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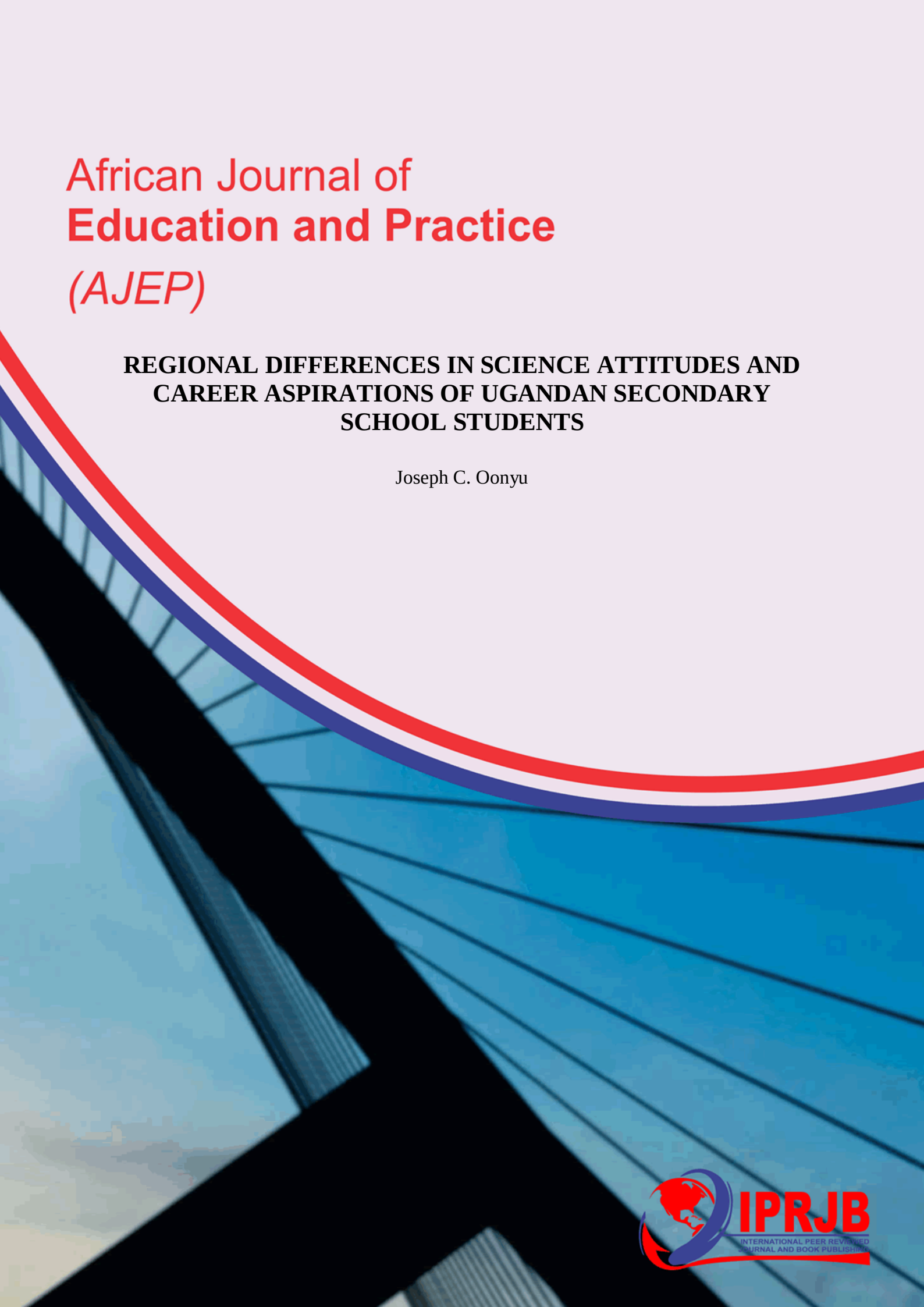

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REGIONAL DIFFERENCES IN SCIENCE ATTITUDES AND CAREER ASPIRATIONS OF UGANDAN SECONDARY SCHOOL STUDENTS

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Abstract

Purpose: The study sought to establish the Regional Differences in Science Attitudes and Career Aspirations of Ugandan Secondary School Students

Methodology: The study adopted a cross sectional survey design to determine the influence of geographical region on the attitudes of secondary school students towards sciences. Most of the data collected was quantitative although an interview was carried out on teachers to triangulate information from the students. The 30 senior secondary schools that were sampled were those schools that the National Council for Science and Technology had identified the previous year for remedial assistance in terms of provision of science kits and other forms of assistance. Data was collected during the months of October – December 2016. Data was analyzed using the Statistical Package for Social Sciences (SPSS) computer programme. Hypotheses one, two and three were tested with the Chi-square test (χ^2) and Analysis of Variance (ANOVA). Pearson Product Moment Correlation Coefficient (r) was computed to establish the relationship between attitudes towards the sciences and perceived performance in the four basic science subjects i.e. Biology, Chemistry, Mathematics and Physics.

Findings: The results show that there were significant differences in students' attitudes and career aspirations in the different regions of Uganda. The Posthoc test revealed that students from eastern region had significantly more positive attitudes towards science followed by western region. Students from northern and central regions had more negative attitudes towards science. There is a positive correlation between students' career aspirations and the careers of their role models. The most popular career choices were medicine, engineering, accountancy and being a lawyer. The region was a strong predictor of science attitudes and career choices of students. The probability of choosing a career in science and technology significantly ($0.000<0.01$) reduces by 0.67 times for students in the central region. Students in eastern region were on average 0.06 times more likely to have a positive attitude to science relative to their colleagues from other regions although the differences were not significant ($p>0.05$).

