technology should be given adequate attention at different post-secondary training levels of the Kenya's education system

Objective

The objective of the study was to explore the relationship between attitude and selection of mathematics related courses among female students in Technical Training Institutes

2. LITERATURE REVIEW

In USA, Brandt (2015) in a survey of 181 female students persisting in Science, technology, engineering and mathematics (STEM) studies at two technological institutions undertaken to help explain why women persist in STEM studies. A cross-sectional online survey was administered to the sampled female students. More than 75% of the respondents are engineering majors. Two statistical methods for analysis were applied a descriptive analysis and Analysis of Variance (ANOVA) comparisons. The results confirmed the importance of a strong academic preparation, but also revealed a high level of self-confidence and right attitude among the female students in their abilities to pursue STEM studies. The results highlight the importance of creating a positive self-image, attitude and vision among the future female students interested in STEM. Similarly, Sellami, Rima, Haneen & Noof (2017) sought to explore the factors that help predict students' interest in Science, Technology, Engineering and Mathematics (STEM) in Qatar. The study involved a nation-wide survey of preparatory and secondary levels of education and data from a randomly stratified sample of 660 preparatory (middle) and secondary (high) school students using survey questionnaires. Factor analysis extracted five valid dimensions and a path analytic model suggested that student interest in STEM is influenced by teachers, perceptions of homework assignments, self-confidence and intention to pursue further study.

Another study done in Korea, Han (2017) employed a survey instrument investigating students' attitudes toward STEM problem-based learning (PBL) and examined the relationships between these attitudes and intent to pursue a STEM major. The gender difference on the paths of the structural model was analyzed using multiple-group analysis. The results indicated that students who were positive toward PBL components except

collaborative learning were more likely to have the intent to pursue a STEM PBL. In addition, belief in STEM majors' benefit played a role as a mediator.

Reis, Patrocínio & Lourtie (2012) also did a study in Greece that highlights gender differences of the perceptions of science, technology and engineering areas of both secondary students and IST freshman students. The study used questionnaires directed to secondary students and IST freshman students in order to analyse the engineering perceptions. The result showed that male and female perceptions concerning the course choice are similar among secondary students but they differ among freshman students. Female engineering students tend to attribute more importance to the information released by the ministry of education, to advice and to the course handbook. The reviewed study employed only quantitative approach which lacked in depth findings. Therefore, the present study saw the need to include the qualitative approach forming a mixed method approach obtaining a corroborated and more reliable finding.

Cerinsek, Hribar, Glodez, & Dolinsek (2013) also did a study addressing the problem of under-representation of young people in general and females in particular in the fields of STEM in Slovenia. The main data collection method was a questionnaire developed within the interest and recruitment in science project group having a Sample of 861 males and 420 female undergraduate STEM students. The data was analyzed using descriptive statistics with one-way analysis of variance. The study demonstrated that all students want to do something interesting and fulfilling using their talents and abilities. Interest in STEM subjects was found as an important factor influencing the choice of studying STEM especially for female students.

In Zimbabwe, a related study by Matope & Makotse (2007) to identify the factors influencing the female engineering Students' career choice in the beginning of the twenty-first Century. The study used a case study targeting students of Mutare polytechnic. Descriptive survey method was used to gather data and analyze the information. 28 questionnaires with responses from the intended sample were received. The results were displayed on pie-charts. From the results it was evident that female engineering students had genuine interest in engineering as indicated by the 98% approval from the students. Therefore, it appeared that shear interest in the engineering field made female engineering students to choose this profession.

In another study done in Ethiopia, Semela (2010) investigated enrolment trends and factors influencing the choice of physics among Ethiopian students. The descriptive study targeted university students. The sample size comprised of 14 first year, 11 second year students and 5 instructors of Hawassa University. The study utilized primary as well as secondary sources. A semi-structured interview schedule was used as the instrument for primary data collection. Secondary data on enrolment and quantitative data on achievement was obtained from the registrar's office. Data were analyzed with the assistance of one-way ANOVA. The study findings indicated the lowest rate of enrolment was in physics and those who were assigned to the physics undergraduate programme had the lowest mean score compared to other groups. Further, the study results indicated a gender gap in enrolment with fewer females enrolling for physics than male students.

