

Factors Affecting the Attitude of Prospective Teachers towards Science

* Sheraz Amjad, MPhil Scholar

** Dr. Iqbal Amin Khan, Lecturer

*** Ayesha Ali



Abstract

Science is known as the mother of all fields. It is the most reliable way to study the natural phenomena objectively. The current study seeks to examine the factors that influence the attitude of prospective teachers toward studying science. The study employed the quantitative (descriptive) approach to obtain the answers to research questions. A sample of 125 prospective teachers was randomly selected from the Department of Education at the University of Malakand. A self-made questionnaire was used to collect data from the sampled prospective teachers (PT). Frequencies, percentage, mean, standard deviation, independent samples *t*-test, One-way ANOVA, and Pearson's coefficient of correlation were used to analyze the collected data. The study results revealed that there was no significant effect of the father's occupation, father's qualification, and mother's occupation, mother's qualification, gender of prospective teachers, and semester in which prospective teachers were studying on the attitude of prospective teachers toward science. The results also revealed that a positive significant relationship was found between the Cumulative Grade Point Average (CGPA) and the attitude of prospective teachers toward science. The prospective teachers having a positive attitude towards science achieved a greater CGPA. It is recommended that a positive and congenial environment be provided at both school and home to develop a positive attitude of prospective teachers toward science. The science curriculum must be enriched with practical activities to attract prospective teachers toward science. Activities like practical work, group work, pair sharing, and presentations may be worthwhile strategies to foster a positive attitude among prospective teachers toward science.

Keywords: Attitude toward Science, Factors Affecting Attitude, Prospective Teachers, Cumulative Grade Point Average, Science Education.

Introduction

Education actively contributes to raising the quality of human resources (Darmaji et al., 2018; Asrial et al., 2019). To save a country it is necessary to raise a generation with a good attitude and the greatest way to do this is through education (Khoiruddin & Sholekah, 2019; Asrial et al., 2019). According to Radhamani (2020), education is any action or experience that fundamentally affects a person's mind, character, or physical capacity. Science as a collection of verified, methodical, and objective knowledge is the key to educating people to be free of preconceptions (Bakircioglu, 2012; Karasar, 1995).

The need for more people to study science has increased as research and technology have advanced, and this is especially true in emerging nations that are vying for recognition in the international world. One of the responsibilities of prospective teachers is to ensure that there is an influx of new scientists and that those pupils have a favorable attitude toward science. It is imperative to contemplate the methods employed in the teaching of science within educational institutions, what factors are influencing prospective teachers' attitudes towards science, and how this strategy influences pupils' readiness to participate actively in their science learning. The importance of attitude in science instruction has been repeatedly shown by research (Joyce & Farenga, 2000; Gardner, 1975; Schibeci & Riley, 1986; Osborne, Simon, & Collins, 2003), which has an impact on students' engagement and interest in science (Simpson & Oliver, 1990; Koballa, Crawley, & Shrigley, 1990; Weinburgh, 1995; Greenfield, 1996;) as well as their progress in science (Linn, 1992).

* Department of Education, University of Malakand Email: sheraz.amjad921@gmail.com

** Department of Education, University of Malakand Email: driqbalaminikhan@gmail.com

*** Department of Education, University of Malakand Email: ayeshaaaali5@gmail.com

Since attitude is a complex concept, there isn't just one definition for it. Various scholars have varied definitions of attitude (Anwer, Iqbal, & Harrison, 2012). Salta and Tzougraki (2004) define attitude as how we sense, act, or contemplate an item within our surroundings. Per Eagly and Chaiken (1993), attitude is a psychological inclination that signifies a person's evaluation of a specific entity, either favorably or unfavorably. They also stated that evaluation is a crucial part of attitude. The evaluation could be of individuals, problems, things, or even occurrences. Entities are referred to as attitude objects when they are evaluated. Furthermore, the term "attitude object" refers to anything that becomes the subject of thought. Attitude objects might be material (like books or newspapers) or ethereal (like knowledge or behavior). A range of stimuli is always used to determine an attitude object (Chaiken & Eagly, 1993). The attitude object "my science teacher," for instance, is seen based on several cues, including his/her name, likeness, and method of instruction. Cognitive, affective, behavioral, or a combination of these characteristics may be used to evaluate individuals, issues, objects, events, and phenomena (Ali & Amanat, 2008). In the work of Johnstone and Reid (1981), attitudes comprise three primary components:

1. Cognitive element (Knowledge)
2. Affective element (Feeling)
3. Behavioral/Conative element (Tendency towards action)

The cognitive element is based on the knowledge we acquire and belief about the fact that we are knowledgeable in that subject and can deliver useful information to someone. It has something to do with "what we know." The emotional aspects of one's relationship with an object are related to the affective element. The affective/emotional component of attitude is expressed, for example, through responses expressed concerning arousal, repulsiveness, love, hate, pleasure, or misery. The behavioral element involves the way we react to certain entities. The result of experience, upbringing, and attitudes has a significant impact on behavior. Although attitudes can change, they are typically persistent. The direct observation of the attitude is not possible because it is a hypothetical construct. Bennett (2003) asserts that a person's attitude towards science is influenced by the ideas and perceptions they have about it as a result of their interactions with various circumstances. An orientation to science is understood as a level of interest in or emotional disposition toward the subject. According to Yara (2009), the pupils tend to love or hate science.

The following ideas have all been incorporated into the complicated concept of attitude toward science at various points in time:

- Demonstrating favorable attitudes towards science and scientists,
- Experiencing satisfaction in science learning,
- Cultivating interests in science and related pursuits,
- Nurturing a desire to pursue a career in science or a closely associated field.

According to Cermik and Fenli-Aktan (2020), it's crucial to produce a generation of productive and inquisitive people as well as people who have positive attitudes toward science. Additionally, they said that it is probable through examining pupils' attitudes towards science beginning at an early age and attempting to remove those problematic components that change pupils' attitude towards science from positive to negative or which can decrease the positive attitude of pupils towards science, if any. It is important to emphasize that prospective teachers should be aware of their roles to raise an inquiring, productive generation, and pupils who have favorable attitudes towards science. The usual tendency of pupils' views toward the importance of science was reported to be positive in the George (2003) study, which examined how students' views on the significance of science changed throughout their middle and high school years. Another study, however, found that between the ages of 10 and 14, pupils' opinions on science and technology start to take shape and that this has a substantial impact on students' future career choices, with students' attitudes towards science and technology progressively increasing adversely as they get older (Osborne, 2003). Likewise, Kapici and Akcay (2016) found that the attitude of students toward science increases negatively with grade level, while it was found in a different study that attitudes of the students toward science deteriorated throughout secondary education (George, 2000). Although Cermik and Fenli-Aktan (2020) believe while students generally exhibit favorable attitudes toward science in their younger years, there is an emphasis on the importance of cultivating and strengthening these positive attitudes as they progress through their academic journey. To produce a generation of productive, and to

nurture an environment for curious and optimistic students with a positive stance toward science, it is essential to ascertain the factors influencing the attitudes of prospective teachers toward science.

Statement of the Problem

Previous research conducted in the area of science has cited various factors responsible for influencing attitude. Previous research studies have found that demographic variables such as gender, qualification of parents, socioeconomic status, parental education, grades, and age have positive effects on shaping the attitude of students towards science (Greenfield, 1996; Mordi, 1991; Okebukola & Jegede, 1990; Schibeci & Riley, 1986; Stables, 1990; Ye, Wells, Talkmitt, & Ren, 1998). Walberg (1984) has pinpointed nine distinct variables shaping students' attitudes toward science, including "student ability, maturity, motivation, quality and quantity of instruction, home and classroom psychological environments, outside-of-classroom peer groups, and amount of time spent watching video/television media" (p. 19-27).

According to Schibeci and Riley (1986), factors such as gender, ethnicity, parental education, home environment, and the quantity of schoolwork had an impact on pupils' attitudes towards science. The curriculum plays a role in shaping students' attitudes toward science (Nieswandt, 2005; Osborne, Simon, & Collins, 2003). Conversely, some studies have shown that a science teacher's personality and attitude play a big part in molding students' attitudes toward science (McMillan, & May, 1979). According to Jegede and Fraser (1989), there is a connection between socio-cultural elements and attitudes towards science. The socioeconomic level of the parents, students' self-concept, and gender are all significant influences on people's attitudes toward science (Rana, 2002). Some other studies have also found a positive significant relationship between students' attitudes towards science and the extent of the degree of students' interest and enjoyment (Bennett, 2001; Haussler, 1987; Zembylas, 2005).

Hence, there is a significant amount of literature that investigated the attitudes of students and individuals toward science in developed countries. Most of the studies have been conducted at the school level, and in developed countries, however, the findings of these studies cannot be generalized to the local setting of Pakistan, because of social, cultural, and ideological factors. A scarcity of scientific literature exists that investigates the influential factors affecting the attitude of prospective teachers toward science at both national and local levels. Addressing this gap, the study aims to identify the key factors shaping the attitudes of prospective teachers toward science.

Study Objectives

1. Examine the impact of specific demographic variables on prospective teachers' attitudes toward science.
2. