Journal of Contemporary Issues in Business and Government Vol. 27, No. 06, 2021
https://cibg.org.au/

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

Investigating Attitude, Subject Enrollment, and Achievement in Science before Investing in Higher Education: A Comparison of Universities and Non-University Institutions

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ABSTRACT
The field of science is changing the world in many ways ACT (2017); however, studies have reported the students' lowest achievement and lower enrollment rate in science courses (Fayer, 2017; Filardo, 2016) with a negative attitude towards science (ATS) (Song & Bruning, 2016). Specially, the ATS continues to be the dominant factor; importantly the decline in ATS has emerged recently. Drawing on the ATS in higher education benefits, the current study hypothesized that ATS would possibly a driving force in improving science degree programs in three areas, first, increase in science enrollment, second, promoting higher achievement in science, and finally, raising academic standards through positive attitude of head of departments (HoDs) and vice chancellors (V.Cs). Technically, there is a need for analysis any possible dissonance between students' ATS and the institution's (Faculty Members & Head) ATS, as both are necessary for improving enrollment in science, and students' achievement. This difference of ATS may create a severe problem for students' performance and/or institutional gross enrollment in science, therefore, we empirically investigated the attitudes of students, parents, the faculty members (FMs), Head of Departments (HoDs), and V.Cs towards science, graduates and postgraduates (G-PGs) academic achievement and enrollment in science. Using stratified sampling technique 1200 G-PGs, 212 faculty members (FMs), 40 HoDs, 500 parents, and 15 Vice Chancellors (VCs) /Vice-Presidents from fifteen universities/non-university institutions (NUIs) selected.. We analyzed the ATS of 1967 participants thorugh stratified sampling technique included from fifteen higher education institutions (universities/NUIs) of Sindh, to identify whether ATS affects students' achievement, and subject enrollment in both types of institution. A panel of experts and pilot testing refined the data instruments. The overall Cronbach alpha value was 0.87 and 0.89 for *Test of Science Related Attitude* (TOSRA) *Students' and Subjects Choice Sheet* (SSCS) respectively.All participants' ATS explored through *Test of Science Related Attitude* (Fraser, B., & Lee, S. 2015), while G-PGs' grades of midterm and final test results considered as marks in science. Similarly, students' science course enrollment explored through *Students' Subjects Choice Sheet (SSCS)*. We administered descriptive statistics, and ANOVA ('F'- ratio), Correlation Coefficient *r*, and *t*- tests. Results identified a positive relationship between ATS [F (2, 1198) = 485.347, p = .05], science achievement [F (2, 1198) =

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18.907, p = .05]. Furthermore, the personal information pool and the student's self-ATS, are mainly responsible for the student's subject enrollment in science. We presented reasonable and practically applicable recommendations.

Keywords: Graduate and Postgraduate Degree, Attitude, Achievement, Science education, Higher Education, Non-university Institution, University.

Introduction

Attitude towards science is a person's predisposition to respond positively or negatively to science-related things, matters, and persons (ACT, 2017). Sometimes, these positive or negative feelings towards science resist the change with much intensity and stability (Fraser, B., & Lee, S. 2015). An individual's ATS, when confronted with a task, is dominated more by his/ her, positive or negative feeling rather than by a person's ability to work on the technicalities of a task. Globally, ATS has remained under consideration of enormous studies, these researches have indicated a number of factors affecting the students' attitude (Adwa, Dona, & Khalid, 2014; Botty & Shahrill, 2015;). Mango (2003) mentioned five dissimilar factors such as achievement motivation, the student's self-efficacy, teaching styles, faculty attitude, and academic achievement that contribute to an individual's ATS. Filardo (2016) explored sex-based dissimilarities in ATS of 670 undergraduates. They administered TOSRA scale in their study and results indicated that the boys had higher ATS than girls on the total score of this scale. Literature reveals parallel results as that of the findings of Moore and Foy, and concluded that the males have higher levels of ATS compared to females (Ramona, 2015; Richardson, Sherman, & Yard, 2014; Simpson & Troost, 1982). Researchers conducted so far in this field have related ATS with gender (Aswandi , Mohammad, & Zaitun, 2015), parental attitude and education (Bennett, 2001), socioeconomic status (Mustafa, 2015), age and grade (Mahadi & Shahrill, 2014).

According to Yee (2010), different type of institution accounts for a dominant role in developing ATS, because an institution prepares its students for the study of essential science courses at the basic level, which in turn develops learner's curiosity in science-related fields. He found that Nigerian secondary school children's ATS was discouraging; this negative attitude was mainly caused by the low level of attitude and low motivation among the science teachers that in turn caused the decline in ATS of these children in Nigeria. Students with lower level of positive ATS drop out early in their studies in comparison with the students of higher level of ATS (Moore et al., 1997). In most cases, teachers and head-teachers may affect a learner's ATS, which in response can significantly alter academic successes in science, for example, securing of low or high grades in the midterm or the final test (Mustafa, 2015; Haladyna & Nolen, 1989). Alexandra (2009) claimed that ATS influences the academic achievement in a general and science achievement in a particular. In another study, Yassin et al., (2015) found a positive correlation between ATS and academic performance along with the academic pursuit for future studies. ATS also positively related to subject enrollment (Yu Xie et al., 2009).