Unique Contribution to Theory, Practice and Policy: The study recommended that investigations are required to establish students' attitudes towards school science, and how interest, self-efficacy, beliefs and other attributes influence attitudes and career aspirations.

Key words: *School location, Science Attitudes, Career Aspirations, Ugandan Secondary School Students*

1.0 INTRODUCTION

Extensive research into students' attitudes towards science has been conducted worldwide, particularly focusing on general attitudes and the influence of gender (Kahle, 2004; Baram-Tsabari & Yarden, 2011; Hyde & Lynn, 2006; Eccles, 2007). Conflicting findings on students' attitude toward S&T have been reported, with some studies indicating positive attitudes (Awan, Sarwar, Naz, & Noreen, 2011; von Roten, 2004), and others reporting negative findings (Osborne, Simon, & Collins, 2003; Mishra, 2013). Overall, there are considerable differences that relate to gender (Baram-Tsabari & Yarden, 2011), age (Barmby, Kind & Jones, 2008), subjects (Schreiner & Sjoberg, 2004), and socio-economic factors (Archer. & Francis, 2006). Despite differences in attitudes, the overall findings indicate that students' attitudes toward science become more negative with age (e.g. Osborne, Simon, & Collins, 2003; George, 2006). In addition, boys show more positive attitudes toward science than girls (Kahle, 2004) and more negative attitudes are associated with the physical sciences rather than biological sciences (e.g. Spall, Barrett, Stanisstreet, Dickson & Boyes, 2003; Spall, Stanisstreet, Dickson & Boyes 2004). Christidou (2011, p. 144), established that 'as students advance from primary to secondary education, they rapidly lose their interest in science and cease seeing it as a viable option for their future careers, or associating it with their success aspirations'. Krapp and Prenzel (2011, p. 42) also suggest that 'students with a high cognitive potential for science do not pursue careers because they lose their original positive attitudes during school. Worldwide assessment studies also indicate that attitudes towards S&T are declining in many countries (Organisation for Economic Co-operation and Development, OECD, 2008). Their findings indicate that S&T professions are becoming less attractive and the share of S&T students in higher education has been decreasing considerably.

Few studies have been conducted to assess how regional location of the school influences attitudes and career aspirations of students (e.g. Anwar & Bhutta, 2014). Although it has been known for long that there are disparities in human and physical resources among schools, and in students' access, dropout rates and performance in schools located in different regions within Uganda (ESSR, 2016), how these influence attitudes and career aspirations of school children has not been extensively investigated in many countries, particularly in Africa. Attitude can be defined as feelings towards an object or an evaluative judgement formed by a person (Ajzen, 2001; Crano & Prislin, 2006; Kind, Jones, & Barmby, 2007), and is seen as a construct which precedes behaviour and guides our decisions and choice, even though it is not directly observable. Science attitude was determined using a summation of five constructs: interest, perceived performance, feelings, appreciation of science and science practices.

The Study Context

In many of the developing countries, the colonial governments either encouraged regional differences in education provision or paid no attention to them (Ssekamwa, 2000). In Uganda the British encouraged better schools in the south of the country from where they expected to recruit staff for the civil service sector (Ssekamwa, 2000). The northern region of the country was to supply the colonialists with soldiers. As a consequence, better schools were built in the south of the country where the capital city was located. Although the post-colonial governments have tried to redress the inequalities, it is still evident that they continue to exist. For example, of secondary school students' performance in the sciences in national

examinations in Uganda (UNEB, 2016; 2017) reveals regional disparities. To make the situation worse, some regions of the country were severely been affected by political instability in the last 30 years, more than others, which have adversely affected many aspects of education provision.

The government of Uganda has promised its citizens, a science and technology-led industrial growth and development. In 2005 a science policy was put in place which made biology, chemistry and physics subjects compulsory for 'O' level secondary school students. The policy also stipulates preferential funding of university students taking science courses. Science students receive the majority (nearly 75%) of government scholarships in universities and other tertiary institutions. Other measures that are in place include the construction of laboratories and science rooms, popularization of science, and re-tooling of teachers. Nevertheless, the numbers of students taking science and technology courses in Uganda's universities and colleges continue to be few, representing only 22% (National Council for Higher Education, NCHE, 2005). If this general trend is not changed, Uganda may not attain its development targets for it will lack the critical mass of people needed for social and economic transformation. Some of the reasons for the low enrolment in the sciences lie in the attitudes of students.

This study differs from the other researches on students' attitudes in that it examines the influence of regional location on students' attitudes toward science. Few studies have examined regional differences in students' attitudes towards science since this is considered generally politically incorrect and because in most developed countries, these differences are not so pronounced due to improved access to all parts of the country. When such an important factor as region is not considered, it could camouflage its influence on attitude and career aspirations, and this may lead to generalized interventions. In the present study, secondary school students' attitudes toward science and career aspirations in Uganda by region are examined.