In a related study done in Kenya, Wandiri (2009) sought to investigate factors influencing women's access to and participation in science oriented Vocational Education and Training (VET) programmes in selected Technical Institutes in Nairobi. The study employed descriptive survey design using questionnaire and interview schedule to collect data. A sample size of 212 female students was selected through simple random sampling methods. The questionnaire contained both open ended

and structured questions. The study revealed that the main factors that contribute to low female enrolment in science oriented courses are the negative attitude females have towards sciences, the belief that science is a man's world, females find sciences to be difficult, peer influence, poor performance by girls in the foundation subjects, gender stereo-type by the society and prospective employers, lack of female role models, lack of proper information on science oriented careers, and high school dropout rate due to early pregnancy.

RESEARCH METHODOLOGY

In order to achieve the study objective, the study employed concurrent triangulation research design within the mixed method research approach using a target population of 1440 female students and 15 deans of students from 15 Technical Training Institutes in Western Region of Kenya. The sample size comprised of 302 female students (Krejcie and Morgan, 1970), 4 female student representatives taking mathematics related courses (purposive sampling), 4 female student representatives not taking mathematics related courses (purposive sampling) and 4 deans of students of the sampled TTIs (purposive sampling). Questionnaires and interview schedules were used as the main data collection instruments for the study. Validation of the instruments was ensured with the assistance of expert lecturers from the Department of Psychology of Jaramogi Oginga Odinga University of Science and Technology (JOOUST) and reliability was ensured through Cronbach alpha and a reliability coefficient 0.723 was reported. Quantitative data was analyzed using descriptive statistics and inferential statistics while qualitative data was analyzed using thematic analysis.

4. RESULTS AND DISCUSSION

Out of the 302 respondents that took part in the study, 277 representing 91.7% response return rate participated in the study. In establishing the relationship between attitude and the choice of mathematics related courses among female students, attitudinal factors influencing the choice of mathematics related courses among female students was measured using a 5- item 5-point Likert scale as on scale of 1 to 5 where 1 = strongly disagree (SD), 2 = disagree (D), 3 = neutral (N), 4 = agree (A) and 5 = strongly agree (SA). The data obtained was analyzed to show frequency of each response as well as percentage per item. The results were as shown in Table 3

Table 3. Frequencies and percentages for attitude and choice of mathematics related courses among female students

STATEMENT	SA	A	N	D	SD
I chose my mathematics related course because mathematics was interesting in secondary	92(33.2%)	86(31.0%)	54(19.5%)	33(11.9%)	12(4.3%)
I chose my mathematics related course because I liked mathematics	79(28.5%)	65(23.5%)	63(22.7%)	49(17.7%)	21(7.6%)
I chose my mathematics related course because I am good at mathematics	88(31.8%)	53(19.1%)	61(22.0%)	52(18.8%)	23(8.3%)
I chose my mathematics related course because the one I wanted to do clashed with other courses on the timetable	67(24.2%)	34(12.3%)	58(20.9%)	94(33.9%)	24(8.7%)
I chose my mathematics related course because I think I will get good grades	86(31.0%)	43(15.5%)	65(23.5%)	62(22.4%)	21(7.6%)
I chose my mathematics related course because I need it for a job I want to do	55(19.9%)	81(29.2%)	64(23.1%)	38(13.7%)	39(14.1%)
I believe I can understand the content in a mathematics course	44(15.9%)	42(15.2%)	52(18.8%)	89(32.1%)	50(18.1%)
I believe I can learn well in a mathematics course	31(11.2%)	43(15.5%)	59(21.3%)	93(33.6%)	51(18.4%)
I believe I can complete all assignments in a mathematics course if I do it now	59(21.3%)	29(10.5%)	32(11.6%)	81(29.2%)	76(27.4%)
I believe am the kind of person who is good in maths	31(11.2%)	36(13.0%)	69(24.9%)	96(34.7%)	45(16.2%)
I believe I will be able to use mathematics in my career when needed	33(11.9%)	42(15.2%)	51(18.4%)	84(30.3%)	67(24.2%)

Findings in Table 3 show that over two thirds of the respondents at 64.2% agreed with the statement that they chose their mathematics related courses because mathematics was interesting in secondary. However, significant number of the respondent at 16.2% disagreed with the statement, while 19.5% remained neutral.

