Pakistan Social Sciences Review
www.pssr.org.pk

RESEARCH PAPER

Relationship of Students' Attitude towards and Achievement in Biology across Gender and Grade

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PAPER INFO

Received:
April 12, 2020
Accepted:
June 15, 2020
Online:
June 30, 2020

Keywords:
Attitude,
Achievement,
Biology,
Gender,
Grade

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ABSTRACT

This study focused on exploration of students' attitude towards biology across gender and grade and its relationship with achievement. Population of this study were the secondary school biology students and sample comprised of 9th and 10th grades (male=694, female =659) respondents (1353) belonging to Punjab. Attitude towards biology was explored through Biology Attitude Questionnaire, having 30 items which was translated in Urdu and validated through experts. After pilot testing it was comprised of 23 items with Cronbach alpha coefficient value 0.82. Through t-test and Pearson r correlation, it was found that overall attitude of the respondents was positive and correlation between the variables was also significant. On the basis of grades and genders it was concluded that 9th graders and female respondents show slightly more positive attitude towards biology. Moreover, correlation between the variables was more significant for 10th graders and male respondents

Introduction

Revolution in life is the result of advancement in science and technology (Wood, 2019 and Nishimura, Kanoshima, & Kono, 2019) which has led to extensive separation of professions, fields and subfields, disciplines and sub disciplines. Now the exploration towards a specific discipline seems not fair due to its division and subdivision. For last many decades the exploration of attitudes towards science has turned towards its branches for best careers choices. Like other fields of science, biology, the study of living things, has also become a most growing field due to rapid increase in population and its needs. So, global changes in climates and economic boundaries/barriers have an effect over minute corners of living environment for their survival upon the surface of this planet. As the fittest can only survive (Darwin, 1809-1859), therefore, now we need right person for right job to survive by creating/producing skilled, competent human capital in relevant field. Previous enormous studies had indicated significant correlation of science attitude and

achievement. So, it seems essential to identify this relationship in other disciplines of science like biology or chemistry which were ever overlooked. Generally, many researchers have been explored the science students' attitude since, but some researchers have examined it for chemistry (Bennett 2001), physics (Krogh, 2005) and similar was in the case of exploration of attitude towards biology in Pakistani context. Due to reason this paper, focused on attitudes towards and achievements in biology.

The economic, technological and environmental improvements around the world resulted into increased interest in science and consequently more attention of researchers to the science education and attitude towards science and related branches. According to Kennedy, Quinn, & Taylor, (2016) substantial research has been conducted to explore science attitude and its branches like biology, chemistry, physics etc. The requisite of this investigation has been further emphasized for the past 4-5 decades because of the constantly decreasing number of students chasing careers in science which has developed a problem of societal distress in global context (European Commission, 2004).

Role of science education for the development of a society cannot be denied. Outlook of a society can be changed with the help of science literate population (AAAS, 1990) which may result in the development of democratic societies (Rudolph & Horibe, 2015). Tobin & Fraser (1988) had been of the view that developing countries needs a handsome number of personnel having skills and understanding of science related fields. Across Nations survey shows that focus of the researchers to study attitude towards science and its branhes and scientific knowledge has been traced back since 1970s (Bauer and Falade, 2018, National Science Board, 2016). Being important components of science education, studies about attitude towards and branches of science with respect to its relation with achievement, has enthused increasing interest among the researchers. Attitude has been a multidimensional construct and since last forty years the major focus of the researches had been to explore the students' attitude towards science within different contexts (Kennedy, Frances & Taylor, 2016).

According to Yara, (2009) interest and feelings for science had been termed as attitude towards science. It was also defined as " disposition for likeness or dislikes of science (Osborne, Simon & Collins, 2003). Hacieminoglu (2016) and Xiuju, Chen Ling, Huiliang and Lihui (2015) had suggested that to enhance the overall insight, for its wider and clear perspective students' attitude towards science should be explored by taking other variables into consideration.

Numerous factors, affecting the students' attitude towards science including classroom learning environment, student-teacher and student-student interaction, achievement in science and gender (Ali, Yager, Hacieminoglu and Caliskan, 2013) and among all, gender act as the most influencing factor (Wan & Lee 2017). Relationship of gender with students' attitude towards science and its branches had been investigated within different contexts. The findings regarding relationship between attitude towards science and gender have always been contradictory. As, Sofiani, Maulida, Fadhillah and Sihite (2017) found no gender related differences among science

students' attitude towards science. Miller, Blessing and Schwartz (2006) are of the view that gender differences exist for science lessons. In Pakistani context Rana (2002) and Anwer (2012) indicated that attitudes towards science also vary among gender on all the subscales of TOSRA (attitude scale). In Chinese context Hu, Leung, Chen (2018) explored science students' gender and attitude were significantly correlated. Moreover, it was discovered that boys showed higher scores on attitude scale as compared to girls (Hu, Leung & Chen, 2018; Wan & Lee, 2017). Researchers (Pahlavan, & VayElah 2005; Jones, 2003) had found that parental education, achievement in science and attitude towards science were significantly correlated and they have direct effect on each other.

According to Osborne et al., (2003, p.1050) attitude consists of beliefs and values, which affects school science, and community. Since last many years, students' attitude has been discussed within different contexts (Kennedy, Quinn, & Taylor, 2016). Azizoglu and Cetin, (2009) recommended that science education should promote positive attitude towards science. Attitudes are not inherited but are learned (Cracker, & Kulce, 2008). Reid (2006) is of the view that depending upon the stability of the attitude they may be changed by developing some mechanisms. Similarly Cracker and Kulce (2008) found that through exposure to science lessons, science exhibitions, science teaching methodologies and learning environment can change attitudes of science students. Numerous factors like gender, achievement, learning environment of classrooms, inter and intra-actions among science related personals, had direct influence on the science related attitude of (Ali, Yager, Hacieminoglu & Caliskan, 2013). In Korean context Bang and Baker (2013) conducted study on 10th grade science students to find out their attitude towards science and findings of their investigation concluded that boys and girls from co-education institutions showed positive attitude towards science. A good number of studies (Buccheri, Gürber, & Brühwiler, 2011) have revealed dissimilarities in attitudes across genders at secondary level. Addressing gender Hacieminoglu (2016) found more positive attitude for males while some other researches across context revealed the reverse results (Anwer, 2012; Miller, Lietz & Kotte, 2002). This can only be achieved through achieving the goals of for quality in science education through its disciplines so reforms are needed to improve the quality of science related fields and careers that can be measured through tools having robust psychometric properties. Due to increasing advancement of science it has become a matter of interest not only for scientific community but also for social scientists (Bak, 2001).

Learning biology is also influenced by attitudes along with other factors as growth of favorable attitudes for science careers molds students' interest to positive ones (Rani, 2000). The expression related to favoring or disfavoring something, place, person or object (Psychology) known as attitude which can directly affect the motivation for a student to excel in the particular field (Osborne et al 2003). Familiarizing with attitudes and associated behaviors can facilitate learning. Similarly exploring attitude towards biology has been the focus of researchers in the recent years as it was at its peak since mid-1960s to facilitate learning in science and to study causes in falling enrollments in science related courses among youth. Coll et al.(2002); Barbera

et al.(2008) have found that learning and attitude are associated with one another and needed new methods of measurement to impact of courses on attitudes developed. A Pakistani researcher Rana (2002) had a conducted research on variables like, higher secondary students' attitude towards science, self-concept and parents' socioeconomic status with demographic variables like gender and found significant correlation between the variables. It was a causal comparative research in which the effect of one variable was noticed on the other variable.

During literature review, it was found that rare number of studies had focused the relationship between variables like biology related attitudes and achievement of secondary grade students in Pakistan on grade and gender basis. Generally, many researchers have been explored the science students' attitude, but some researchers have examined it branches of science (Bennett 2001 and Krogh 2005). Due to this reason, this paper focused on exploration of attitudes towards and achievements in biology across grade and gender. Biology as subject is difficult to understand that decreases students' interest, so, for improvement in attitude and achievement in biology, it is necessary to explore this construct at secondary level with respect to gender and grade. It seems to be fair to explore the students attitude towards biology in a country like Pakistan with rapid explosion of education, with increased diseases, pollution, and starvation in thar and also, having agriculture as a profession of about 70 percent of population, having adverse rapid depletion of renewable resources and facing challenges of low economy and GDP allocated for education, especially science education and moreover deficiency of funds for exploration and research in the field of biological education that deals with, not only with food production but also food preservation , eradicating diseases ,dangerous diseases like cancer, reducing pollution increasing energy resources to eliminate energy crisis. So, regarding the importance of attitude towards biology, the present study was conducted in the developing country like Pakistan to explore the adolescents' attitude towards biology by relating it with achievement across gender and grade. It enabled the researchers to establish a bridge between the gap of assumptions and reality. The objectives of the study were to: examine learners' attitude toward biology across gender and grades and determine correlation between learners' attitude towards biology and achievement across gender and grades.

Null Hypothesis

i. There are no differences between students' attitude towards biology across gender and grade level.

ii. There is no relationship between learners' attitude towards biology and achievement across gender and grades.

Material and Methods

The nature of this research was correlational and descriptive in nature (Sutter, 2006; Frankel, 2006).

Population and Sampling Procedures

Biology students studying in ninth and tenth grade in Public schools formed the population of this research. Sample was comprised of 1353 students (694 males and 659 females) belonging to 4 conveniently selected districts (Kasur, Khanewal, Faisalbad and Okara) of Punjab from the jurisdiction of 4 conveniently selected Secondary Boards across Punjab province through multi-stage sampling. These students were regular students of public schools of 4 districts. At provincial level, Punjab was divided in accordance with the jurisdiction of eight BISES which have non-overlapping regions. This procedure was comprised of two phases. In the first phase out of eight BISEs, four were selected randomly. From each of the selected BISE, 1 district was taken randomly. In the second phase sample was taken from strata and substrata level for gender and locale basis. From each selected school two classes (9th and 10th) of biology were selected from each group (Science and Arts group). In case, there was more sections of each group, only 1 was randomly selected and 30 students were randomly selected if number of students in the section is more than thirty otherwise whole section was included in the sample.

Instrument of Research

The Biology Attitude Questionnaire (BAQ) developed by Salta and Tzougraki, (2004) was the instrument for data collection. Initially, it has 30 items with reliability 0.83 was adapted in Pakistani context. It was translated into Urdu language. After pilot testing and validation from experts it has 0.82 reliability and 23 items. The researcher personally collected the data through BAQ questionnaire, after taking permission from department and school head along with the consent of biology teacher. Achievement scores were taken from BISE results of respective classes of Public schools for the subject of biology.

Results and Discussion

The data was entered in SPSS software version 20 for analysis.

Table 1
Students' attitude towards Biology across gender and grade

Respondents	N	Mean	Std. Deviation
Overall	1353	92.49	11.263
Males	694	90.07	11.651
Females	659	95.03	10.252
9th	675	94.29	11.141
10th	678	90.68	11.102
Males 9th	349	92.83	11.100
Females 9th	326	95.86	10.988
Males 10th	345	87.28	11.545
Females 10th	333	94.21	9.421

From the table 1, it is obvious that overall students have positive attitude towards biology as the mean score value indicates (92.49). Females and 9th graders have more positive attitude towards biology than their counter parts as values indicates respectively (95.03, 94.29) and (90.07, 90.68).

Table 2
Correlation of Attitude toward Biology with Achievement across gender and grade

Respondents	N	R	p
Overall	1353	.118	0.000
Male	694	.164	0.000
Female	659	.074	.057
9th	675	0.044	.573
10th	678	.246	0.000

Table 2 indicates that biology attitude and achievement were more significant for males (0.164) and 10th graders (0.246) as compared to females (.074) and 9th graders (0.044) while the over respondents also show the significant relationship i.e.0.118.

Conclusion

This research showed overall positive attitude towards biology among respondents that was similar to Osborne et al., (2003), Nasar (2011) and Oluremi, (2019). Attitude towards biology was more positive for females that contradict the findings of Osborne et al., (2003) and Nasar (2011). Biology attitude scale and achievement showed significant correlation which was similar to Osborne et al., (2003), Nasar (2011) Sarwar, Bashir and Alam, (2017); Ajayi, Kassim, Adewale and Abayomi, (2016) ; Crede and Kuncel, (2008) ; Ogunyemi and Hassan, (2011).; moreover, males have more significant relationship as compared to females which was not aligned with the results of Osborne et al., (2003) and Nasar (2011). Males and 10th graders have more significant relationship as compared to females and 9th graders. The result showed positive attitude was similar to Rani (2000 & 2006), Rana (2002), Anwer, Iqbal and Harison (2012) moreover it is very significant finding, as Navarro, Förster, González and González-Pose, (2016) had indicated that the key role of science education is the development of favorable attitude. Overall attitude of the respondents was positive. These results showed similarity to that of Rani (2000 & 2006), Rana (2002), Anwer, Iqbal and Harrison (2012). These results were very significant for the future studies because the key role of science education in the development not only the favorable attitude but also to develop scientific society. It is an admitted fact which cannot be denied that Science and Technology are the basic pillars for the advancement of a country and any nation can achieve respectable status in the word with the help of Science and Technology. It becomes more valuable for the countries which are striving for best position regarding their development and also for countries facing alarming situation where the interest of the young generation is decreasing in

science related careers as in the case of developed nations having a decrease in enrollment in science related courses (Biology, Chemistry etc.) due to negative attitudes. For, Pakistan it is very hopeful signal to explore that the young generation have positive attitude towards science and can take part to pay back for the development of the country because of the fact that every country needs a number of researchers, engineers and technicians who can work for the improvement of the country. In case of Pakistan the positive attitude towards science is a signal that the students would be trying their best to improve their living standards in the near future to gain a higher status in the society by means of science education and technology. It is an admitted fact that the persons having specializations in the science related careers can get a better status in the society and can earn a handsome amount of money and one can say that they are considered as the white-collar gentry of a developing country. Because from the childhood they are taking into consideration that science is very important for the change in the leaves. In this way the results of this study positive attitude for science is no doubt is a very interesting for the future generation which can take part in the development of any nation. These findings similarity and contradiction with the findings of the following studies. Comprehensive but critical investigation within the researches shows it as problem in classrooms (Kelly,2009), science curriculum can produce positive attitude towards science (Nadirova & Burger,2008). Gender and attitude towards science have no relationship (Waering, 1990) but boys have more positive attitude towards enjoyment, enthusiasm and excitement towards science (Weinburgh, 2000) in science abilities boys were confident than girls. while Iqbal et al., (2008) attitude of girls from urban areas was more positive for girls than boys. More positive effect of women with science related careers as role models on girls' attitude as compared to boys (Smith & Erb, 2006 & 1996). Moreover Anwer (2012), Anwer, Mehmood, Saleem, Akram & Jamil, (2014), Osborne et al., (2000) have found positive correlation between attitude and achievement. The situation turns still more interesting position when it goes across grade, gender, locale and achievement. George, (2006), Anwer et al (2015) studied factors like grade level and Mehmood, Anwer, Khurshid, Bibi, Jamil, Rafi and Ahmad (2015) and Anwer (2012) Rana (2002) studied correlation between attitude, achievement and gender which are the most affecting factors affecting attitude of high school students. In this way findings of the studies dealing with changes in attitude of different age group are not consistent due to different factors which are contextualized. According to Osborne et al. (2003) it is important to study variety of these constructs of attitude to explore it as George (2006) found that students' attitude towards science declines but attitude towards the science utilization increases at secondary level. While on the other hand Francis et al.,(1999) showed no significant difference across ages at13-16 years about the importance of science. But Anwer et al. (2014) have found across grade level from 5th through 10th attitude towards science was positive, females have significant positive attitude than males while no significant differences at locale level. Moreover, use of living organisms and practical work during biology lesson which is being used through in our classrooms may also be supplemented through the use of e-learning in Punjab. Contact through biology career related persons may also be helpful in achieving more positive attitude and achievement relationships. While for implication of the above-mentioned research studies it will be interesting to replicate this research

across nations with different contexts with different populations. The finding was similar to some other studies in which it was mentioned females showed less attitude towards science with respect to males (Yaman & Oner, 2006) while in some other researches these findings were reversed (Akpinar et al., 2009). The higher score of girls on attitude towards science and related fields as compared to boys might be possible as they utilize their time at homes for learning and reading to do work assigned in classes that may result in higher level of science related attitudes as compared to boys. In another study Rana (2002) found that the students having average socioeconomic background showed more score on attitude scale as compared to science students with higher socio-economic background. Even contradiction is there with different subjects as Pehlivan and Koseoglu (2010) showed that parents' socioeconomic status (neither mothers' and fathers educational background nor their employment level) had no significant influence on students' self- concept and attitudes towards biology. Hacieminoglu, (2016) noted that students having positive attitude for science had more preference towards meaningful learning approach and resultantly have high achievement. This research found positive attitude for science which was convenient with Hacieminoglu (2016), Anwar and Bhutta, (2014), Rani (2000 &2006), Rana (2002), Mukhopadhyay ,2014 ; Abell & Lederman ,2007). It was explored that females' science attitude was higher with respect to males which was supported by Hacieminoglu (2016), Anwer and Iqbal (2012). Dissimilar results were also reported in literature with respect to gender as with no gender differences (Dhindsa & Chung, 2003; Miller, Lietz & Kotte, 2002). Usak et al. (2009) reported that significant link for attitudes toward biology with respect to learning achievement, although the correlation was weak. It is also reported that the correlation was not affected by gender (Dwyer & Moore, 2001) but by the students' interest toward the biology program.

Recommendations

Following recommendations were suggested at the end of this study.

- In the schools, biology related culture may favor positive attitude towards it.
- The curriculum developers and its implementers should highlight utilitarian purpose of biology which can improve the positive attitude towards this subject.
- All other stake holders of education system should ensure the achievement in biology by dislodging the negative attitude among students.
- Attitude towards this life sciences subject should be improved through continuous field visits to zoo and farmhouses which would result in best performance of students in this subject.
- Students attitude towards biology and achievement are interrelated with teaching strategies. So, interesting teaching strategies like cooperative learning,

multimedia, hands on activities through graphic organizers can improve both the variables.

- It was recommended that the learning in biology can be effective by improving the teaching methodologies ensuring the use of laboratories.

- For implications of the study it must be conducted on large scale basis.

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