Theoretical review

Relevant theories to this study include: Eccles et al.'s expectancy-value theory which describes how young people base their educational choices on their expectation of success, interest and enjoyment, attainment value, utility value and the cost they ascribe to various options. The other is the Theory of Planned Behaviour, which is an extension of Fishbein and Ajzen's 1980 Theory of Reasoned Action. It argues that attitude, subjective norms, and perceived behavioural control, together shape an individual's intentions and behaviours. The third theory is Social Cognitive Career Theory, which is based on Bandura's (1986) general social cognitive theory which states that choice can be explained as a result of interests and self-reference beliefs. This study is anchored more on the Theory of Planned Behavior (TPB) which can predict an individual's intention to engage in a behavior. The theory explains behaviors over which people have the ability to exert self-control. The key assertion of this theory is behavioural intentions are influenced by the attitude about the likelihood that the behavior will have on the expected outcome and the subjective evaluation of the risks and benefits of that outcome. Specifically, the study sought to answer the following research questions:

1. How well does the region determine secondary school students' attitudes towards science?

2. How well does the region determine secondary school students' career aspirations in science?
3. How well can region be used to predict students' attitude towards sciences?

Research hypothesis

1. There are significant differences in secondary school students' attitudes towards science by region
2. There are significant differences in students' career plans in the sciences by region
3. Region is a significant predictor of students attitudes towards science and their career aspirations

2.0 METHODOLOGY

Study Area, Research design and Sampling

Uganda is divided into four geographical regions, namely, northern, eastern, central and western. In turn, each of the four regions is divided into a number of districts. There are currently 127 districts in the country and one city (Kampala). As of 2016, the Central region contained 958 secondary schools, Western region has 915 schools, the Eastern region contained 768 schools and the Northern region had 428 secondary schools, giving 3070 schools (Education Statistical Abstract, 2016). The study adopted a cross sectional survey design to determine the influence of geographical region on the attitudes of secondary school students towards sciences. Most of the data collected was quantitative although an interview was carried out on teachers to triangulate information from the students.

Figure 1: Map of Uganda showing the regions of the country

The 30 senior secondary schools that were sampled were those schools that the National Council for Science and Technology had identified the previous year for remedial assistance in terms of provision of science kits and other forms of assistance. They can generally be classified as medium to high performing 'O' and 'A' level schools. These schools were stratified on the basis of four geographical regions, namely, eastern, northern, central and western. Four (13.3%) schools were located in the north, 5 (16.7%) in the east, 7 (23.3%) in the west and 13 (43.3%) in the central region. The majority of these schools (80%) were government aided, while 6 (20%) were private. Seventeen (56.7%) were co-educational while 13 (43.3%) were single sex schools; 7 (23.3%) for girls and 6 (20%) for boys. Eighteen (60%) were boarding while 6 (20%) were day schools. The rest (20%) were both boarding and day. Fifty (50) senior three students in each of the 30 senior secondary schools were randomly selected to answer the pretested questionnaire. Every student was handed a copy of the questionnaire (in a kind of written examination setting) to fill and hand in after completing it but they were not permitted to share their responses with their peers. In a school where there was more than one stream, one stream was randomly selected. However, some schools had less than 50 students in senior three giving a questionnaire return of 1,473 (96%) out of 1,500 students.

Data collection methods and Data Analysis

Data was collected during the months of October – December 2016. All questionnaires were edited to specifically check for omissions and eliminate all errors in the responses such as double answers to one item and were then scored. The instrument used was developed from several Student Attitude Scales and validated by experts at the University. It had both open and closed ended items and consisted of 22 items and several sub-items. It was divided into four sections with Section A dealing with the biographic data of the students like their school name, nature, type and location of school, nationality, region, subjects being offered, sex and age. Section B looked at students attitudes and consisted of self rating of efficacy in the sciences (level of interest and performance), Section C looked at students career plans, and Section D examined students perceptions of the importance of science and technology, and their practices. The closed ended items had four or five options: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) and I don't know (DK) for questions on students' perceptions of the importance of science; Never (N), Very Rarely (VR), Rarely (R), Often (O) and Very Often (VO) for questions on practices; Very Poor (VP), Poor (P), Average (A), Good (G) and Excellent (E) for self rating of performance; Very Uninterested (VU), Uninterested (U), Interested (I) and Very Interested (VI) for questions on interest. These were then collapsed into Agree (A), I don't Know (DK) and Disagree (D); Never (N), Rarely (R) and Often (O); and Poor (P), Average (A) and Good (G) respectively. To determine the instruments' reliability, the questionnaire was pilot tested on 50 students in one of the schools that was not part of the study. The Cronbach alpha value obtained was 0.86 which showed that the instrument was reliable and could be used for the study.

Data was analyzed using the Statistical Package for Social Sciences (SPSS) computer programme. Hypotheses one, two and three were tested with the Chi-square test (χ^2) and Analysis of Variance (ANOVA). Pearson Product Moment Correlation Coefficient (r) was computed to establish the relationship between attitudes towards the sciences and perceived performance in the four basic science subjects i.e. Biology, Chemistry, Mathematics and Physics. Students were asked to rate themselves on a scale of 1-5 (Very poor and Excellent).

Consequently, two indices were created by taking the average rating for each of these two variables. In order to establish how well the region predicts attitude towards science and career choices of students, two models were run. In the first model, the analysis is based on Ordinary least squares (OLS) regression in which students' attitude to science subjects was perceived to be dependent on region. In the second model, the outcome variable (career choice) was binary with either a student choosing a science related or humanities related career. Therefore, in the second model a logit model was used to determine whether region and location have a significant role in predicting the choice of career. In this analysis, the base and reference category (RC) were science and humanities respectively.

3.0 FINDINGS

The frequency and percentage of students in the various regions of the country are summarized in Table 1 below:

Table 1:Proportion of respondents by region where the school is located (Frequency and percentage of students)

		Frequency	%
Region	Western	350	23.8
	Central	624	42.4
	Eastern	291	19.8
	Northern	208	14.1
Total		1473	100.o%

Majority of students were from schools in Central region (624) constituting 42.6% and most of them (628) were from schools located in rural areas. The majority of these students were in schools located in rural areas (628 or 42.6%), followed by those in urban centres (39.5%). Only 17.9% of these students were from the City of Kampala, Nearly 84% (1236) students stated that they enjoy studying science.

3.1 How well the region determines students' attitudes towards science

In all the four basic science subjects, more students from eastern and northern Uganda perceived their performance in these subjects to be better, and their attitudes were also more positive compared to those from other regions, particularly the central region. More students recorded positive attitudes towards biology and mathematics compared to chemistry. Just over half the students in eastern and northern Uganda had positive attitudes towards all the basic sciences apart from chemistry. This observation was also true regarding the perceived performance of students from eastern and northern regions in these subjects. This observation seems to point to the existence of a strong correlation between students' performance and their attitudes towards the different subjects. Mathematics recorded the highest number of students with positive attitudes (e.g. 58% in eastern and 56% in northern Uganda), and yet this was not reflected in their perceived performance in the subject. Only eastern region recorded more students (53%) who perceived their performance in chemistry to be good. When data was analysed, it was found that region significantly ($p<0.001$) influenced students' perceptions of performance in all the four basic science subjects and their attitudes towards these subjects.

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Table 2: Regional differences in students' attitude towards sciences and self-rating of performance

Subject	Region	Rating of performance (Proportion of student responses from various regions)				Attitude towards sciences (Proportion of student responses from various regions)			
		Poor	Average	Good	χ^2	Negative	Neutral	Positive	χ^2
Biology	Central	72(11.6%)	279(44.7%)	273(43.8%)	55.33***	74(15%)	273(44.6%)	252(40.4%)	40.05***
	Eastern	10(3.4%)	100(34.4%)	181(62.2%)		17(5.8%)	121(41.6%)	153(52.6%)	
	Northern	10(4.8%)	73(35.1%)	125(60.1%)		9(4.3%)	91(43.8%)	108(51.9%)	
	Western	129(8.8%)	610(41.4%)	734(49.8%)		46(13.2%)	143(40.9%)	161(46.0%)	
Chemistry	Central	139(22.3%)	260(41.7%)	225(36.0%)	49.56***	119(19.1%)	292(46.8%)	213(34.1%)	40.05***
	Eastern	40(13.7%)	97(33.3%)	154(53.0%)		25(8.6%)	136(46.7%)	130(44.7%)	
	Northern	39(18.8%)	97(46.6%)	72(34.6%)		37(17.8%)	102(49.0%)	69(33.2%)	
	Western	77(22.0%)	158(45.1%)	135(32.8%)		75(21.4%)	127(36.3%)	148(42.3%)	
Mathematics	Central	238(34.9%)	194(31.1%)	212(34.0%)	98.06***	146(23.4%)	230(369%)	248(39.7%)	66.98***
	Eastern	28(9.7%)	105(36.1%)	158(54.3%)		22(7.6%)	99(34.0%)	170(58.4%)	
	Northern	36(16.4%)	61(29.3%)	113(54.4%)		19(9.2%)	73(35.1%)	116(55.8%)	
	Western	98(28.0%)	113(32.3%)	139(39.7%)		42(12.0%)	122(34.9%)	186(53.1%)	
Physics	Central	(31.4%)	(37.8%)	(30.7%)	120.29***	147(23.5%)	268(42.9%)	209(33.5%)	83.23***
	Eastern	22(7.6%)	103(35.4%)	166(57.0%)		13(4.4%)	125(43.0%)	153(52.6%)	
	Northern	33(15.9%)	78(37.5%)	97(46.6%)		19(9.1%)	80(38.5%)	109(52.4%)	
	Western	58(16.6%)	162(46.3%)	130(37.1%)		47(13.4%)	137(39.1%)	166(47.4%)	

3.1.1 Students' appreciation of science and their practices

Regarding students' appreciation of science (Table 3), on average 90% of the students in all regions appreciated the importance of science and technology (Table 3) but the proportion was higher for students from eastern and northern Uganda. However, this proportion dropped considerably when it came to the role of science in the health and in providing greater opportunities for the youth. Students were positive that new technologies would make work easier. For example, in all the regions except central region (76.7%), more than 82% of the students agreed that the application of science and technology such as the use of computers would open up new opportunities in employment and make it easier to execute work activities. The proportion of those who agreed that S&T would provide more opportunities

was greatest in eastern region (90%) compared to other regions and was least (72%) in central region. The number of students who agreed that S&T would eradicate poverty dropped considerably (51-69%). Except in central region, just over half of students in the rest of the regions disagreed on the statement that S&T is the cause of environmental problems. This means that the central region recorded the highest proportion of students who agreed with the statement (48%), implying these students had more negative attitudes than those from other regions.

On students' practices (Table 4), data revealed that less than 30% of the students in each of the regions often visited Botanical gardens and zoos. Although the proportion of those who read science articles in newspapers, read science fiction books, watched science fiction films and other educational documentaries, and those who played computer games often was higher (40-50%), the students from eastern region consistently led the other regions in terms of numbers of students who were involved in these practices. Interestingly, more students from the central region (52%) and those from eastern region (54%) played computer games.

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Table 3:Students' Appreciation of Science and Technology (proportion of respondents) by region, n=1,473

Students' View		Students' Views (Proportion of respondents) by region				χ^2	P-Value
		Central	Eastern	Northern	Western		
Science and Technology are important	D	37(5.9)	9(3.1%)	6(2.9%)	13(3.7%)	41.22	0.000***
	A	563(90.2%)	272(93.5%)	196(94.3%)	330(94.2%)		
	NS	24(3.8%)	10(3.4%)	6(2.9%)	7(2.0%)		
Country needs science and technology to develop	D	38(6.1%)	3(1.0%)	2(1.0%)	13(3.7%)	39.30	0.000***
	A	555(88.8%)	277(95.2%)	294(93.3%)	321(91.7%)		
	NS	32(5.1%)	11(3.8%)	12(5.8%)	15(4.3%)		
Science and technology hold hope for cures of diseases	D	77(12.3%)	22(7.6%)	24(11.5%)	58(12.5%)	43.57	0.000***
	A	491(78.7%)	252(86.6%)	159(76.5%)	244(69.7%)		
	NS	56(9.0%)	17(5.8%)	25(12.0%)	48(13.7%)		
Thanks to science there will be greater opportunities	D	102(16.4%)	8(2.7%)	17(8.1%)	36(10.2)	67.42	0.000***
	A	451(72.3%)	262(90.0%)	172(82.7%)	267(76.3%)		
	NS	71(11.4%)	21(7.2%)	19(9.1%)	47(13.4%)		
New technologies will make work more interesting	D	110(17.6%)	16(5.5%)	13(6.2%)	35(10.0%)	48.00	0.000***
	A	479(76.7%)	257(88.3%)	183(88.0)	290(82.9%)		
	NS	35(56%)	18(6.2%)	12(5.8%)	25(7.1%)		
Sciences and technology can make our lives healthier and easier	D	94(15.1%)	7(2.4%)	8(3.8%)	36(10.3%)	55.92	0.000***
	A	475(76.1%)	267(91.7%)	184(88.5%)	280(89.0%)		
	NS	55(8.8%)	17(5.8%)	16(7.7%)	34(9.7%)		
Benefits of science are greater than harmful effects	D	206(33.0%)	43(14.7%)	25(12.0%)	73(20.9%)	76.38	0.000***
	A	338(54.2%)	218(74.9%)	149(71.6%)	216(61.7%)		
	NS	80(12.8%)	30(10.3%)	34(16.3%)	61(17.4%)		
Sciences and technology will help eradicate poverty	D	216(34.6%)	61(20.9%)	48(23.1%)	106(30.3%)	52.61	0.000***
	A	304(51.1%)	201(69.1%)	133(63.9%)	205(58.6%)		
	NS	89(14.3%)	29(10.0%)	27(13.0%)	39(11.1%)		
Sciences and technology are the cause of environmental problems	D	251(40.2%)	148(50.9%)	108(52.0%)	175(50.0%)	27.97	0.000***
	A	298(47.7%)	118(40.6%)	78(37.5%)	136(38.8%)		
	NS	75(12.0%)	25(8.6%)	22(10.6%)	39(11.1%)		

D=Disagree, A=Agree, NS=Not Sure ***Significant at p=0.01, **Significant at p=0.05

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Table 4:Students' Science and Technology Practices that Promote Positive Science Attitudes (proportion of respondents) by region, n=1,473

Practice		Proportion of respondents by regional location Central	Eastern	Northern	Western	χ^2	P-Value
Visit Botanical gardens and Zoos	N	118(18.9%)	72(24.7%)	82(39.4%)	124(35.4%)	57.60	0.000***
	R	343(55.0%)	147(50.5%)	90(43.3%)	164(46.8%)		
	O	163(26.1%)	72(24.7%)	36(17.3%)	62(17.7%)		
Read science articles in newspapers	N	88(14.1%)	15(5.2%)	22(10.6%)	57(16.3%)	57.55	0.000***
	R	264(42.3%)	87(29.8%)	86(31.4%)	142(40.6%)		
	O	272(43.6%)	189(64.9%)	100(48.1%)	151(43.1%)		
Read science fiction novels	N	170(27.2%)	44(15.1%)	42(20.2%)	95(27.1%)	49.17	0.000***
	R	266(42.6%)	103(52.2%)	83(39.9%)	148(42.3%)		
	O	188(30.1%)	144(49.4%)	83(39.9%)	107(30.6%)		
Read science textbook	N	59(9.5%)	19(6.5%)	15(7.2%)	31(8.9%)	54.24	0.000***
	R	170(27.3%)	29(10.0%)	50(24.1%)	81(23.1%)		
	O	395(63.3%)	243(83.5%)	143(68.8%)	238(68.0%)		
Watch scientific TV documentaries	N	122(19.6%)	43(14.8%)	42(20.2%)	90(25.7%)	40.46	0.000***
	R	221(35.4%)	90(30.9%)	93(44.7%)	140(40.0%)		
	O	279(44.8%)	153(52.6%)	88(42.3%)	106(30.2%)		
Watch science ficti films	N	123(19.7%)	42(14.4%)	32(15.4%)	94(26.9%)	65.88	0.000***
	R	222(35.6%)	96(33.0%)	88(42.3%)	150(42.8%)		
	O	279(44.8%)	153(52.6%)	88(42.3%)	106(30.2%)		
Watch scienti educational programmes	N	101(16.2%)	34(11.7%)	41(19.7%)	75(21.4%)	46.18	0.000***
	R	257(41.1%)	85(29.2%)	83(39.9%)	138(39.4%)		
	O	266(42.6%)	172(59.1%)	84(40.4%)	137(39.2%)		
Play computer games	N	109(17.5%)	45(15.5%)	62(29.8%)	75(21.4%)	63.92	0.000***
	R	192(39.8%)	88(30.3%)	91(43.8%)	111(31.7%)		
	O	323(51.8%)	158(54.3%)	55(26.4%)	164(46.8%)		

N=Never, R=Rarely, O=Often ***Significant at p=0.01, **Significant at p=0.05

ANOVA results on how significantly different the attitude, perceived performance, interest and appreciation of science and practices are by region (Table 5) indicate significant differences by region.