This result revealed that students positively perceived the content to be learnt as interesting, fun, meaningful and relevant they got motivated to learn, were stimulated and their interest was aroused in readiness to understand the content being presented to them in a mathematics related course of their choice.

Likewise, during the interview sessions with the deans of students, one of the deans of students asserted that positive attitude towards a subject was related positively to being successful in a mathematics related course. He said;

Students feeling confident in doing mathematics are linked with being successful in mathematics related courses, which is regarded as a positive attitude towards the mathematics courses. However, if students are not confident in doing mathematics, they may not experience success in mathematics related courses, this may be regarded as negative attitude (DS, 4)

It was noted that students' attitudes play a crucial role in learning and achievement in mathematics related courses hence determines the student's success in these courses subject. This was similar to a study with secondary school students by Mato and De La Torre (2010) that those with better academic performance exhibited more positive attitudes towards mathematics than those with low performance. Likewise, Ndalichako & Komba (2014) found that the choice of subject is related to the attitude of student their ability and overall performance in the school. However, these findings are in contrary to the research findings by (Georgiou, Stavrinides & Kalavana, 2007; Mata, Monteiro and Peixoto, 2012) which showed that high achievement in mathematics related courses could serve to predict a positive attitude, but such a positive attitude alone could not predict stronger achievement in mathematics related courses. In addition, the findings are also parallel to Awan, Sarwar, Mehd, Noureen & Anwar (2017) that usage of mathematics was not very much important for the choice of mathematics related courses in the higher education. Awan *et al.,* (2017) found that a very high majority were concerned with the interest of course to opt for the mathematics related courses in the higher education. The results also indicated that previous attainments were not so important element to take that very course in the higher education (Awan *et al.,* 2017). The study also found that over half of the respondents at 52.0% supported the statement that they chose their mathematics related course because they liked mathematics while they were in secondary schools. Similarly, during the interview session with dean of students, it was found that positive attitude influence learning and performance in mathematics. The dean said;

The positive attitude towards mathematics is to develop curiosity and interest in investigating and solving problems, creativity to formulate conjectures, flexibility to modify their own point of view, and intellectual autonomy to deal with unknown situations by students. Assuming a confidence position in the ability to learn (DS 2)

This finding shows that positive attitude leads to high confidence level and is an indication of achievement in mathematics. The students feel they are capable of overcoming most of the difficulties experienced in the subject hence would perform better. This is in line with (Flores, 2007; Morony, Kleitman, Lee & Stankov, 2013) which points to the fact that confidence results from mathematical ability (self- efficacy) which is a predictor for achievement in mathematics related courses. Similarly, (Badri, Alnuaimi, Mohaidat, Rashedi, Yang & Mazroui, 2016; Rice, Guadagno, Smith & McCallum, 2013; Valenti, Masnick, Cox & Osman, 2016) also found that students' positive attitude towards STEM is a vital element that is required among students to fulfill the need to achieve students' STEM career aspiration. In contrast, Leung (2002) found that positive attitudes are not always connected with high achievement in STEM

courses. In addition, Skilling, Bobis & Martin (2015) also found the opposite case that not all students who are highly engaged experience high achievement and high levels of students' achievements are not necessarily indicative of high level of engagement in mathematics related courses.

It was also found that 50.9% of the respondents agreed with the statement that they chose their mathematics related course because they were good at mathematics, while significantly, 27.1% disagreed with the statement. Another 22.0% remained neutral. Another 46.5% revealed that they chose mathematics related course because they thought they would get good grade, while only 30.0% disagreed with statement. Only 23.5% remained neutral. This showed that students' attitudes affected achievement levels, whereby an increase in positive attitudes towards mathematics might increase students' achievement levels and students' enrolment in mathematics courses. It was also noted that students' attitudes came about after ability in forecasting students' mathematics achievement. This was in line with Brandt (2015) whose results confirmed the importance of a strong academic preparation, but also revealed a high level of self confidence among the female students in their abilities. In addition, during the interview with the female student representatives, it was found that female students who took mathematics related courses had their attitude influenced by their ability to learn the mathematic units. In fact, one of them said;

Attitude on mathematics determines our ability and willingness to learn the subject, work on a variety of assigned tasks and our persistence in the tasks available. In general, the conceptions we hold about Mathematics determines how we approach mathematics tasks leading us into either productive or nonproductive orientations (FSR, 3)

This shows that majority of the students were confident that they could tackle mathematics problems and almost half of them will go for mathematics related courses. Nicolaidou & Philippou (2013) also asserts that when students have positive attitudes towards mathematics they would achieve better which reflect a significant relationship between attitudes and performance. The finding is also supported by Yerdelen, Kahraman & Tas (2016) which found a positive relationship between mathematics attitudes and Core STEM career areas among students. The outcome of the research is also supported by (Ndalichako & Komba, 2014; Suprapto, 2016) which found that the attitude towards STEM has a direct influence and it is the basic key for students to explore mathematics related career. However, this contrasts with Wiebe, Alana & Malinda (2018) which found that the relationship of mathematics attitudes to career interest varied by mathematics related career cluster and that students' attitudes towards mathematics related careers are not static over their primary and secondary grades, stabilizing and leveling during their secondary years.

Another 49.1% agreed with the statement that they chose mathematics related course because they needed it for a job they wanted to do. While 31.1% strongly indicated that they believed they could understand the content in a mathematics course, majority at 50.2% disagreed that they understood content in a mathematics course. Only 18.8% remained neutral in this statement. This shows that students who believe mathematics would be useful for their future and who were interested in a mathematics related career are more likely to earn degrees in STEM. In an interview session with one of the deans of students, it was noted that students attitude towards mathematics related course affects their choice of the course and that a negative attitude towards a course leads to lack of interest, he said:

Students' attitudes towards mathematics related course affect their choice of the course. Generally, a negative attitude towards a given course leads to lack of interest and when courses are to be

selected, as in senior secondary schools, it leads to avoiding the subject or course. Furthermore, a positive attitude towards mathematics leads to its greater performance (DS 4).

This shows that the ability to grasp mathematical concepts lies on attitudes and perception about the course. This finding revealed that attitudes played a critical role in students' performance. Students with positive attitude tended to perform well in an examination which was an indicator that it was a very essential element in the Mathematics curriculum. In the light of these results, it can be suggested that students with high mathematics achievement develop positive attitudes towards mathematics related course as well. According to Simpson (2016) positive attitude and perception leads to a positive commitment to mathematics subject that influences lifelong interest and choice of mathematics related courses. This is the reason why major science education reform efforts in Africa have emphasized the improvement of students' attitudes towards science and mathematics subjects. Similarly, (Lent, Sheu, Gloster & Wilkings, 2010; Maltese & Tai, 2011) also found that students are influenced in their intent to pursue mathematics related courses by outcome expectations and perception pertaining to STEM. Students who believed STEM would be useful in the future have been found to be more likely to complete and earn STEM degrees. In addition, these studies (Byars-Winston, Estrada, Howard, Davis & Zalapa, 2010; Maltese and Tai, 2011; Wang, 2013) have also indicated in common that students' interest and positive attitude towards STEM fields are the critical factor in whether they major in STEM disciplines at the college level. However, this finding contradicts (Halpern, Benbow, Geary, Gur, Hyde & Gernsbacher, 2007; Marsh, Trautwein, Lüdtke, Köller & Baumert, 2005; Seymour and Hewitt, 1997) which found that the choice to pursue STEM fields is not affected by mathematics and science related interest and self-assessment. Renninger & Hidi (2011) also found that agreement on theoretical orientation towards the concept of interest does not exist.

Majority of the respondents at 52.0%, 56.6%, 50.9% and 54.5% did not support the statement that they believed they could learn well in a mathematics course, complete all assignments in a mathematics course, were good in mathematics and were able to use mathematics in their career when needed respectively. These statements were also corroborated with that of one of the female student representatives, who were not taking mathematics related courses during the interview, she said;

Majority of us avoided careers related to mathematics even though we knew we could do well in the subject if we make a personal effort to improve. Personally, I understand that performance is not about talents or innate abilities but that everyone has the capacity to tackle mathematics depending on the level of commitment to improve and interest in the subject (FS 1)

These sentiments show that students' success in mathematics related courses depends upon the learners' attitude towards the subject as this determines their ability, willingness to learn, choice of action and response to challenges. It determines the level of engagement, interest, personal effort without which one can hardly perform. Favorable attitude should be created and fostered due to the fact that; there is a common belief that positive attitudes, the liking for, interest in the subject can lead to greater effort and to higher achievement in mathematics related courses. In the same breadth, Lipnevich, MacCann, Krumm, Burrus & Roberts (2011) posited that positive attitudes in the subject are regarded as a valid objective of mathematics education in its own right that should be nurtured regardless of the learners' achievement level given that the affective domain interacts and influences the cognitive domain thereby affecting learning and achievement in the subject.

Students attitudes towards mathematics are connected with their achievement (Lipnevich *et al.*, 2011) and they influence future career choices (Riegle – Crumb, Moore and Ramos – Wada, 2010; Sonnet, Sadler & Bressoud, 2014). However, this finding again contradicts, (Awan *et al.*, 2017; Skilling, Bobis & Martin, 2015) which found the opposite case that not all students who are highly engaged experience high achievement and high levels of students' achievements are not necessarily indicative of high level of engagement in mathematics related courses. In addition, the finding is also opposed to Leung (2002) which found a negative connection between positive attitudes and high achievement in STEM courses.

4.1 Correlation output for Attitude and Choice of Mathematics Related Courses

To establish whether there was any significant relationship between attitude and the choice of mathematics related courses among female students, a Pearson Correlation analysis was conducted between the two variables. Since data for positive attitude and the choice of mathematics related courses among female students were measured on ordinal Likert level for each item, it was important to obtain continuous data to facilitate performance of correlation analysis. Thus, summated scores for each respondent were obtained for each of the two scales. The corresponding scores for each respondent were used as data points for the 277 participants (female students). The correlation output is presented in Table 5.

Table 4. Correlation output for attitude and choice of mathematics related courses

		Positive attitude	Selection of mathematics related courses
Positive attitude	Pearson Correlation	1	.622**
	Sig. (2-tailed)		.000
	N	277	277
Selection of mathematics related courses	Pearson Correlation	.622**	1
	Sig. (2-tailed)	.000	
	N	277	277

***. Correlation is significant at the 0.05 level (2-tailed).*

The findings in Table 4 show that there is a strong positive relationship (r = .622) between Positive attitude and selection of mathematics related courses which was statistically significant ($p < 0.05$). The findings show that *p*- value is less than the significance level (0.05) (P=0.00; < 0.05). This implies that more positive attitude on mathematics the female students have, the more likely they would select mathematics related courses. This result is also supported by Burstein (2012) who reiterated that student attitude towards mathematics and their performance and achievements are directly related with each other. Therefore, those students who are having positive attitude perform better than bearing negative attitude regarding mathematics related courses (Gibbons, Kimmel & O"Shea, 2017). However, these results are in contrary to the research findings by (Awan *et al.*, 2017; Georgiou *et al.*, 2007; Mata, Monteiro & Peixoto, 2012) which showed that high achievement in mathematics related courses could serve to predict a positive attitude, but positive attitude alone could not predict stronger achievement in mathematics related courses. The results are also contradicting (Halpern *et al.*, 2007; Leung, 2002; Seymour & Hewitt, 1997; Skilling, Bobis & Martin, 2015) which found a negative connection between positive attitudes and high achievement in STEM courses.

4.2 Regression Output for Attitude and choice of mathematics related courses

To determine the relationship between attitude among female students and choice of mathematics related courses, regression analysis was also conducted between the variables. Data collected was converted to continuous data by summating the individual item scores in the scale for

each respondent. Data obtained from the 277 respondents effectively provided 277 data points. The regression output is presented in Table 5.

Table 5 Regression output for Attitude and choice of mathematics related courses

Model Summary						
Model	**R**	**R Square**	**Adjusted R Square**			**Std. Error of the Estimate**
1	.729[a]	.519	.532			1.730
ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	125.6	1	125.6	141.990	.000[b]
	Residual	110.7	276	2.992		
	Total	236.3	277			
Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	33.93	2.454		13.82	.000
	Positive attitude	.598	.092	.729	6.480	.000
a. Dependent Variable: Positive attitude among female students						
b. Predictors: (Constant), choice of mathematics related courses						

The study found that positive attitude among female students explain up to 53.2% (Adjusted R square = .532) of variance in the choice of mathematics related courses. The model was found to be statistically significant as F (1, 276) = 141.99 [p < .05]. Thus, positive attitude among female students account for 53.2% of variance in the choice of mathematics related courses. The variables were modeled to be connected by the linear regression equation in the form:

$$Y = B_0 + B_2X_2 + \varepsilon$$

Where Y is choice of mathematics related courses, B_0 is Coefficient of constant term, B_2 is coefficient of positive attitude among female students, X_2 is positive attitude among female students and ε is error term. Thus, replacing the coefficients of regression the equation becomes;

$$Y = 33.9 + 0.598X_3$$

This shows that, when positive attitude among female students increase by one positive unit, choice of mathematics related courses increases by 0.598. Thus, positive attitude among female students positively affects choice of mathematics related courses to a magnitude of 0.598 as indicated by the main effects.

5. CONCLUSIONS AND RECOMMENDATIONS

The study concluded that right attitude, that is good perception and feeling about mathematics and choice of mathematics related courses are positively and significantly correlated. This implies that more positive attitude on mathematics the female students have, the more likely they would choose mathematics related courses. The study therefore recommends that mathematics teachers should teach students' study habits, raise student's confidence in their mathematical abilities and provide more practical tasks during mathematics class to boost their feeling and attitude towards the subject and its related courses. The Ministry of education, teachers and parents should ensure that students obtain the right attitude towards mathematics as this will help in improving their performance in mathematics related courses and dislodge the negative attitude that is characterized by failure in career. The learners should also be able to understand the need for a commitment to be fully engaged and to be willing to embrace logic behind every success in mathematics related courses so as to acquire the necessary knowledge and skills for their future careers.

REFERENCES

1. Amaka, A., Favour, N., & Laju, A. (2013). Low enrolment in technical schools: the crack in the 6-3-3-4 system. Retrieved from www.vangardgr.com
2. Awan,R.N., Sarwar, M., Mehdi, M., Ghazala, N., & Anwar, N. (2017). Interests and Recruitment in Science: Factors

Influencing Recruitment and Retention in STEM Education at University Level in Pakistan. Bulletin of Education and Research, 39(3): 19-43

3. Byars-Winston, T., Estrada. M, Howard. P, Davis., S & Zalapa, K., (2010); Exploratory Study of MOOC learners' demographics and motivation: The case of students involved in groups. Open Praxis, 8(3): 223-233.
4. Cerinsek, G., Hribar, T., Glodez, N., & Dolinsek, S. (2013). Which are my Future Career Priorities and What Influenced my Choice of Studying Science, Technology, Engineering or Mathematics? Some Insights on Educational Choice - Case of Slovenia. International journal of science education, 35(17), 2999-3025. doi: 10.1080/09500693.2012.681813
5. European Commission (2010). Gender Differences in Educational Outcomes: Study on the Measures Taken and the Current Situation in Europe. Available on the Internet (http://www.eurydice.org).
6. Farooq, M.S., & Shah, S.Z.U. (2008). Students attitude towards mathematics. Parkistan Economic and social Review. 46 (1): 75 – 83
7. Flores, A. (2007). Examining disparities in mathematics education. Achievement gap or education gap. High school Journal. 91(1) 24-42.
8. Georgiou, S. Stavrinides, P., & Kalavana, T. (2007). Is Victor better than Victoria at maths? Educational Psychology in Practice. 23(4) 329–342
9. Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. Psychological Science in Public Interest, 8, 1–51.
10. Han, S. (2017). Korean Students' Attitudes toward STEM Project-Based Learning and Major Selection. Research Article, 17(2): 529–548.www.estp.com.tr
11. IFIIE & Instituto de La Mujer, (2009). Institute for teacher Training and Educational Research and Innovation & Institute for Women CES. Madrid.
12. ISTAT (2009). National institute of statistics. (Online). Available at http://www.istat.it
13. Kochung, E., & Migunde, Q. (2011). Factors influencing students career choices among secondary school students in Kisumu Municipality, Kenya. Journal of emerging Trends in Educational Research and policy studies, 2(2):81 - 87
14. Lent, R. W., Sheu, H., Gloster, C. S., & Wilkings, G. (2010). Longitudinal test of the social cognitive model of choice in engineering students at historically Black universities. Journal of Vocational Behavior, 76(3): 387–394.
15. Leung, F.K. (2002). Behind the high achievement of East Asian Students. Educational Research and evaluation, 8(1): 87-108
16. Lipnevich, A.A., Roberts, D. R., & Preckel, F. (2011). Chronotype, cognitive abilities, and academic achievement: A meta-analytic investigation. Learning and Individual Differences. 21 483–492
17. Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. Science Education, 95(5), 877-907. https://doi.org/10.1002/sce.20441
18. Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. Child Development, 76(2), 397-416.
19. Masanja,V., & Butare ,H. (2010). Increasing Women's Participation in Science, Mathematics and Technology Education and Employment in Africa, Expert group meeting in Gender, science and technology. Paris
20. Mata, M. L., Monteiro, V., & Peixoto, F. (2012). Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors. Child Development Research Article. doi:10.1155/2012/876028
21. Matope, S., & Makotse, A.B. (2007). A study into the factors that influence female Engineering students' career choice: a case study of Mutare Polytechnic, Zimbabwe. Academic Journals, 1992-2248. Available online at http://www.academicjournals.org/SRE
22. Mbano, N., & Nolan, K. (2017). Increasing Access of Female Students in Science
23. Technology, Engineering and Mathematics (STEM), in the University of Malawi (UNIMA). Science Education International. 28(1): 53-77

