Bulletin of Education and Research
December 2017, Vol. 39, No. 3 pp. 19-43

Interests and Recruitment in Science: Factors Influencing Recruitment and Retention in STEM Education at University Level in Pakistan

Riffat-un-Nisa Awan[*], Muhammad Sarwar[**], Munim Mehdi[***], Ghazala Noureen[****] and Nadeem Anwar[*****]

Abstract

This study has been carried out as a part of the IRIS, which is a collaborative research project, supported by the European Commission (7th Framework program). It intends to identify the factors involved in the choice of STEM subjects by the university students of the Punjab. Seven major factors has been discussed which play role in the choice and retention of students in STEM areas in higher education. These factors include impact of school experience, personal choice of students, importance of subject area, experience as student in the subject, expectations of everyday life, educational status of students in the subject and priorities for future. This study also digs out the gender mean difference in the choice of subject. A structured questionnaire IRIS-Q was used containing items regarding the influence of various factors for the choice of STEM subjects. Only those students were the part of study that had completed their first year of education in any area of STEM in the public sector universities of the Punjab. Results indicated that school experience was identified as an important factor for the selection of STEM subjects. Among the family and relatives the role of fathers was prominent in the choice of STEM areas. The role of media and technology had no significant role to motivate the students to choose the subjects. Students' learning endeavours played effective role for the retention of students in STEM areas. Future priorities like job security had been identified as major factor for retaining in STEM subjects. The study explored that

[*]Associate Professor, Department of Education, University of Sargodha, Sargodha, Pakistan.
Email: riffarukh@gmail.com.
[**] Professor, Department of Education, University of Sargodha, Sargodha, Pakistan.
[***]Sqn. Leader, PAF College, Sargodha.
[****]Assistant Professor, Division of Education, University of Education, Lahore, Pakistan.
[*****]Assistant Professor, Department of Education, University of Sargodha, Sargodha, Pakistan.

there was significant gender difference among the perception of respondents in their self-efficacy, personal satisfaction and future opportunities. It was recommended that the attention of all other stakeholders should be drawn to foster STEM education in Pakistan.

Keywords: Interests, recruitment, science, factors, retention, education

Introduction

STEM is widely used acronym for four separate disciplines of Science, Technology, Engineering and Mathematics (Kennedy & Odell, 2014). The enrolment of students in STEM subjects has been a topic of research for last two and half decades. The number of publications about STEM especially regarding factors influencing STEM enrolment is increasing exponentially (Yu, Chang, & Yu, 2016). Need of competent and skilled workforce within STEM disciplines is vital to meet the challenges the world facing these days (Lynch, Behrend, Burton, & Means, 2013; Reis, Patrocínio, & Lourtie, 2012). The provision of workforce in STEM areas depends on the enrolment of students in the STEM courses, which is affected by different factors. The factors include past experiences with the subjects, media images of STEM graduates, future priorities, social/family influence, success expectancy, achievement level and gender of the student. The question why less number of females opt STEM subjects needs deep digging out into causes and cures. The present study intends to explore the experiences, considerations, and priorities, on which youth base their educational choices in STEM and to explore gender differences between the factors effecting the selection of, and retaining in, the STM subjects by students at university level using IRIS framework (Interests-and-Recruitment-in-Science, 2011).

Theoretical Framework

The study was drawn upon concepts that encompass essentials of expectancy-value theory, alongside the study on career choices in the field of STEM. Expectancy-Value Theory has been well-known in the works of educational scientists (Eccles & Wigfield, 1995, 2002; McCormick & McPherson, 2007). Eccles and Wigfield (2002) had emphasized that underneath this theory, peoples' selections would be deliberated to be instantaneously by expectancy for success and value of that success. Hopes for achievement would be understood as existence largely linked to self-perceptions around one's recent capabilities and the idea of self-efficacy (Bandura, 1997).

Values in expectancy-value theory would be dividable into four classes that enlighten how various actions meet different requirements of persons. 1) attainment value i.e., the importance of existence positive in an action, 2) intrinsic value, 3) utility value i.e., utility of the action, such as the ahead of credit or revenue, and 4) the chance, time, expressive, or connected charges related with an action (Eccles & Wigfield, 2002). Decision making in the favour of career choices plays a vital role to increase the rate of STEM enrolment.

Literature Review

The choice of subject is related to the attitude of student their ability and overall performance in the school (Ndalichako & Komba, 2014). Women not only have less chance to enroll in STEM but also are less likely to present themselves in these areas than men (McClelland & Holland, 2015), mainly due to stereotype thinking. The question of equity needs to be considered for improving participation in STEM education as it is generally observed that STEM fields are more likely to be chosen by men (Riegle-Crumb, King, Grodsky, & Muller, 2012). Gender equality has been seen as better way to promote scientific and technological excellence (Höft, 2016).

Even the developed world is struggling to end the gender inequity within STEM which starts at secondary and the undergraduate level of study (Crosling, Heagney, & Thomas, 2009; Goodrum, Druhan, & Abbs, 2012; Lyons et al., 2012; Wang, 2013). According to Wilson, Lyons, and Quinn (2013) reports that the retention of females in STEM is falling in Australia, Europe and USA (ASPIRES, 2013),due to variety of reasons.

Different researchers have worked on the factors which may be the reasons for not considering the STEM subjects (Maltese & Tai, 2011; Wilson et al., 2013). Here are some of the common points:

1. Stereotype thinking which is prevailing at different levels like social culture, family, belief system, educational institutes, teachers' motivation, media etc.
2. Absence of role models in females which may be motivating factor next generations.
3. Counselling and guidance to young generation going for higher education.
4. Traditional way of teaching science, technology, engineering and mathematics in schools, colleges and university levels which is irrelevant with the practicalities of field.
5. Curriculum format is outdated and do not meet the requirements of market, particularly for female students.

6. Political and cultural hindrances for female professionals.
7. Family system which do not permit females to continue their profession after marriage.
8. Low wages of women as compared to men having same qualification in the field of science and technology.

The above mentioned points show that gender plays a significant role in the STEM career choices. Despite all efforts employment statistics still show that men and women are entering in these careers in disproportionate numbers (Reis et al., 2012). Due to the gender parity, females are less likely to go into the careers in science, mathematics and technologies.