No area of science learning in higher education has attracted as much global consideration as has the attitude toward science. This is appropriate as science, as takes up approximately 33% of the world's share in higher education enrollment (Carlos, 2009). The field of science is changing the world in many ways (AAAS, 1993); however, studies have reported the students' lowest achievement with a negative attitude towards science (Ajzen, 2001; Andaya, 2014; Barlia & Beeth, 1999). The ATS continues to be the dominant factor; importantly the decline in ATS has also emerged recently. Drawing on the ATS in higher education benefits, the

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current study hypothesized that ATS would possibly a driving force improving science degree programs in three areas, firstly, increase in science enrollment, secondly, promoting higher achievement in science, and finally, raising academic standards through positive attitude of HoDs and V.Cs. Technically, there is a need for analysis any possible dissonance between students' ATS and the institution's (Faculty Members & Head) ATS, as both are necessary for improving enrollment in science, and students' achievement. This difference of ATS may create a severe problem for students' performance and/or institutional gross enrollment in science, therefore, we tried to explore the ATS of G-PGs, Faculty Members (FMs), Head-of-Department (HoD), and V.Cs. We analyzed the attitudes of 1967 participants randomly included from fifteen higher education institutions (universities/NUIs) to identify whether ATS affects students' achievement, and subject enrollment in both types of institution.

We tried to add to this promising discussion examining how ATS in higher education runs as continuously altering positive feelings and thoughts into desirable achievement. This study regards empirical work on ATS in higher education targeted at graduate and postgraduate degree programs (G-PGDPs) in science courses as only being efficient insofar as positive attitude improves students' aggregate achievement (Yassin et al., 2015). From this perspective, ATS affects achievement makes a normative claim — that the positive ATS produces a greater level of achievement of the graduate and postgraduate students (G-PGS). However, at the same time, it is possible that negative attitude in any/many ways may hamper the students' achievement, reducing the inclination to opt science as a career, and/or gross enrollment in science degree programs (Richardson et al., 2014). We therefore seek evidence whether positive/negative attitudes towards science (ATS) are likely to create systemic improvement/depreciation in students' achievement or will be dominating factor on the gross enrollment in science degree programs.

Why Measuring Attitudes

Attitude and Enrollment in Science

Despite the importance of science higher education in scientific and technological development of a country, students' low enrollment rates have been a challenge to the policy makers and planners. Researchers have identified several factors causing students' low enrollment in science related courses. Among these include, inadequate laboratory facilities, poor teaching strategies, and poorly funded among others (Ajzen, 2001). Barlia and Beeth (1999) have recognized faculty's attitude toward science teaching subjects as a dominant factor influencing change the student's attitude toward science subjects, which in turn caused for students' low enrollment in science courses.

Attitude toward Science Contributes to Achievement in Science

In a meta-analysis, Turkmen (2007) examined the variations in students' ATS on the basis of gender and achievement in science. According to Turkmen, (2007) there is a significant difference existed in ATS between both genders; mainly the positive correlation between students' ATS and their science achievement was 0.65 for boys and 0.75 for girls. Similarly, findings revealed that the students' higher level of positive attitude contributes higher achievement in science courses. In another study, Ozcan and Danju (2013) examined the correlation of ATS with science achievement and found a positive correlation in students' ATS with science achievement.

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Gender Differences on ATS

For many years, gender differences have been a reoccurring theme throughout higher education in science literature (Jonathan, Shirley, & Sue, 2000). Yassin et al., (2015) concluded that ATS is an area of interest in which males have found high achievers in science compared to female participants; and findings advocate the existence of significant differences between male and female participants with reference to their ATS in higher education. However, according to Mbugua et al., (2012), gender may not necessarily influence the attitude alone, but it is one of the vital factors, which affect the ATS. Brian and McPhee (2008) analyzed the relationship of attitudes towards science with achievement based on gender. They indicated a significant relationship between ATS and achievement for both genders separately; there was no significant correlation of ATS and science achievement among the girls, while among boys, this relationship was found significant.

Faculty ATS

Globally, rising pressure between constrained budgets and the demand of higher enrollment rates has caused for a disappointing environment for those of teaching profession personnel. Without a well-qualified and committed faculty as well as staff, no higher education institution (university or NUI) can hope for success in this competitive environment. Neither state-of-the-art campuses nor a modern courses and an impressive curriculum can contribute in desired results excluding high profile professors (Botty & Shahrill, 2015). Researches revealed that college and university faculty member, head of departments, and vice chancellors see science education as generally important and constructive (Botty et al., 2015).

The Centrality of Type of Institution in Science Enrollment

It is very difficult to undo the influence of type of institution while knowing the reality that students have diverse personality may prefer to join a different institution for academic pursuit. For instance, students with higher level of ability may choose a higher quality institution, now, it is hard to conclude whether to attribute educational organization-led benefit to better performance of an individual or to that educational institution, where the student belongs, hence, we cannot separate the students and institution from the institutional success. Both, the students and institution are the part of an academic success. Globally, the growing participation in higher education has caused a significant increase in the number of higher education institutions, this explosive expansion of institutions has raised the concerns about the ratio of enrollment in science and non-science courses, whether these institutions accommodate their student's choice and provide support to student's ATS in higher education.

Parents ATS

The study by Cornelius and Nsisong (2014) seems to be one of the basic studies exploring parents' ATS. With the help of PISA, data and applying multiple analytical approaches, Cornelius et al., (2014) tried to find potential factors that might contribute to students' achievement in science in Nigeria. They sought this factor (parents' ATS) statistically significant and dominant among all other factors such as school, teachers, and gender. According to them, parent's ATS influence students' achievement in science broadly in two ways; one such way is by contributing student's ATS, and in the second, by influencing involvement in student's science studies. In another study, Botty and Shahrill (2015) analyzed parental ATS, positively

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correlated with their children's science achievement. Nevertheless, the results of the study were limited in two ways, first, they mainly analyzed on correlation coefficients and, second, they were limited to North Carolina's families. While parental attitude affects the academic achievement in science of their children, still, there is a need of more empirical data to sustain this point of claim.

Literature review reveals the gender differences with regard to ATS, type of institution, and science achievement. Nevertheless, there is need to explore the phenomenon in the university and NUI. The results of these studies declared a positive correlation among ATS, enrollment, and science achievement at elementary or secondary school level. The relationship between ATS learning was directly proportional with achievement in science and subject enrollment, it means more positive attitude caused the higher achievement in science and more subject enrollment in science related fields. We could not find any study, which explored ATS at graduation and post graduation level among students, FMs, parents, V. Cs, and HoDs. Therefore, this study focuses on ATS of graduate and postgraduate students (G-PGS), faculty members (FMs), head of departments (HoDs), and Vice Chancellors are hypnotized to be more important for students' enrollment and achievement in science. It will be motivating to widen the data collection and analysis while including fifteen universities and NUIs from different cities and areas to explore whether the relationship is positive significant. We aim to add to the international context by studying the relationship among G-PG students' ATS, FMs, HoDs, and Vice Chancellors seem to be more relevant for students' achievement and their enrollment in science.

Theoretical Orientation

In 1983, Eccles and his colleagues jointly worked on the role of attitude (value attachment/motivation) in the low / high achievement of children and adolescents; they developed a theory of expectancy of success and achievement. According to this theory, students' values attachment on achievement in learning and expectancies for their success promote learning trajectories and positive achievement behaviors. Theoretically, these constructs symbolize the student's attitude to the studies through their hope for achievement and the value they attach on success. The attitude of a student has a direct effect on his/her performance, persistence, and choices (Kuyper et al., 2000). According to Frazer (1982), task choice, persistence, effort, performance, and cognitive engagement are the components of expectancy-value theory. We adopt Frazer's developed tool for surveying ATS, namely, *Test of Science Related Attitudes* (TOSRA, 1982). According to UNESCO, for a decade or more, achievement in science, and subject enrollment in degree programs has the declined in higher education (UNESCO, 2010).

Although the required critical and analytical skills for accomplishment of the science projects and assignments are among frequently investigated reasons for students' poor performance in their academic pursuits, similarly, the increasing negative attitude toward science is also one of the major contributing factors for students' discontinuation of higher education in science courses (Hynd, Holschuh, & Nist, 2000). How a student attaches meaning to his/her learning and his /her liking and disliking of science courses, it has hypnotized to be mainly related to achievement and enrollment in science. As such, the issue how students' ATS may affect learner's performance in science and enrollment has become a considerably relevant pedagogical focus of the current study. The theoretical pining is given in figure 1.

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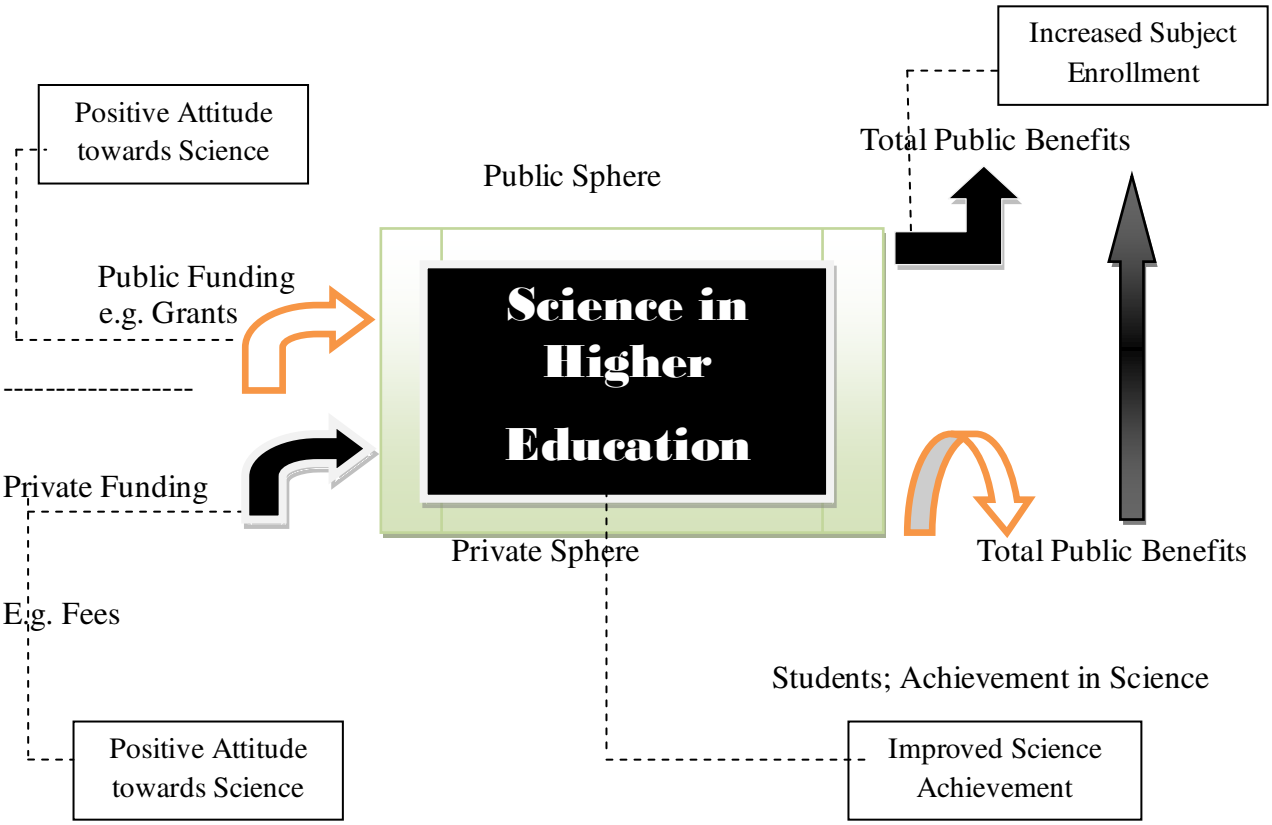

Figure 1. *A Conceptual Model of ATS in Higher Education and the Possible Contribution in Subject Enrollment, and Science Achievement*

Research Questions

The guiding questions of this study are given as:

1. How far students' ATS is correlated with their enrolment in science courses?
2. In what direction is the G-PG students' ATS in higher education oriented?

a. Is there any difference among the G-PGs' ATS with reference to their degree program enrolled?
b. Is there any difference among the G-PGs' ATS with reference to the difference in gender?
c. Is there any difference among the G-PGs' ATS with reference to the institutional difference?
d. What are the factors that may contribute in development of G-PG students' attitude toward higher education in science?

3. How far students' ATS is correlated with their achievement in science?

Method

This study applied a quantitative descriptive-correlation research design. The strength of this design is to investigate relationships between variables (attitudes, science achievement and science enrollment). The data were collected from the five stakeholders (students, parents, faculty, HoDs, and V. Cs) from fifteen universities/NUIs. We could not find relevant instrument that could fulfill the local needs of analyzing attitude towards science and course choices related

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to science at graduate and post-graduate level. For this purpose, we adapted two instruments separately, namely, *Test of Science Related Attitudes* (*TOSRA)* and *Students' Subjects Choice Sheet (SSCS).*

Sample

In the first step of sample selection, we selected fifteen higher education intuitions (the university or NUI) stratified sampling technique drawn from the1967 (N=1967) public or privately owned in area of study. Then from the target population the sample of 1967 participants was selected using stratified sampling techniques, which exceed the necessary sample size as identified by Cochran (1988). According to Cochran, the minimum sample size for 30,000-target population is 600. The sample comprised of 1200 graduates and post graduates (G-PGs), 212 faculty members (FMs), 500 parents, 40 HoDs/chairmen, and 15 Vice-Chancellors/Rectors of 7 universities and 8 NUIs. Students from two science courses out of eleven science courses offered for the semester were randomly selected. Table 1 describes the participation of the sample in detail.

Table 1

Sample Distribution on Gender differences across the N=1967

Category	N	Gender				Overall %
		M	%	F	%	
1. All Students	1200	485	24.57	715	36.22	60.8%
Graduates (33.7%)	665	300	15.19%	365	18.5%	
Postgraduates (27.18%)	535	185	9.3%	350	17.73%	
2. Faculty	212	112	5.67%	100	5.04%	10.73%
3. HoDs	40	10	0.50%	39	1.51%	2.02%
4. Vice Chancellors	15	12	0.6%	03	0.5%	1.11%
5. Parents	500	300	15.19%	200	10.13%	25.32%
Total	1967					100
OVERALL= (M: N =921, 46.65%); (F: N=1046, 53.34%)						
The university: N= 938, 47.56%; (M: N =486, 24.62%); (F: N=452, 22.94%); Overall, students = 544: M=265, F =279, Graduates = 329: M=169, F= 169, Postgraduates = 215: M = 105, F = 110						
NUI: N= 1029, 52.43%; (M: N =435, 22.03%); (F: N=593, 30.39%); Overall, students = 656: M =220, F =436, Graduates =336: M = 140, F = 196, Postgraduates = 320: M = 80, F =240.						

Instruments

We aimed to investigate attitudes toward science (ATS) of graduates and postgraduates, FMs, HoDs, parents, and V. Cs, in Sindh, Pakistan. This research also examined whether there were differences in attitude based on gender and different institution type (the university/NUI). Finally, it was determined whether a relationship existed among ATS, subject enrollment and achievement in science. We used two tools for data collection. These included; *Students' Subjects Choice Sheet (SSCS)*, and *Test of Science Related Attitudes (TOSRA)*. The description of each instrument is given here.

To identify what type of courses either science or non-science, are of choice for males and females, we administered the *Students' Subjects Choice Sheet (SSCS)*. The *SSCS* required the students to select seven courses (either science or non-science, or combined) they would prefer to attend in two upcoming years. The *SSCS* incorporated eleven course choice, five

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

science and six non-science course. The choice of 'other then what would you choose' was also given to them in the *SSCS*. To determine the choice of course for the opposite gender (males choose for females, and vice versa), we administered it in the second part of the course selection process. Students were asked to select the course for their opposite gender. The course choice and the format were the equivalent as the course the students opted for them in part one of the *SSCS*.

The strength of TOSRA is that it is multidimensional, that we can look at specific areas under the broad heading "ATS." On the reviewing of use of TOSRA in the previous studies discussed earlier and, and pilot testing, total 67 statements were adapted; each statement with five choices on the Likert Scale, i.e., Surely Agree, Agree, Not Decided, Disagree, and Surely Disagree.

The midterm and the final test results were used for determining the levels of achievement for science course. This part of the research was conducted to determine if a statistically significant relationship existed between levels of positive ATS and the grades secured in science courses.

Response Rate and Analysis of Data

We personally administered both the questionnaires, and the respondents filled them on the spost in presence of us (any of two researchers). Our presence on the spot served facilitation and guidance for research respondents. This personal administration of the questionnaires rendered three objectives i.e., clarity of respondents' doubts and ambiguities, enhance willingness to participate, and assure 100% response rate.

Data collected from the selected sample were scored and subjected to statistical processing for verification of questions. The latest version of Statistical Package for Social Sciences (SPSS 22.0) was used for analysis of appropriate descriptive and inferential statistics. Descriptive statistics included calculating means, standard deviations and percentages of each group's choice. While inferential statistics comprised of T-tests, One-Way Analysis of Variance (ANOVA), and Karl Pearson's Product Moment Correlation Coefficient *r*. All four hypotheses on question one was tested using t-test at 95% confidence level. The second and third questions were tested by using t-test, Pearson's Coefficient (*r*) and ANOVA, since the F-values of the ANOVA were significant, the further analysis performed on the both questions using Fisher's Least Significant Difference post hoc test in order to ascertain the contributions of the various groups to the significance of the f-values.

Results

We administered the *SSCS* during the first month of the Fall semester. Two thousand sixty four responses received from 1200 graduates and postgraduates (G-PGs) of Chemistry, Physics, Microbiology, Biochemistry and Zoology course through *SSCS*. Six hundred sixty five students were from graduate degree and five hundred thirty five were of postgraduate degree (M.Sc.), either belonged to the university or NUI. The *t*-tests were used in the analysis of independent and non-independent samples. To determine the gender differences on numbers of course for independent samples, we used *t*-tests. Similarly, we administered the paired *t*-tests for analysis of the selection of a course, for oneself and for the opposite gender. The *t*-test's result was evaluated separately concerning the degree of effect size (Cohen's *d, p* <.*05*). The significance level for all statistical analysis accepted at .05 and all the results were tested two-ways. Furthermore, ANOVA was applied to the data to determine the least significance.

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The Students' Subjects Choice Sheet (SSCS)

Tables 2, 3, and 4 provide preliminary information about students' attitude in terms of science-related course in G-PGDPs. Table 2 shows the students' choice with regard to their science majors they had ever opted in the university/NUI degrees. On selecting a non-science course, students were advised to follow the next questions based upon their selection. While selecting "Yes, but this was not my choice," students were asked to follow Table 3 for their selection. In addition, students were advised to follow Table 4 question, if any student selected "Never" as his/her choice. Table 2 shows a discouraging fact emerged that 39.58% of the students had opted a non-science course, while only 28% considered a science course as a major. Similarly, students opted science course as a major, but settled on something else remained 32.41%. The majority of the students may consider a non-science profession as a career.

Table 2

Did you ever opt science course in graduation or/and post graduation degree?

Select any one of the following answer choices: (1200 respondents in total)	Respondents	Percentages
Yes, my current degree program is a science degree.	336	28
Yes, but this was not my choice.	389	32.41
Never.	475	39.58

Table 3

I attended a science degree program, but this was not my choice because

Please select all answers that are applicable. (Total 389 respondents)	Respondents	Percentages
There was insufficient information about science-related careers.	88	22.62
Science is too difficult for me.	74	19.01
Science is too much technical and scientific.	39	10.02
I would not choose it as a career for me.	32	8.22
I considered the employment benefits were not good.	78	2.05
Other (be specific)	78	2.05

Table 4

I did not choose a science course because: (475 respondents in total)

Please select all answers that are applicable.	Respondents	Percentages
There was no any information about science-related careers.	180	38
My interest lies in non-science careers.	139	29
I do not pursue for the sciences.	45	9.41
People who use sciences are strange.	20	4.25
I considered the employment benefits were not good.	60	12.66

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I have access to science.	17	3.66
Other (be specific)	14	3

Table 5

How did you select your course (Science or Non-science)?

Please select all answers that are applicable.	Respondents	Percentage
Parents' Inputs	372	31
Personally gathered information inputs	588	49
Faculty's Inputs	96	8
Other (be specific)	144	12

Table 6

Total Science Course Selected by Gender

Variable	No. of cases	Mean	Standard Deviation	Standard Error Mean	t-value
Females	715	4.52	1.49	0.0677	13.27*
Males	485	3.42	1.35	.0505	

*$p < .05$.

Table 7

Total Non-Science Course Selected by Gender

Variable	No. of cases	Mean	Standard Deviation	Standard Error Mean	t-value
Females	715	4.32	2.49	0.113	29.60*
Males	485	7.62	1.35	.0505	

*$p < .05$

Table 8

Total Science Course Selected by Males for Females

Variable	No. of cases	Mean	Standard Deviation	Standard Error Mean	t-value
Females	715	6.62	3.23	0.147	31.548*
Males	485	2.41	1.25	0.046	

*$p < .05$

Table 9

Total Science Course Selected by Females for Males

Variable	No. of cases	Mean	Standard Deviation	Standard Error Mean	t-value
Females	715	5.52	1.19	0.104	52.131*
Males	485	2.12	1.05	0.090	

*$p < .05$

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Test of Science Related Attitudes (TOSRA)

The table below (see Table 10) shows the overall ATS of all participants, while t-values identify the difference of level of ATS among the participants. With TOSRA, we know, for the females in our sample, that they are more positive than their male peers about considering the science area. We also know that they are more open to embracing new ideas, which is an important characteristic of a scientist. The analysis in Table 10 shows that, a statistical significant difference exists between the attitude of FMs in the university and NUI towards science (t 3.853, p <.0002). Similarly an extremely statistically significant difference found between the parents of G-PGs of the university and NUI (t 8.874, p <.0001). However, in two groups of the sample, namely, HoDs and V. Cs, we did not find any statistically significant difference of ATS at the university and NUI level, the values were (HoDs t .967, p <.3393; V. Cs t .776, p < .513) respectively. The t-test results show that there is an extremely statistical significant difference exist between the graduates of the university and NUI (t 6.373, p <.0001). Similarly, a statistical significant difference exists between the postgraduates of the university and NUI (t 8.824, p <.0001). Overall samples t-test results in relation to types of institution showed that the university G-PGs' level of positive ATS was higher than NUI (t=8.19*, p<.0001). In addition, females have higher levels of positive ATS than to their male peers (females t 18.74, p<.0001; males t 13.29, p<.0001). These values indicate extremely statistically significant relationships exist between genders and both types of institutions. Gender and type of institution have been important factors in ATS. Researchers believe that science is a male dominating area, which needs to be changed (Gregory, 1997). However, female students found to be more positive towards science in this study. In another study, Yavuz (2008) found the similar results as that in this study, in which female students had more level of positive attitude towards science when compared to their counterpart male students at Biligi University. These results indicated that female students could be more successful than male students could when appropriate conditions prevail.

Table10

Classification of Attitudes through TOSRA Scale on t test

Variable	Sample	Group	Type of Institution						t	p
			University			NUI				
			N	Mean	SD	N	Mean	SD		
ATS	Overall Sample	Faculty Members	125	4.36	2.35	87	3.28	1.37	3.853*	0.0002
		Parents	245	4.97	2.33	255	3.26	1.97	8.874*	.05
		HoDs	17	4.39	2.36	23	3.78	1.63	0.967	0.3393
		V. Cs	07	4.43	2.35	08	3.63	1.62	0.776	0.4513
		Graduates	329	4.27	2.36	336	3.36	1.12	6.373*	.05
		Postgraduates	215	2.14	1.65	320	3.29	1.35	8.824*	.05
		Gender Male	486	3.37	1.62	435	2.22	0.84	13.29*	.05
		Female	452	2.32	0.92	594	1.27	0.88	18.74*	.05
		Total (N = 1967)	938	4.63	2.62	1029	5.73	3.26	8.19*	.05
	Male Sample	Faculty Members	60	3.24	2.16	52	3.39	1.20	0.444	0.6574
		Parents	150	2.72	1.84	150	5.35	2.16	11.35*	.05
		HoDs	07	2.46	1.29	05	2.10	1.39	0.462	0.6540
		V. Cs	04	3.39	1.20	08	2.46	1.29	1.20	0.2571
		Graduates	160	2.46	1.29	140	2.10	1.39	2.325*	0.0207

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	Postgraduates	105	3.39	1.20	80	2.46	1.29	5.055*	.05
	Total	486	5.47	2.64	435	4.35	2.56	6.52*	.05
Female Sample	Faculty Members	65	4.73	1.64	35	4.27	1.46	1.388	0.1681
	Parents	95	4.27	1.46	105	4.14	1.26	0.6757	0.5000
	HoDs	10	3.14	1.44	18	4.73	1.43	2.813*	0.0092
	V. Cs	03	4.53	1.46	---	---	----	5.37**	0.0329
	Graduates	169	3.14	1.44	196	4.14	1.26	7.07*	.05
	Postgraduates	110	4.53	1.46	240	4.73	1.43	1.20	0.2284
	Total	452	4.38	1.89	594	3.76	1.09	6.669*	.05

*p< .01, **p< .05

Table 11
One-Way ANOVA of Overall Samples' Attitude towards Science

Source of Variance	Sum of Squares	*df*	Mean Square	F	p
Main Effects	7365.1274	5	1473.0255	185.212	-0.000
Gender	1959.0564	2	979.528	363.872	0.000
Degree	1434.9592	2	717.497	133.808	0.000
Type of Institution	593.7440	2	296.872	67.217	0.000
Error	40783.8177	1962	1473.0255		
Total	48148.9451	1967	7.9532		

P<.05

Attitude versus Achievement

To measure students' achievement in science courses, we used their grades of the midterm and the final test results. The data of these grades received in type of the interval scale of measurement. We converted these grades into a numerical the data type by applying the conventional way; a represents 4.00, B represents 3.00, C represents 2.00, D represents 1.00, and F equals to 0 scales. Table 12 shows descriptive statistics for the achievement construct of the study. The mean levels of achievement of the university students were 5.14 in the midterm and 4.64 in the final test (SD = 1.27, 1.39), while, these mean levels among NUI students were 3.39 and 3.21 in the midterm and the final test respectively (SD = 1.95, 1.05).

Table12.
Overall Classification of Mean Scores and SD for the midterm and Final Grades in Science

Variable	Sample	Source of Difference	Group	Type of Institution								
				University					NUI			
				N	The midterm		The final test		N	The midterm		The final test	
					Mean	SD	Mean	SD		Mean	SD	Mean	SD
Achievement in Science	Overall Sample	Degree	Graduate	329	4.27	1.36	4.26	1.16	336	3.88	1.12	3.86	1.12
			Post Graduate	215	3.14	1.65	4.67	1.88	320	3.92	1.35	3.29	1.30
		Total (N = 1200)		544	5.14	1.27	4.64	1.39	656	3.29	1.95	3.21	1.05
	Male Sample	Degree	Graduate	160	4.43	1.32	3.47	1.06	140	4.27	1.06	4.17	1.86
			Post Graduate	105	3.16	1.65	4.33	1.09	80	4.14	1.65	4.21	1.06
		Total		265	4.63	1.69	4.22	1.39	220	4.14	1.05	3.11	1.08
	Female Sample	Degree	Graduate	169	5.27	1.31	5.86	1.36	196	4.27	1.06	4.22	1.80
			Post Graduate	110	4.65	1.65	4.32	1.31	240	4.14	1.60	4.17	1.38
		Total		279	6.33	1.68	5.27	1.31	436	5.14	1.05	5.17	1.86

*p< 0.001, **p< 0.01

Journal of Contemporary Issues in Business and Government Vol. 27, No. 06, 2021
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P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

Table13

T-test Analysis of Means of Selected Variables of Students in different Category of Institution

Variable	Sample	Source of Difference	Groups	Type of Institution									t	p
				University				NUI						
				N	M	SD	SEM	N	M	SD	SEM	SED		
ATS	Overall sample N = 1200	Degree	Graduate	329	4.27	2.36	.130	336	3.36	1.12	.061	0.143	6.37*	.05
			Postgraduate	215	2.14	1.65	.112	320	3.29	1.35	.075	0.130	8.824*	.05
		Total		544	4.63	2.62	.112	656	3.15	1.60	.062	0.123	12.097*	.05
	Male Sample	Degree	Graduate	160	2.46	1.29	.102	140	2.10	1.39	.117	0.155	2.325*	0.0207
			Postgraduate	105	3.39	1.20	.117	80	2.46	1.29	.144	0.184	5.055*	.05
		Total		265	5.33	2.20	.135	220	4.57	2.38	.160	0.208	3.745*	0.0002
	Female Sample	Degree	Graduate	169	3.14	1.44	.110	196	4.14	1.26	.090	0.141	7.075*	.05
			Postgraduate	110	4.53	1.46	.139	240	4.73	1.43	.092	0.166	1.206	0.2284
		Total		279	6.13	1.05	.062	436	4.18	1.45	.069	0.100	19.435*	.05
Achievement in Science	Overall sample N = 1200	Degree	Graduate	329	5.11	1.66	.091	336	4.33	1.63	.088	0.128	6.113*	.05
			Postgraduate	215	4.55	1.66	.113	320	4.23	1.33	.074	0.130	2.466*	0.0140
		Total		544	5.35	1.20	.051	656	4.20	1.56	.060	0.082	14.082*	.05
	Male Sample	Degree	Graduate	160	2.15	1.05	.083	140	2.10	1.64	.138	0.157	0.3183	0.7505
			Postgraduate	105	2.35	1.07	.104	80	2.30	1.24	.138	0.170	0.2939	0.7692
		Total		265	2.64	1.10	.067	220	2.05	1.13	.076	0.102	5.808*	.05
	Female Sample	Degree	Graduate	169	4.34	1.07	.082	196	3.06	1.27	.090	0.124	10.319*	.05
			Postgraduate	110	4.44	1.60	.152	240	3.04	1.86	.120	0.205	6.820*	.05
		Total		279	6.24	2.02	.120	436	4.06	2.66	.127	0.186	11.698*	.05

*p< 0.001, **p< 0.01

Table 14

One-Way ANOVA of Students' Achievement in Science and ATS on TOSRA

Variable	Source of Variation	*df*	Sum of Squares	Mean of Squares	*F*-ratio
Attitude toward Science	Between groups	2	464.667	464.667	
	Within groups	1198	1146.955	0.957	485.347**
	Total	1200	1611.621	-	
Achievement in Science	Between groups	2	18.012	18.012	18.907**
	Within groups	1198	1101.230	0.953	
	Total	1200	1119.242		

**p< .05

Table15

Pearson's Correlation between the ATS and Achievement in Science

		Attitude toward Science	Achievement in Science of Students
ATS	Pearson Correlation	1.000	0.898*
	Sig. (2-tailed)		.0001
	N	1200	1200
Achievement in Science	Pearson Correlation	0.898*	1.000
	Sig. (2-tailed)	.05	
	N	1200	1200

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

*p< 0.001

Conclusion and Discussion

Question 1: How far students' ATS is correlated with their enrolment in science course?