Table 5: ANOVA results on how region influences perceived performance, attitude, interest and appreciation of science and practices

	REGION					
	Western	Central	Eastern	Northern	F	p-value
Perceived performance in science	3.4±1.2	3.2±0.8	3.8±0.6	3.6±0.6	30.984	.000
Attitude to science	3.9±0.4	3.7±0.4	3.9±0.3	3.8±0.4	19.089	.000
Science practices or activities	2.9±0.8	3.1±0.8	3.4±0.8	3.0±0.8	22.156	.000
Appreciation of science	3.9±0.6	3.8±0.7	4.2±0.5	4.1±0.6	31.208	.000
Interest in science	3.9±0.4	3.7±0.4	3.9±0.3	3.8±0.4	19.089	.000

From the One-way ANOVA, the outcome of the analysis show region having a significant ($p<.01$) effect on the mean differences for each of the five dependent variables namely perceived performance, attitude, interest and appreciation of science and practices. But since the results of the F-test hardly tell us where those differences lie, Posthoc comparisons using the LSD (Least Significant Differences) were run to isolate the differences in the means.

For perceived performance, the findings showed that apart from Northern (3.6±0.6) and Eastern (3.8±0.6) whose means were insignificantly ($p>0.05$) different from each other, the difference in the means for other regions were highly significant at 0.01. According to the posthoc results, students in Western region reported a significantly better performance (3.4±1.2) than those in the Central region (3.2±0.8). However, students in Eastern (3.8±0.6) and Northern region (3.6±0.6) reported significantly ($p<0.01$) better performance than their counterparts in Western Uganda.

Posthoc comparisons for attitude to science showed no statistically significant mean differences in the means for western (3.9±0.4) and northern (3.8±0.4). In the results of the Posthoc test, the p-value for the differences in these two means was ($0.391>0.05$) implying that students in the two regions exhibit the same attitude to science. Differences in the means were evident between the west and central regions where the attitude for the former was significantly better than that of the latter ($p<0.01$). For western and eastern, the mean difference of (-.07) was significant at 5 percent level which implies that the attitude of students in eastern is on average better than that of students in western.

Regarding frequency of participation in science activities, all group means significantly differed apart from western (2.9±0.8) and Northern (3.0±0.8) regions whose mean differences were insignificant ($0.539>0.05$). This finding therefore means that taken together, the region significantly influenced the frequency of participation in science activities.

In relation to Appreciation of science, the mean differences in the four groups were significantly different from each other at either 1% or 5% level. Specifically, the results suggest that appreciation of science is more likely to be high if a student is from the Eastern (4.2±0.5), followed by Northern (4.1±0.6), western (3.9±0.6) and reduces if a student is from the central (3.8±0.7). Variations in the mean differences in students' interest in science were also highly significant at 1 percent level. In the results of the posthoc tests, apart from western (3.9±0.4) and north (3.8±0.4) whose mean differences were insignificant at all levels, the means for other groups were significantly differently from one another. The highest interest was reported among students in the eastern region followed by western region. Like in the previous analyses, students in the central demonstrated the lowest interest (3.7±0.4) in science.

3.2 How well the region determines students' career aspirations in science

In all regions, about a third of the students were interested in pursuing medical careers, followed by engineering (18%), being a lawyer (9.6%), science teacher (9.9%) and accountancy (8%) (Table 6). Comparatively fewer students from the central region wished to pursue medical careers (26.2%) and engineering (14.4%). However, more students from the central region than those from other regions wished to pursue careers in Law (12.8%) and Accountancy (8.5%). The careers of role models of the students (Table 7) closely resembled those for which students aspired, implying that careers of role models greatly influenced the

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aspirations of students. Region significantly influenced career aspirations of students ($p<0.01$) and the careers of role models. However, in order to establish if the careers of role models were correlated with the career aspirations of students (Table 8), further analysis was conducted.

Table 6: Students' Career Aspirations by Region, n=1473

	What do you want to be in future? (Students' responses by region on the most popular professions they aspire for)							
Region	Medical doctor	Science teacher	Engineer	Accountant	Lawyer	Others	χ^2	P-Value
Central	163(26.2%)	46(7.4%)	90(14.4%)	53(8.5%)	80(12.8%)	192(30.8%)	103.03	0.000
Eastern	98(33.7%)	40(13.7%)	55(18.9%)	23(7.9%)	17(5.8%)	58(20.0%)		
Northern	76(36.5%)	28(13.5%)	48(23.1%)	15(7.2%)	7(3.4%)	34(16.3%)		
Western	106(30.3%)	31(8.9%)	76(21.7%)	28(8.0%)	38(10.9%)	71(20.2%)		
Total	443(30.1%)	145(9.9%)	269(18.3%)	119(8.1%)	142(9.6%)	355(24.1%)		