The situation of participation of Women, in STEM Education in Pakistan is not different from rest of the world. Like rest of the world, Pakistan is also trying to bring gender parity in STEM subjects. In National Education Policy 1998-2010, the goal for female education was set to reduce gender inequality by 10% (Government-of-Pakistan, 1998). According to Higher Education Annual Report 2010-11(Higher-Education-Comission, 2011) 6807 total PhDs were produced by Pakistani universities. Among them 76.25% were male while 23.74% were female. The percentage of PhDs in science is about 57.17%. “During the years 2004-05 to 2009-10, 2050 PhDs in science disciplines have been produced by Pakistani universities in total, out of which 73.60 % (1509) were male and 26.39% (541) were female” (www.hec.gov.pk). Most of these researches have been supervised by working scientists and engineers in higher education institutes. According to HEC data 1642 were males and 277 were females out of total 1919 STEM area supervisors for PhD research (www.hec.gov.pk). The percentage of science and technology field supervisors was relatively higher as compared to social sciences. A significant raise in the number of female students opting STEM subjects in their higher education is being observed. The ratio given by HEC about the award of higher education degrees in 2010 was 76.23 (male) and 23.74 (female). But the figure has increased according to the findings as of this research which is 55.7 (male) and 44.2 (female) currently registered in the public sector universities of Pakistan. It means that gender disparities in the area of STEM are decreasing gradually.

To understand the complex issue of obstacles in the path of opting STEM subjects by the female students for higher education we need to study all above mentioned factors to make the young females for taking science and technology subjects as their future career. Diversified causes needs to be dig out and cures have to be sought out from the root level starting from school level and passing through college experience which ultimate result into the option of STEM subjects in higher education. The main objective of this study was to explore the experiences, considerations, and, priorities, on which youth base their educational choices in STM and to explore gender differences between the factors affecting the selection of, and retaining in, the STM subjects by science students at university level using IRIS framework.

Methodology

The data were collected from 740 first year University students enrolled in STEM courses in various public sector universities of the Punjab (Pakistan). Among the 25 universities of the Punjab only 15 universities were selected for the survey due to the reason that science subjects were being offered over there only, other were newly established or on-campus classes were not being conducted regularly.

The instrument used in this study was Interests and Recruitment in Science (IRIS) questionnaire developed by IRIS (2010), and also used by (Henriksen, Jensen, & Sjaastad, 2015; Jidesjö, Danielsson, & Björn, 2015).

Interests and Recruitment in Science (IRIS) is a large-scale international research project of student recruitment, retention and gender equity in university STEM courses to find the factors for opting and retaining STEM in young students of higher education (Hribar & Dolinšek, 2015). This IRIS-Q was developed by the consortium partners of IRIS and was previously administered to more than seven thousand European first year STEM university students (Wilson et al., 2013). The questionnaire consists of 50 items comprising various parts i.e. demographic part; questions on Personal Interest, Family Factors, Media, Personal Experience, Usage in everyday Life, Progress in the Subject, and Future priorities. The following factors were studies in detail in this research:

- Role of personal interest in related subjects and impact of school experience on choosing the course
- Influence of family members and friends in terms of importance of father, mother, friends, siblings, teachers etc. in choosing the course

- Influence of media; Importance of different things, books, museums, activities, competitions, etc., in choosing the course and importance of film, drama and TV on the respondents choice of course
- Personal satisfaction of students' learning experience and their experience as a student
- Role of expectation fulfilment in retaining of STEM subjects in terms of expectation of everyday life aspects during course
- Students perceived self-efficacy in STEM subjects
- Students' priorities for the future

Utilizing Statistical Package for Social Sciences (SPSS), a range of frequencies were generated to elicit the agreement of respondents and *t*-test was applied to find out the gender differences.

Results

Impact of School Experience on Choosing the Course

In order to find out the impact of school experience on choosing the current course, the respondents were given different statements and were asked to rate, using a five point scale from 1 for Not Important to 5 for Very Important.

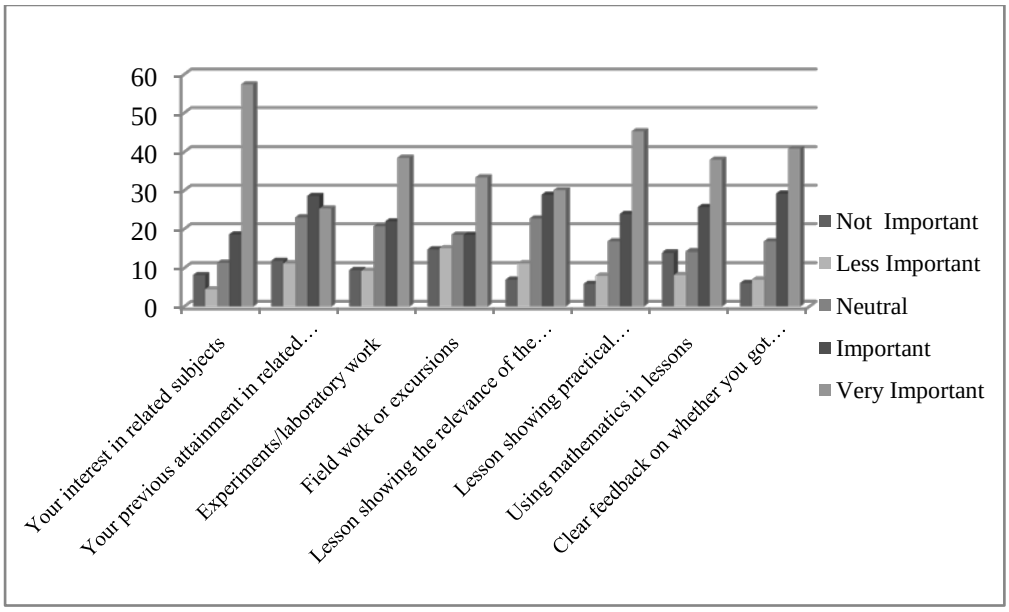

Figure 1 **Importance of school experiences in choosing the course**

When the respondents were asked about their school experiences in choosing their course, a big majority was optimistic about their school experience as 425 (57.4%) respondents rated that their interest in the related subject was very important. Majority of them i.e. 212(28.6%) and 187(25.3%) respondents replied that their previous attainment in the related subject was important and very important in choosing their course respectively and 285(38.5%) considered experiment/laboratory work as very important factor in choosing their course. The respondents were also asked about the impact of field work or excursion on the choosing of course. Majority i.e. 247(33.4%) considered the factor excursion as very important factor in choosing their course.

The respondents were also asked whether is it important for you to choose the course that is relevance to the society or not. 214(28.9%) and 223(30.1%) respondents rated this statement as important and very important. Likewise Majority i.e. 336(45.4%) respondent rated that lessons showing practical application of the subject as very important in choosing their course. 281(38.0%) respondents rated importance of using mathematics in lesson in choosing the course as very important. Lastly the respondents were asked about the importance of clear feedback in choosing the course. The result shows that 216(29.2%) respondents rated it as important factor in choosing the course. 303(40.9%) respondents rated it as very important in choosing the course. Details are given in figure 1.

Importance of Persons in Choosing Your Course

In order to find out the impact of persons on choosing the course, the respondents were given different options like father, mother, friends, siblings, teachers etc and were asked to rate them in terms of importance.

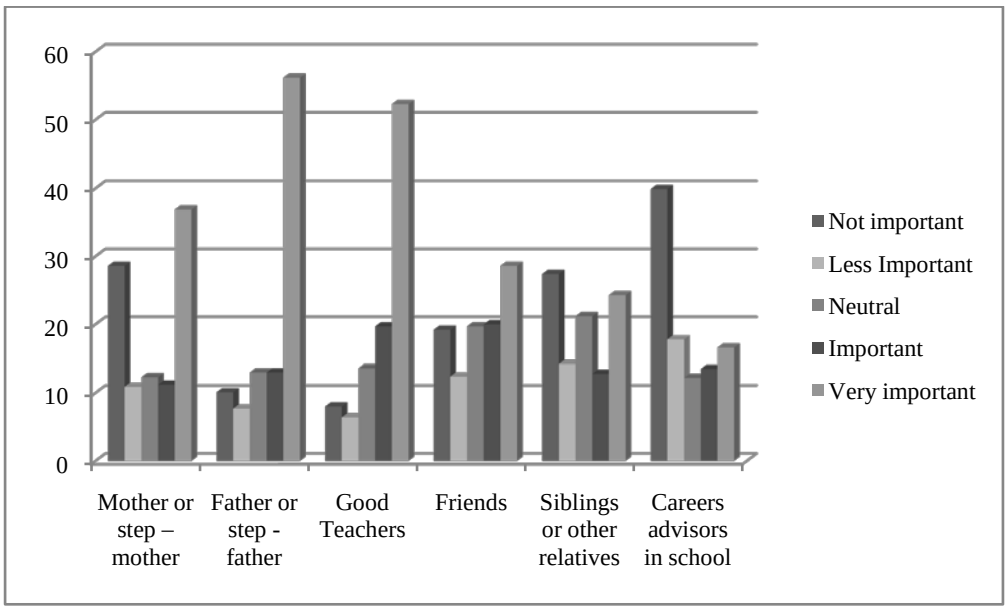

Figure 2 **Important of family and friends in choosing the course**

The respondents were asked about the importance of close relatives in the selection of subject. Majority respondents i.e. 416 (56.2%) and 387 (52.3%) rated their fathers and teachers as very important respectively.

Importance of Different Things in Choosing the Course

In order to find out the importance of different things like Books, Museums, Activities, Competitions, etc., they were provided different option and were asked to rate themselves.

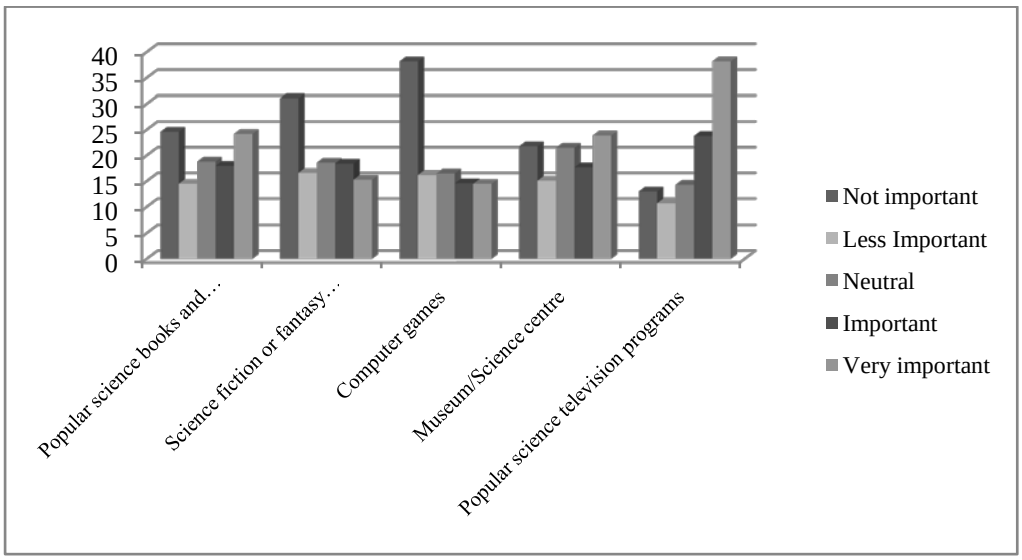

Figure 3 **Important of Books, Museums, Activities, Competitions, etc in choosing the course**

The respondents were asked to rate the importance of popular books, museums, popular science television programs and computer games in choosing the course. The result shows that popular science books (24.6%) and science television programs (38.2%) were rated as important while computer games were least important (38.2%).

Film or Drama on Television

In order to find the importance of film or drama on TV on the respondents choice of course, they were asked to rate it on a five point scale.

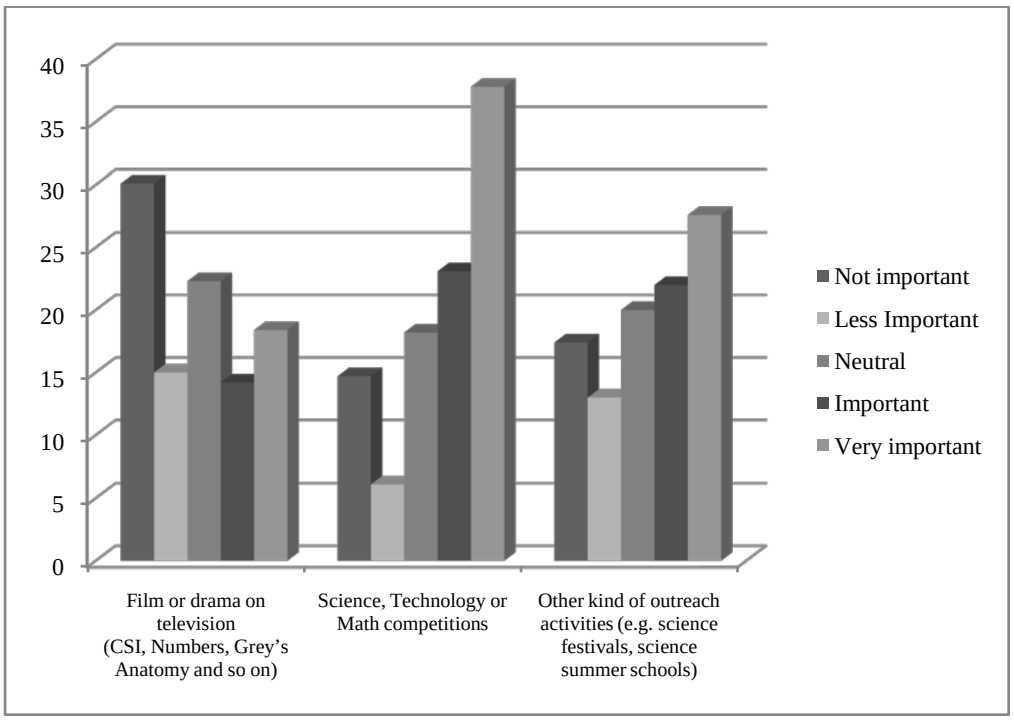

Figure 4 **Importance of Film or Drama in the choice of course**

The result show that majority of the respondents i.e. 223(30.1%) and 11(15.0%) respondents rated film or drama on TV as not important or less important respectively while 280(37.8%) respondents rated science technology or mathematics competitions as very important in choosing their course. 204(27.6%) respondents rated science festivals and science summer schools as very important in choosing their.

Experience as Student so far

In order to find out the experience of the respondents as a student so far, they were given different statements and were asked to rate them(with five point likert scale using 1 for Strongly Disagree to 5 for strongly agree) to what extent they are agree or disagree to the given statements.

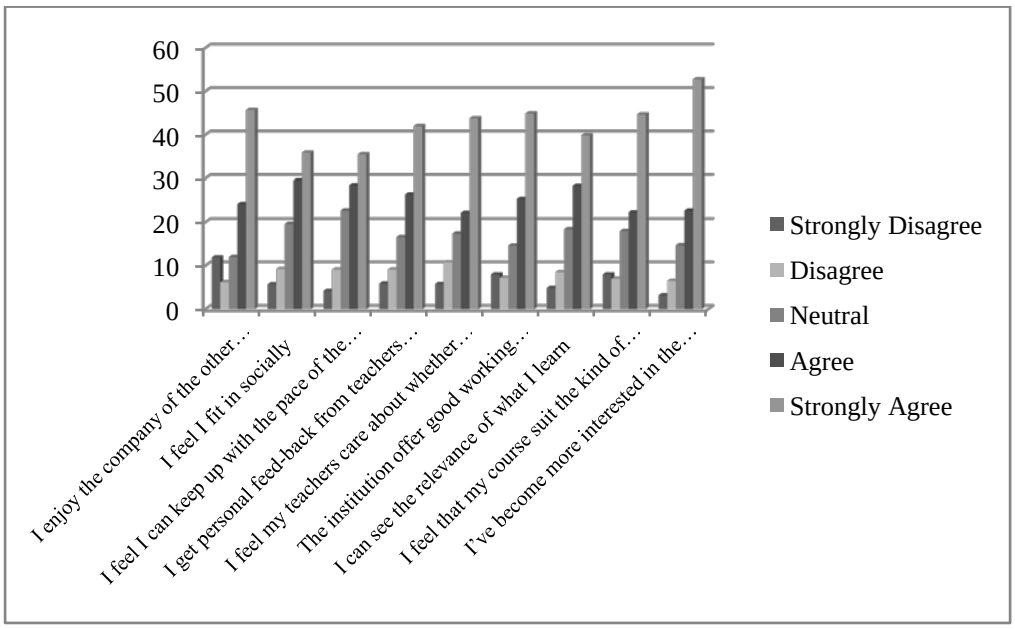

Figure 5 **School experiences as a student**

Respondents were asked about the effect of their experience in the school as a student in selection of their course. The result shows that a majority ranging from 35.5% to 52.8% agreed to the statements that their school experience was great in the school and it was positively helping them in the selection of subjects.

Expectation of Everyday Life Aspects During Course

In order to find whether different aspects of the student's everyday life is matching to their expectation or not? They were provided different statements regarding the different aspects of their everyday life and were asked to rate (with three point likert scale using 1 for worse than expected to 3 for better than expected) it whether they are matching to your expectation, better that your expectations or worse than their expectation.

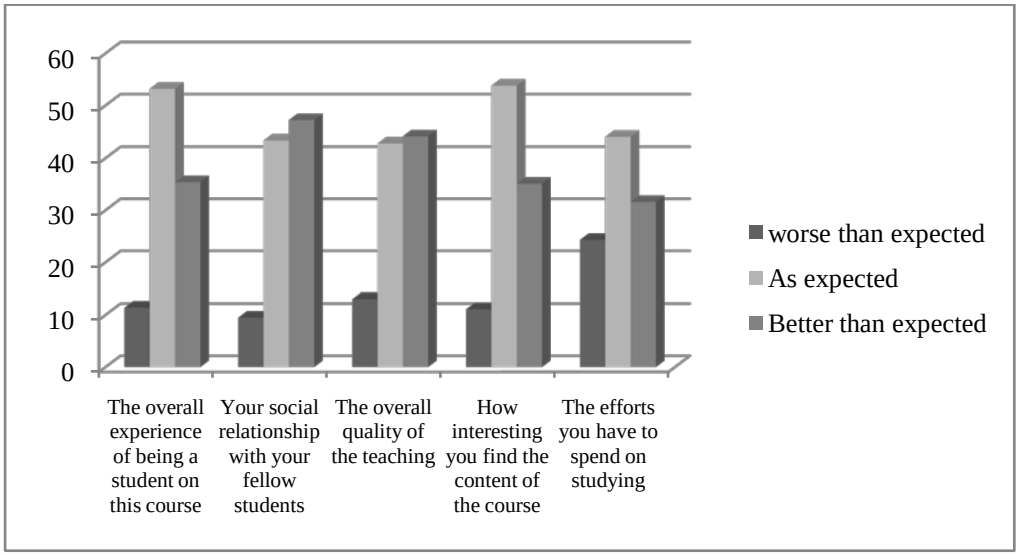

Figure 6 **Expectation of everyday life aspects during the course been as expected, better than expected or worse than expected**

The respondents were asked to rate how was their overall experience of being a student of this course. The result showed 94(53.2%) had the same experience as they were expecting.

In terms of their social relationship with their fellow (47.2%) and the overall quality of teaching (44.2) Students were positive and reported that they have better experience than they were expecting. More than 50 % i.e.398(53.8%) respondents found the contents of their course as they were expecting and the efforts they are putting (44.1%) was again the same as was expected.

Perceived Self-efficacy and Status of the Students in the Current Course

In order to find out the current status and their perceived self-efficacy in the current course, they were given different statements and were asked to rate them with a five point likert scale using 1 for strongly disagree to 5 for strongly agree.

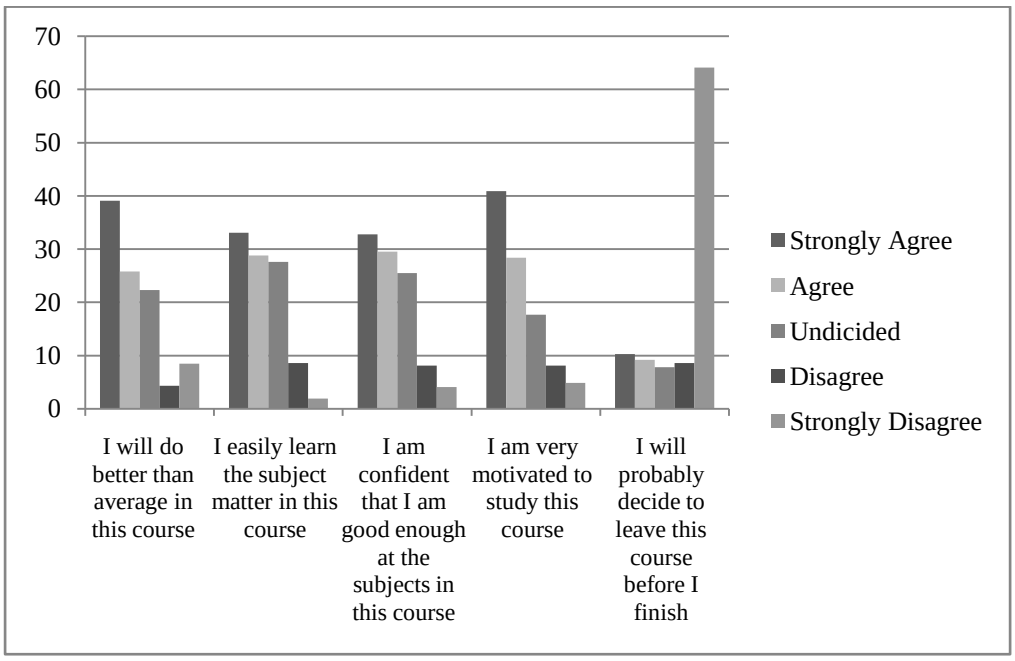

Figure 7 **The current status and the perceived self-efficacy in the current course**

The respondents were asked about their current status and their perceived self-efficacy. The result showed that majority respondents (ranging from 32.8 to 40.9) strongly agreed with the first four statements that they will perform better than the average in this course and are motivated. However, majority i.e. 474 (64.1%) respondents strongly disagreed that they will decide to leave this course before it is finished.

Priorities for the Future

In order to find out the priorities of the respondents for the future, they were provided different statement regarding their future and were asked to rate it to the degree to which they are agreeing to the statements in terms of their importance.

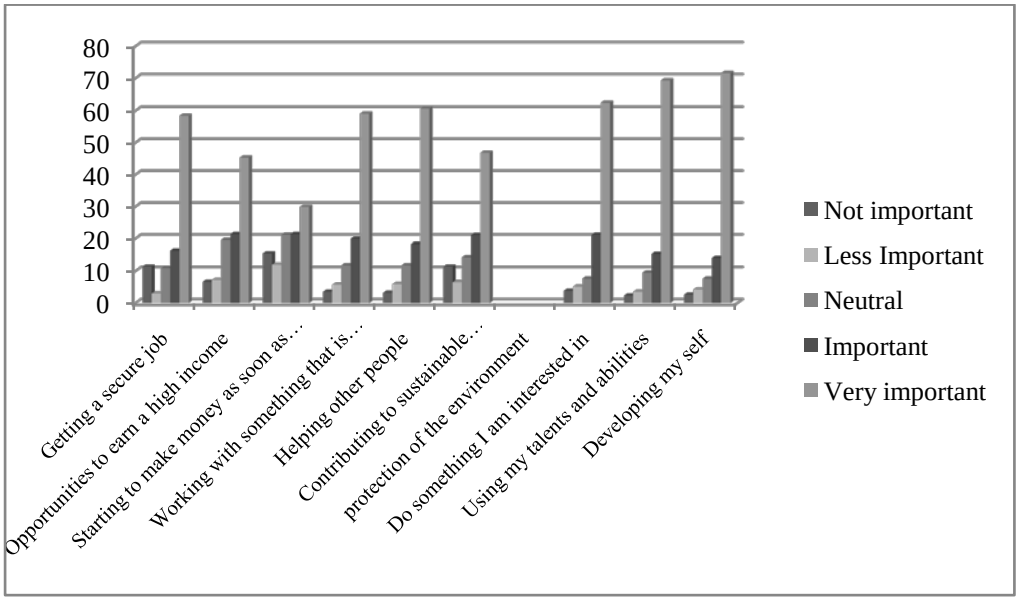

Figure 8 **Regarding your priorities for the future; how important are the following factors to you?**

So far as priorities of the respondents for the future are concerned they gave high importance to; getting a secure job, opportunities to earn a high income, making money, to work with something that is important for the society, help other people in future, to contribute to sustainable development and protection of the environment in future and doing the job of their interest. Majority respondents were interested in developing themselves (71.6) while least number (29.9) wanted to make money.

Impact of different factors on male and female students in selection of STEM subjects at university level

In order to find out the gender difference regarding the impact of different factors like; personal interest, family and media while selecting STEM subjects at university level independent sample t-test was applied the results are given bellow.

Table 1

Comparison of mean scores of male and female students in selection of STEM subjects at university level regarding role of their personal interest family members, friends and media in related subjects

	Gender	N	Mean	SD	*df*	*t*	*P*
Role of personal interest in related subjects	M	388	29.93	5.10	738	.482	.630
	F	352	29.74	5.85			
Influence of family members and friends	M	388	19.81	5.05	738	-.145	.884
	F	352	19.87	5.24			
Influence of media	M	388	25.05	6.40	738	1.79	.073
	F	352	24.15	7.21			

The table 1 shows no significant difference between male students and female students at university level, regarding interest in related subjects, influence of family members and influence of media, while choosing STEM subjects.

Impact of different factors on male and female students while retaining in STEM subjects at university level

In order to find out the gender difference regarding the impact of different factors like; Personal satisfaction, Expectation fulfilment, Self-Efficacy and Future opportunities while retaining in STEM subjects at university level independent sample t-test was applied the results are given bellow.

Table 2

Comparison of mean scores of male and female students while retaining in STEM subjects at university level

	Gender	N	Mean	SD	*df*	*t*	*P*
Personal Satisfaction of their learning experience	M	388	35.90	6.66	738	3.346	.001
	F	352	34.24	6.81			
Role of expectation fulfilment in retaining of STEM subjects	M	388	11.30	1.81	738	1.068	.286
	F	352	11.17	1.70			
Self-Efficacy in related subjects	M	388	17.68	3.51	738	3.147	.002
	F	352	16.86	3.58			
Future opportunities	M	388	37.73	5.79	738	3.248	.001
	F	352	36.22	6.73			

The above table shows comparison of mean scores of male and female students at university level in retention in STEM subjects regarding role of personal satisfaction of their learning experience. There was significant difference between male students (M =35.90, SD = 6.66) and female students (M = 34.24, SD = 6.81) of university level, *t* (738) =3.346, p = .001. There was no significant difference between male students (M =11.30, SD = 1.81) and female students (M = 11.17, SD = 1.70) of university level, *t* (738) =1.068, p = .286, regarding role of personal interest and influence of family members, friends, teachers and media. There was significant difference between male students (M =17.68, SD = 3.51) and female students (M = 16.86, SD = 3.58) of university level, *t* (738) =3.147, p = .002, regarding role of self-efficacy in related subjects for retaining STEM subjects. Lastly, there was significant difference between male students (M =37.73, SD = 5.79) and female students (M = 36.22, SD = 6.73) at university level, *t* (738) =3.248, p = .001, regarding role of future opportunities in related subjects for retention in STEM subjects.

Findings

The findings of study shows that the school experience plays very important role in the choice of subjects in higher education without very significant part of previous attainments and working in school labs with same consideration of real application in the society. Usage of math was not very much important for the choice of science subjects in the higher education. A very high majority was concerned with the interest of subject to opt for the science and technology subjects in the higher education. The results also indicated that previous attainments were not so important element to take that very subject in the higher education.

The practical application of subject was considered very important motive for the choice of STEM subject as the results were exhibiting that students considered that they would get admissions in those subject that would help them to do something practically in the future life. It means that they are pragmatic and consider the usage of the subjects in practical life.

Very interesting findings had been derived from the study that instead of mothers, fathers played significant role in the choice of subjects for their children in higher education. The role of good teachers seemed pertinent in the choice of subjects both for male and female. Same were the findings for the role of friends and family. However friends were playing their role in the choice of institution/university etc. Almost similar findings had been observed in the study about relatives, siblings, science journals/magazines and computer games etc. Different media sources were

not very popular in making the opinion of students for choosing STEM subjects at higher education level. The role of career advisors was less important in the choice of STEM subjects.

The ratio of students, who enjoyed the peers, was higher, however students felt that choice of science subjects would raise their social status. Students considered that pace of teaching was satisfactory and they personally were getting feedback from teachers. They also valued the caring behaviour of teachers about the leaning of students. Students also felt good about the learning facilities of institutions like library, labs, etc. STEM students believed that their subject area was quite suitable for their personality and this interest was natural since their childhood. The motivation and buck up attitude of teachers were important factors for the choice and retention in this area.

The experience of STEM students with their classmates was very positive and as per their expectations or better than that. The social relation with the fellow students also enhanced interest for the students to develop and create interest. Also the quality of teaching was as per their expectations or better what they expected along with the course contents. However they deemed not to spend as much efforts as it should be during their studies.

The on-going development and learning also motivated them to be in the subject and most of the students felt that they were very good in the adopted courses. They were more than average students and the subject matter was easily understandable for them. Students were motivated to study the same course and eagerly study the subject. The considerable factor in the study was that very few students desired to leave the course and desired to grow and learn the subject.

Science students judged that the subject they had chosen was of their interest and they were very good in their subject. Learning in this subject was very easy for them and it motivated them to learn about the subject. Most of them strongly disagreed that they would leave the subject before completion.

STEM students consider it that they desired to add value for society in their subject area and wanted to contribute for the sustainable development of their country. Job security was highly important element of their consideration and they utter that they are not after money making however bread and butter was necessity. After using all of their abilities they desired to grow and develop in their field as well as in their career too. Significant gender differences had been seen in retention of STEM subjects on the basis of self-efficacy, personal satisfaction, and future career

opportunities but case was reverse for selection of subject as no significant gender differences were observed in the personal satisfaction and the influence of family members and media.

Discussion

As it has been mentioned already that the ratio of female students in Pakistan is increasing in STEM subjects, which is evident in HEC report which says that there is increase in the number of enrolled female students from 2001-2004 (Government-of-Pakistan, 2004) These results are further supported by The-News-Tribe (2011). The admissions of girls in universities have been increased by 400% while the admissions of boys increased by 235%". If we compare the results of education boards and universities the findings of this study can be further verified that number of passing female students is more than male students. In another study of India decrease in the enrolment of women was observed (Chanana, 2007) .

Many students ranked almost all the factors in the IRIS-Q high, considering them as important contributors to choose STEM education. Same results could be observed in many other researches related to IRIS project (Interests-and-Recruitment-in-Science, 2012; Jidesjö et al., 2015; Ndalichako & Komba, 2014). In a study by (Lyons et al., 2012) about eighty six percent respondents rated interest as highly important in their decisions to choose STEM at university. Studentslook foractivities which are stimulating and enriching, and which correspond with their personal identity (Interests-and-Recruitment-in-Science, 2012) For Pakistan it would be a good sign that the choice of STEM subjects is continuously raising and previous experience is serving as catalyst for opting sciences in the higher education. The roll of previous experiences plays an important role in the decision making of human beings; naturally it drives and motivates humans to revive the previous good experiments. Successful always builds more castles. The results of study shows that there is significant ratio of respondents which reveals that the students consider it very important to choose the STEM subjects which they have studied in their schools and colleges levels. In most of educational institutes of Pakistan there is binding that they cannot choose the subjects (especially STEM) in their higher education if these have not been studied in the previous academic career. The previous experience also creates interest and awareness among the students which can help the students to choose same subjects in their future educational career.

Relatives, peers, and siblings play a major role in the choice of career and subjects for higher education in all over the World and countries like Pakistan. The family system in Pakistan is comparatively strong and all the decisions are being lead by the family head (father) in most of the cases (Richter et al., 2011). Parents' influence on children's career paths is well known (Reis et al., 2012). The results show that among the persons who help/effect to choose subjects of students in higher education, fathers are at the top of all. For example students believe that fathers are significant element in the choice of subjects which is 67% while role of mothers is not as much important. These finding conform the results given in publishable summary of IRIS which states that "school-related factors impact greatly on young people's choices and Good teachers were the persons rated highest as inspiring IRIS respondents (particularly females') STEM choice"(Interests-and-Recruitment-in-Science, 2012, p. 3). Findings by Darling and Glendinning (1996) oppose the results of this study concluding that the influence of parents and school staff on decision making was seen to be of less significance. However other factors like teachers, mothers, and friends have also been considered but these factors have comparatively less value as the fathers in choosing subjects of their young ones. The role of career advisors which is gaining momentum in the rest of the World but in Pakistan it is not so important. This finding is in confirmation with Lyons et al. (2012) as their finding said that 'the careers advisors were rated by students as the least important persons less important than teachers, parents, friends and siblings, in their decisions to take university STEM courses'. The above mentioned IRIS study also found that both males and females opted STEM subjects under the influence of their teachers. While a sizable portion of females mentioned personal encouragement from science teacher as a factor for selection of STEM subjects.

We are living in age of information technology and tools are part and parcel of our daily life. The results of this study reveal that role of science magazines, books, fiction, films, games and media channels are not very significant. These results contradict the results by (Hribar & Dolinšek, 2015; Interests-and-Recruitment-in-Science, 2011, 2012; Wang, 2013). Pellegrini (2012) concludes that "Young people are attracted by television series that use science and technology. However the significant importance of outreach activities, science festivals science museums and centres have been considered very imperative. The results indicate that activities like science festivals, events and shows motivate students for the choice of STEM subjects and the same could be conformed in Jidesjö et al. (2015) and Reis et al. (2012). These activities affect the perception of students about their careers and shape their future aspirations and interests. The role of science centres is also very important for young students to opt science and technology subjects in their higher education.

Peer relationship and learning environment act as catalyst to provoke learning and to enjoy the learning process. There are some learning support services which also increase learning and help the students of higher education to attract towards STEM subjects. These services may include library, canteen, societies etc. The results shows that students of higher education are significantly consider these items important for higher learning. Mahoney and Thelen (2009)have concluded that research conducted on improvement on learning endeavours of students in STEM subjects is very little. There are many factors along with above discussed factors which contribute in enhancing the interest of STEM students in developing motivation for opting and staying in this area. The learning aptitude and understanding in the subject also contribute a lot in staying and recommending it to other fellows. The interest will be multiplied if the contents of the course easy comprehended by the learner. He or she would desire to learn more and tries to learn at advanced level. The results show that the students of STEM subjects in higher education in Pakistan are significantly interested and highly satisfied with the learning pace and they are confident enough that they are growing well in the subject. The results represent that if they have willingly opted the subjects and they would stay in the area. Only twelve percent students showed that they may quit from the subject while significant ratio can be seen motivated to grow more.

Concerning priorities for future career, most of STEM students belonged to the middle class families and they desire to secure their future**.** Families and students have dreamed wishfully and they have planned accordingly about the future to fulfill the needs. To ignore the needs of the future and just hope it works out is not a plan. The results show that students desire to get job after the completion of their degrees. Students do want to serve society and contribute in countries but not at the cost of their future(Cerinsek, Hribar, Glodez, & Dolinsek, 2013; Hribar & Dolinšek, 2015). These results are further verified by Interests-and-Recruitment-in-Science (2012, p. 2) as respondents of different countries highlight intrinsic value and “females favour idealistic priorities (helping others, protecting the environment) more than males”.

Through Independent Sample t-test the mean score of male and female students were tested for significant difference. The results show no significant gender difference in the subject selection on the basis of personal interest in related subjects. This result is in confirmation with a research conducted by Jidesjö et al. (2015). The result might be due to the cultural and gender nature of male students in which one has more interest orientation and has independence to choose the subjects of their interest and future needs as compare to their gender opponents.

Three factors were significantly different between males and females which included personal satisfaction of their learning experience, self- efficacy in related subjects and future opportunities as a whole. Basically questions of different domains were asked from the students which showed variety of answers like personal satisfaction with regards to classroom learning has significant difference between males and females. The mean of male is higher as compared to female which shows the self efficacy, experience and expectation of male science students were better than their female partners. The study IRIS 'Interests-and-Recruitment-in-Science' (2012, p.3)showed that "all students experience a gap between their expectations and what they experience. The gap relates to the form and content of the study as well as to job prospects". This study further explains that Italian students' perception of science as masculine was evident and appeared to impact on educational choices. Moreover, The experiences of female students in Denmark indicated that "they still have to distance themselves from a female connoted practice and identity to become recognized as legitimate members of the STEM student community".

The results show a significant difference in the retention of male and female students on the basis of self-efficacy in related subjects. The result might be due to the cultural and gender nature of male students in which one has low temperament to move from subject to subject or some other mobility factors like job seeking urge and more interaction with the outside world. Future targets have a deliberate effect on the retention of STEM students as predicted by respondents. This may include intrinsic as well as extrinsic factors. The difference between male and female may also have a cultural connection too in which females are more concerned with the future opportunities. The retention factor is relatively higher with regarding to female because they go for higher education due to having secure future after completing their education in their practical life.

Conclusion

The results of the study help conclude that the ratio of female students in STEM subjects is increasing day by day in higher education institutions of Pakistan**.** The STEM students of higher education took keen interest in their subjects and they consider it very important for staying and developing in the area. Students consider the value of previous attainments in the relevant subjects an important factor to opt it at higher level. The experimentation in labs and the availability of experiment instruments in labs of educational institutes is prime consideration for opting science and technology subjects.

The fieldwork, hands on learning about the subject and practical application in the field is important consideration for taking the concerned subject at higher education level. The role of father was considered highly significant, as compared to mothers, friends, siblings, career counsellors and other relatives.