Our study reports the results of preliminary information about students' attitude in terms of science-related course in G-PGDPs (see Question 1). This initial analysis suggests that there are potential factors because the decline in science enrollment, if we address them properly and promptly that may lead to increase science course enrollment. The findings of this study reported that mainly fresh graduate students are not getting proper and accurate information related to science careers or course. The results also revealed diverse factors responsible for the negative or less positive ATS in a science-related course and/or career. These factors are mainly divided into two broad categories, first, such as personal preferences/likes or dislikes (e.g., I do not like science), and second, factors related to access of adequate and relevant information about careers and/or course in science. Parents may address personal likes/dislikes and FMs' positive attitude toward science course and/or careers, while, the second category of factors needs to be addressed proactively. One dominant finding of the study was the evidence that 588 (49%) of the students revealed their dislike of science course. Although, the students reported high influence of their own developed information to be more prominent in decision making for science course, however, they also revealed the importance of their parents' choice for their studies. Findings report that students' ATS have positive link to the science course enrollment. For an institution to be effective and make a difference in students' learning and achievement in science, they must develop more positive ATS among students, teachers and HoDs at the center of their work. Additionally, realizing FMs have a significant impact on students' attitude, they should strive to develop students' ATS required to enhance their ability to explore phenomena and events and to solve problems in an institution. The findings of our study are parallel to the results of Carlos, (2009), who investigated the decline of interest among the students of Spain and United Kingdom. He concluded the decline of interest in both countries, Spain and U.K. The findings of our study do not match with the previous studies sought out by Andaya (2014), Ajzen (2001) and Bennett (2001).

Question 2: In what direction is the G-PG students' ATS in higher education oriented?
Question 3: How far students' ATS is correlated with their achievement in science?

Researches in science education have found a significant positive relationship between students' attitude toward science and their science achievement (Andaya, 2014). However, there are some studies also reported conflicting correlations. Hanrahan at el., (1998) found a statistically significant positive relationship between science achievement and attitude among undergraduates in part-one Physics. In another study, Germann et al., (1988) concluded an extremely significant positive correlation between college graduates' attitude and achievement in Chemistry. Muhammad and Taiba conducted a study in Uttar Pradesh, India in the current year (2015); the sample consisted of the university graduates and postgraduates from various universities of social science course. They found the positive correlation between the attitude and achievement in science, while they concluded that females had more positive attitude with higher levels of achievement in science as that of the findings of this study. However, Carlos (2009) did not find a significant relationship between science achievement and students' ATS in elementary science. In the present study, we found that students in the university have significantly higher levels of

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

ATS when compared to the students of NUI. Females have higher levels of positive ATS than the males between both categories of institutions. The faculty of the university and HoDs has a positive ATS teaching, and this enables them to plan for more science-oriented assignments and projects during their classroom activities. Learning of science for these students is more effective, because of the attitude has developed in the subject. Thus, these students in the university are able to perform significantly better when compared to the students of other category of institution namely, NUI. Results also identified that the females have higher levels of ATS than the males; similarly, they secured higher scores in science achievement than the males compared both categories of institutions, namely, the university and NUI following the same system.

Results have shown that ATS is positively associated with science achievement and science course enrollment of graduates and postgraduates. In addition, we found that gender, type of institution, parental attitude, attitude of faculty and management have a significant bearing of achievement science, science course enrollment. Hence, higher the level of positive ATS greater the achievement in science and increased science enrollment.

Reconmmentations

On the basis of findings and conclusions, the following recommendations are the best choices for the all stakeholders for enhancing the attitude towards science of graduates and post-graduates in universities and non-university institutions that in return can increase the enrollment in science courses at both levels of the higher education. These are:

Attitude and enrollment in science courses at graduate and post-graduate level

The findings of this study reported that mainly fresh graduate students are not getting proper and accurate information related to science careers or course. There should be arrangement of open days in higher education intuitions, time to time, on science careers and courses in which local and international science related personalities be invited on public awareness. In addition, science related poster and banner competitions should be scheduled in the academic year of these institutions.

The results also revealed diverse factors responsible for the negative or less positive ATS in a science-related course and/or career. To address this factor, higher education institutions (universities and non-universities) should administer talk shows and debates on science related careers and course choices as a public gathering for FMs, parents and guardians. Therefore, parents and guardians may address personal likes/dislikes and FMs' positive attitude toward science course and/or careers.

Direction of the G-PG students' ATS in higher education

One dominant finding of the study was the evidence that 588 (49%) of the students revealed their dislike (negative attitude towards science related course) of science course. Although, the students reported high influence of their own developed information to be more prominent in decision making for science course, however, they also revealed the importance of their parents' choice for their studies. These both factors can easily be addressed through these talk shows and public awareness meetings at local level.

For an institution to be effective and make a difference in students' learning and achievement in science, they must develop more positive ATS among students, teachers and HoDs at the center of their work. Additionally, realizing FMs have a significant impact on

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.06.043

students' attitude, they should strive to develop students' ATS required to enhance their ability to explore phenomena and events and to solve problems in an institution.

Students' ATS and its correlation with their achievement in science

In the present study, we found that male students in the university have significantly higher levels of achievement due to high rate of ATS when compared to the male students of NUI. However, females have higher levels of achievement due to high rate of positive ATS than the males between both categories of institutions (universities and UNIs). For this purpose, NUIs should train the FMs and HoDs to motivate the students, especially, the male students to strive for the best of their potentials for securing higher achievements in science courses. Furthermore, FMs who have a positive ATS teaching can enable them to plan for more science-oriented assignments and projects during their classroom activities.

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