***significant at p=0.01 **significant at p=0.05 NS

Table 7: Occupations of Students' Role Models by Region

	What is the occupation of your role model? (Students' responses on occupation of role model)								
Region	Medical doctor	Engineer	Science teacher	Lawyer	Accountant	Administrator occupations	Others	χ^2	P-Value
Central	203(32.5%)	88(14.1%)	47(7.5%)	30(4.8%)	176(28.2%)	40(6.4%)	40(6.4%)	56.40	0.000***
Eastern	117(40.2%)	44(15.1%)	29(10.0%)	17(5.8%)	47(16.2%)	17(5.8%)	20(6.9%)		
Northern	69(36.2%)	51(24.5%)	25(12.0%)	7(3.4%)	29(13.9%)	15(7.2%)	12(5.8%)		
Western	95(27.1%)	64(18.3%)	45(12.9%)	30(8.6%)	78(22.9%)	21(6.0%)	17(4.9%)		
Total	484(32.9%)	247(16.8%)	146(9.9%)	84(5.7%)	330(22.4%)	93(6.3%)	89(6.0%)		

***significant at p=0.01 **significant at p=0.05 NS

3.2.1 How career of the role models correlates with students' future careers

Table 8 presents the results pertaining to whether careers of students' role models influence their future career choices. The analysis was based on a Pearson chi-square test.

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Table 8:How career of the role models correlates with students' future careers

Career of the role model	Future career Humanities		Science career		Chi-square	p-value
None science	178	44.5%	155	14.4%		
Doctor	65	16.3%	445	41.5%		
Engineer	12	3.0%	140	13.0%	200.91	0.000
Science teacher	78	19.5%	179	16.7%		
Other	67	16.8%	154	14.4%		
Total	400	100%	1073	100%		

Of those who saw their future career in Humanities, the highest proportion (44.5%), stated that the careers of their role models were in none science related fields. In contrast, only 14% of those with prospects of choosing a science career had their role models in none science careers. Results further demonstrated that the tendency to choose science as a career increases if the career of the role model is say doctor (41.5%) or engineer (13%). These differences in the observed frequencies were highly significant (χ^2=200.91, p=.000<.01) which means that having a role model in a particular field say a science related career increases students' chances of pursuing a similar career.

3.3 Region as a predictor of career choices of students in the sciences

The overall model was statistically significant at 1 percent level as indicated by the likelihood ratio chi-square value of 47.71 whose p-value was significant (0.000<0.01). The Pseudo R-squared value was 0.0277. This means that approximately 27.7 percent of choosing a science related career is predicted for by the explanatory variable (region) summarized in the binary logit model (Table 9).

Table 9:Summary of the binary logit model for the influence of region as a factor predicting the likelihood that a student will pick a science career

	Coef.	Odds Ratio	z	P>z
Constant	1.01	2.76	7.26	0.000
Region (RC=Western)				
Central	-0.40	0.67	-2.69	0.007
Eastern	0.47	1.61	2.38	0.017
Northern	0.63	1.88	2.71	0.007
Number of obs = 1,473				
LR chi2(5) = 47.71				
Prob > chi2 = 0.0000				
Pseudo R^2 = 0.0277				

The study established that the decision to choose a science related career is significantly predicted by region. In Table 9, the dummy coefficient for central region took a negative coefficient (-0.40) with an odds ratio of 0.67 which means that the probability of choosing a career in science related fields significantly (0.000<0.01) reduces by 0.67 times for students in the central region. For eastern and northern regions, the coefficients are 0.47 and 0.63 respectively with odds ratios of 1.61 and 1.88 respectively. This means that the probability of choosing a science career significantly (0.000<0.01) increases by 1.61 and 1.88 times if the student is in eastern and northern regions respectively. The effect of the region significantly

explains who would choose a career in science (p<0.01). Thus, the region is an important factor in predicting the choice of science career (dependent variable).

Table 10 presents a summary of the Ordinary Least Squares (OLS) regression which was used to estimate factors predicting students' attitude towards science subjects. The key explanatory variable was region. In the regression model the F-statistic (11.73) shows the model can significantly (0.000<0.01) be used to predict students' attitudes towards science. This led to the conclusion that region can significantly predict students' attitude towards science. In the same table, the value of R-squared is 0.0384 suggesting that other things being equal, approximately 38.4 percent of attitude towards science is accounted for by the region.

Turning to the values of the coefficients, the results show that the variable of region is significant. The standardized regression coefficient for eastern region was positive as indicated by value of 0.06, which means that these students were 0.06 times more likely to have more favourable attitudes towards science subjects. For central region, students' negative attitudes towards science were highly significantly different (0.000<0.01).

Table 10: Summary of the OLS regression for the effect of region on students' attitude to science

	Coef.	Std. Err.	t	P>t
Constant	3.88	0.02	159.22	0.000
Region (RC=Western)				
Central	-0.13	0.03	-4.9	0.000
Eastern	0.06	0.03	1.85	0.064
Northern	-0.04	0.04	-1.08	0.281
Number of obs = 1,473				
F(5, 1467) = 11.73				
Prob > F = 0.0000				
R-squared = 0.0384				

Students in eastern region were on average 0.06 times more likely to have a positive attitude to science relative to their colleagues from other regions although the differences were not significant (p>0.05). The negative values of -0.13 and -0.04 for central and northern regions respectively show that compared to schools in the reference category (western region), students in these regions have more negative attitudes towards science subjects.

4.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Discussion

The study has demonstrated that more students from eastern Uganda perceived their performance in the science subjects to be better, and their attitudes were more positive compared to those from other regions, particularly the central region. Other scholars such as Kapici &Akcay (2016) in Turkey, Anwer & Bhuta (2014) in Pakistan reported regional variations in science attitude. The findings showed that more students from western regions of Turkey had positive attitudes toward science and other related concepts. The results of the Pakistan study revealed that students exhibited positive attitudes towards science, irrespective of province. However, comparison across regions favoured students from the province of

Sindh as compared to their counterparts in Balochistan. These two studies did not pinpoint the exact cause of the differences across the different regions. In the case of Uganda, further investigations are also required to establish the exact cause of these differences but may include both school and non-school factors.