The role of museums, and science centres was considered very important motivator to promote the STEM education in Pakistan. Moreover, science festivals and other such activities were judged very important factor to encourage STEM education at higher level. Peer relationship was valued by the students for progressing in the subject and to enjoy the course. Students of higher education feel that they would be socially fit after completing their education in STEM areas. Students feel that it is very important that the leaner must keep pace with the teaching and teachers should take care of the student progress and it is very important to keep the students attached with the subjects.

The experience of students was better than their expectations which mean they have enjoyed their stay at university. A significant number of students perceived that teaching quality was fulfilling their expectations and was better than hoped. Most of the students deemed that course contents were as their expectations. Most of the students were eager to take this subject and no one imposed the subject on them and a very small number of students desired to leave the subject. Students desire to secure job after the education and earn from the subject but they were not after money. Service to society was significantly important for them and they want to contribute in the development of country and personal development was earnest desire of students.

Note: This research project was conducted as an associate partner of IRIS: Interests-and-Recruitment-in-Sciencehttp://iri.uni-lj.si/data/Projekti/IRIS/irisarhiv/about-iris/index.html

References

ASPIRES. (2013). *Young people's science & career aspirations, age 10-14* London: Kings college London.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Macmillan.

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

Chanana, K. (2007). Globalisation, higher education and gender: Changing subject choices of Indian women students. *Economic and Political Weekly, 42*, 590-598.

Crosling, G., Heagney, M., & Thomas, L. (2009). Improving student retention in higher education: Improving teaching and learning. *Australian Universites Review, 51*(2), 9-18.

Darling, J., & Glendinning, A. (1996). *Gender matters in schools: Pupils and Teachers*. London: Cassell and Co.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21*(3), 215–225.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual review of psychology, 53*(1), 109-132.

Goodrum, D., Druhan, A., & Abbs, J. (2012). *The status and quality of year 11 and 12 science in Australian schools:A report prepared for the office of the Chief Scientist.* Canberra: Australian Academy of Science

Government-of-Pakistan. (1998). *National Education Policy: 1998-2010*. Islamabad: Ministry of Education.

Government-of-Pakistan. (2004). *Statistical booklet on HEC.* Islamabad: Higher Education Comission.

Henriksen, E. K., Jensen, F., & Sjaastad, J. (2015). The Role of Out-of-School Experiences and Targeted Recruitment Efforts in Norwegian Science and Technology Students' Educational Choice. *International Journal of Science Education, Part B, 5*(3), 203-222. doi: 10.1080/21548455.2014.900585

Higher-Education-Comission. (2011). *Higher Education Commission Annual Report (2010-11).* Islamabad: Higher Education Commission.

Höft, M. (2016). *IT/Mathematics: Statistical Science STEM Learning* (pp. 121-152): London: Springer.

Hribar, T., & Dolinšek, S. (2015). *Choice Patterns of PhD Students: Why Should I Pursue a PhD? Understanding Student Participation and Choice in Science and Technology Education* (pp. 169-184) London: Springer.

IRIS,Interests-and-Recruitment-in-Science. (2011). *Factors Influencing recruitment, retention and gender equity in science, technology and mathematics higher education.* from http://iri.uni-lj.si/data/Projekti/IRIS/irisarhiv/about-iris/index.html

Interests-and-Recruitment-in-Science. (2012). *Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education.* from http://iri.uni-lj.si/data/Projekti/IRIS/irisarhiv/about-iris/index.html

Jidesjö, A., Danielsson, Å., & Björn, A. (2015). Interest and Recruitment in Science: A Reform, Gender and Experience Perspective. *Procedia-Social and Behavioral Sciences, 167*, 211-216.

Kennedy, T., & Odell, M. (2014). Engaging students in STEM education. *Science Education International, 25*(3), 246-258.

Lynch, S. J., Behrend, T., Burton, E. P., & Means, B. (2013). *Inclusive STEM-focused high schools: STEM education policy and opportunity structures.* Paper presented at the annual conference of National Association for Research in Science Teaching (NARST), Rio Grande, Puerto Rico.

Lyons, T., Quinn, F., Rizk, N., Anderson, N., Hubber, P., Kenny, J., Wilson, S. (2012). S*tarting out in STEM: a study of young men and women in first year science, technology, engineering and mathematics courses:* University of New England.

Mahoney, J., & Thelen, K. (2009). *Explaining institutional change: ambiguity, agency, and power*. Cambridge: Cambridge University Press.

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science education, 95*(5), 877-907.

McClelland, S. I., & Holland, K. J. (2015). You, Me, or Her Leaders' Perceptions of Responsibility for Increasing Gender Diversity in STEM Departments. *Psychology of Women Quarterly, 39*(2), 210-225.

McCormick, J., & McPherson, G. E. (2007). Expectancy-value motivation in the context of a music performance examination. *Musicæ Scientiæ, 11*(2), 37-52.

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.

Pellegrini, G. (2012, 18-20 April). *Science goes to Hollywood: students' choices and the impact of science fiction.* Paper presented at the 12th International Public Communication of Science and Technology Conference on Quality, Honesty and Beauty in Science and Technology Communication.

Reis, A., Patrocínio, C., & Lourtie, P. (2012). *Gender issues in attracting students to science, technology and engineering higher education.* Paper presented at the Proc. of the SEFI 40th annual conference, Thessaloniki, Greece.

Richter, L., Chikovore, J., Makusha, T., Bhana, A., Mokomane, Z., Swartz, S., & Makiwane, M. (2011). *Men in families and family policy in a changing world* (D. f. S. P. a. Development, Trans.). New York: United Nations.

Riegle-Crumb, C., King, B., Grodsky, E., & Muller, C. (2012). The more things change, the more they stay the same? Prior achievement fails to explain gender inequality in entry into STEM college majors over time. *American Educational Research Journal, 49*(6), 1048-1073.

The-News-Tribe. (2011). Pakistan: Admission ratio of girls in education centers increases *The News Tribe (December 20)*. Retrieved from http://www.thenewstribe.com/2011/12/20/pakistan-admission-ratio-of-girls-in-education-centers-increases/#.TvB5MzWP94o

Wang, X. (2013). Why students choose STEM majors motivation, high school learning, and postsecondary context of support. *American Educational Research Journal*, 0002831213488622.

Wilson, S. A., Lyons, T., & Quinn, F. (2013). *The influence of school science teachers: the differential importance attributed by males and females to encouragement from science teachers*. Paper presented at the World Conference on Science and Technology Education (WorldSTE Borneo).

Yu, Y.-C., Chang, S.-H., & Yu, L.-C. (2016). An Academic Trend in STEM Education from Bibliometric and Co-Citation Method. *Psychology, 77*, 32.08.