24. Mohamed, L., & Waheed, H. (2011). Secondary students' attitude towards mathematics in a selected school of Maldives. International Journal of Humanities and Social Science
25. Ndalichako, J. L., & Komba, A. A. (2014). Students' Subject Choice in Secondary Schools in Tanzania: A Matter of Students' Ability and Interests or Forced Circumstances? Open Journal of Social Sciences, 2(08), 49-56.
26. Nicolaidou, M., & Philippou, G. (2003). Attitudes towards mathematics, self-efficacy and machievement in problem solving. European Research in Mathematics Education III, M. A. Mariotti, Ed., pp. 1–11, University of Pisa, Italy
27. OECD, (2013). PISA 2012 results: What students know and can do-student performance in Mathematics, Reading and Science (volume 1), PISA, OECD Publishing
28. Reis, A., Patrocínio, C., & Lourtie, P. (2012). Gender issues in attracting students to science, technology and engineering higher education. Paper presented at the Proceedings of the SEFI 40th annual conference, Thessaloniki, Greece.
29. Renninger, K. A., & Hidi, S. (2011). Revisiting the conceptualization, measurement, and generation of interest. Educational Psychologist, 46(3), 168-184, doi:10.1080/00461520.2011.587723
30. Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P. A., & McCallum, D. M. (2013). The Role of Social Support in Students' Perceived Abilities and Attitudes Toward Math and Science. Journal of Youth and Adolescence, 42(7), 1028–1040. http://doi.org/10.1007/s10964-012-9801-8
31. Riegle-Crumb, C., Farkas, G., & Muller, C. (2006). The role of gender and friendship in advanced course taking. Sociology of Education, 79, 1017-1045.
32. Sellami, A., Rima, C. E., Haneen, B.A., & Noof, A. A. (2017). A Path Analysis of Student Interest in STEM, with Specific Reference to Qatari Students. Social and Economic Survey Research Institute (SESRI), Qatar University, Doha, Qatar
33. Semela, T. (2010). Who is Joining Physics and Why? Factors Influencing the Choice of Physics among Ethiopian University Students. International Journal of Environmental and Science Education, 5(3): 319-340
34. Seymour, E., & Hewitt, N. (1997). Talking about leaving: Why undergraduates leave the sciences. Boulder, CO: Westview Press
35. Simpson, A. (2016). Are adolescents' views of mathematics changing due to enrolment in single – sex mathematics classroom? NCTM Research Conference, San Francisco, USA
36. Skilling, K., Bobis, J., & Martin, A. (2015). The engagement of students with high and low achievement levels in mathematics. Psychology of Mathematics Education (PME), Hobart, Australia.
37. Sonnet, G., Sadler, P. M., & Bressoud, D.M. (2014). The impact of instructor pedagogy on college calculus students' attitude toward mathematics. International journal of Mathematics Education in Science and Technology, 46(3), 370- 387.
38. Suprapto, N. (2016). Students` Attitudes towards STEM Education: Voices from Indonesian Junior High Schools Students' Attitudes towards STEM Education: voices from Indonesian Junior High Schools. Journal of Turkish Science Education, (13) 75–87. http://doi.org/10.12973/tused.10172a
39. Thien, L.M., & Ong, M. Y. (2015). Malaysian and Singaporean students' affective characteristics and mathematics performance: evidence from PISA 2012. Springer plus, 4(2015): 563 – 577.
40. UNESCO, (2012). Special project on scientific, technical and vocational education of girls in Africa from www.UNESCO.org/education/educproject/ste/projects/girls%20africa/women.html
41. Valenti, S. S., Masnick, A. M., Cox, B. D., & Osman, C. J. (2016). Adolescents and Emerging Adults Implicit Attitudes about STEM Careers: "Science is Not Creative." Science Education International, 27(1), 40–58.
42. Wandiri, L.M. (2009). Access to and participation of women in science-oriented vocation education and training programmes in Kenya (Published Master's Thesis): Kenyatta University.
43. Wang, X. (2013). Why students choose STEM majors motivation, high school learning, and postsecondary context of support. American Educational Research Journal, 0002831213488622.

44. Wiebe, E., Alana, U., & Malinda, F. (2018). The Relationship of STEM Attitudes and Career Interest EURASIA Journal of Mathematics, Science and Technology Education, 14(10) 1305-8223 (online) OPEN ACCESS Research Paper https://doi.org/10.29333/ejmste/92286
45. Yerdelen, S., Kahraman, N., & Tas, Y. (2016). Low Socioeconomic Status Students' STEM Career Interest in Relation to Gender, Grade Level, and STEM Attitude. Journal of Turkish Science Education, 13, 59-74.

How to cite this article: Achuodho Hamphrey, Pamela Raburu, Benard Mwebi. Relationship between attitude and choice of mathematics related courses among female students in technical training institutes in Western Region of Kenya. International Journal of Research and Review. 2020; 7(11): 559-572.

******