Mathematics recorded the highest number of students with positive attitudes, and yet this was not translated into their performance in the subject. Only eastern region recorded more students who stated that their performance in chemistry was good. When data was analysed, it was found that region significantly influenced students' perceptions of performance in all the four basic science subjects and their attitudes towards these subjects. This observation demonstrates that although students may have positive attitudes towards a subject, this does not necessarily translate into good performance. Other scholars (e.g. Osborne, Simon, & Collins, 2003; Barmby, Kind, and Jones, 2008) have also reported that the correlation between students' science attitudes and their performance is weak. Performance is a product of many factors including teachers, the parental support and school environment.

Majority of students understood the importance of S&T in all regions but the proportion was significantly higher for students from eastern Uganda. Specifically, the results suggest that appreciation of science is more likely to be high if a student is from the eastern, followed by northern and western region and reduces if a student is from the central region. Students were also not so sure about its role in poverty reduction, development and in creating new opportunities for them. Other scholars such as Osborne, Simon, & Collins (2003); Mishra (2014); Awan, Sarwar, Naz, & Noreen (2011) and von Roten Crettaz (2004) also reported similar findings of students' appreciation of science. Further investigation is needed to establish the reason for the regional variations in students' attitudes towards science in Uganda. However, students will appreciate S&T if the teachers and the community where they live can demonstrate its relevance and, if they in turn have positive attitudes towards them. It is apparently for this reason that students failed to link science and technology to poverty reduction and creation of job opportunities, which are urgent concerns among the Ugandan youth. Anwar & Bhutta (2014) reported that students, particularly at the secondary level, perceive science as being irrelevant to life. They feel that advancement in science has generated social and environmental problems. Bennett (2001) adds that students also perceive science to be difficult and is about things not people. For these reasons, many students do not want to continue studying science (Kind, Jones & Barmby, 2007).

This study demonstrates the importance of Ugandan students' practices in shaping their attitudes. Slightly less than a third of the students in each of the regions often visited Botanical gardens and zoos. Although the proportion of those who read science articles in newspapers, read science fiction books, watched science fiction films, watched educational documentaries and those who played computer games often was nearly half, the students from eastern region consistently led the other regions in terms of involvement in these practices. This finding therefore means that region significantly influenced the frequency of participation in science activities by secondary school students in Uganda. Various reports (e.g. NAPE, 2015; DES, 2015) reveal many science teachers in Uganda teach the subjects theoretically and do not sufficiently encourage practices that are essential for shaping attitudes and careers in science. A study on science teaching and students' attitudes and aspirations by Sheldrake et al., (2017) recommended that conveying the wider applications of

science to students was the only teaching approach to consistently and positively associate with students' utility and other attitudes. Developing students' attitudes, and hence their aspirations, through highlighting the applications and relevance of science to everyday life may be beneficial to students' perceived utility of science most strongly and is positively associated with their science-related career aspirations.

Overall, this study demonstrated that region is a significant determinant of students' attitudes. The students from eastern region were 0.06 times more likely to have more favourable attitudes towards sciences while those from the central region demonstrated significantly more negative attitudes towards science as demonstrated by the negative coefficient value (-0.13). Other studies e.g. Awan, Sarwar, Naz, & Noreen (2011) and Crettaz von Roten (2004) have also established positive attitudes of students towards sciences and career choices and by region (Kapici &Akcay, 2016 and Anwer & Bhuta, 2014). Shumba1 & Naong (2012); DeWitt, Archer & Osborne (2014); Vidal Rodiero (2007) noted that students'' attitudes are likely play a role in their choice of subjects and careers.

Results further demonstrated that the tendency to choose science as a career increases if the career of the role model is say doctor (41.5%) or engineer (13%). The study further demonstrated that having a role model in a particular field say a science related career increases students' chances of pursuing a similar career. This study re-echoes similar findings by other scholars such as Fried & MacCleave, (2009) and Ardies, Maeyer & Gijbels (2015) to the effect that role models and mentors influenced female graduate students' choice of science as a career. Role modelling significantly influences career aspirations of schoolchildren by influencing their beliefs and other factors. Furthermore, approximately 27.7 percent of choosing a science related career is predicted by region where the students' school is located. The probability of choosing a career in science related fields also significantly reduces by 0.67 times for students in the central region but increases by 1.61 and 1.88 times if the student is in eastern and northern regions respectively. The effect of the region therefore significantly explains who would choose a career in science thus the region is an important factor in predicting the choice of science career.

Conclusion

The study has demonstrated that more students from eastern Uganda perceived their performance in the science subjects to be better, and their attitudes were more positive compared to those from other regions, particularly the central region. However, the attitudes did not necessarily translate into students' performance. Overall, this study demonstrated that region is a significant determinant of students' attitudes and career aspirations of Ugandan secondary school students. Results further demonstrated that the tendency to choose science as a career increases if the career of the role model is say doctor or engineer. Having a role model in a particular field say a science related career increases students' chances of pursuing a similar career.

Recommendations

Further investigations are required to establish the exact cause of the regional differences in attitudes and career aspirations of students. Investigations are also required to establish students' attitudes towards school science, and how interest, self-efficacy, beliefs and other attributes influence attitudes and career aspirations. Lastly, more research is needed on

teachers' practices and attitude toward science and how these influence their student's attitudes and career aspirations.

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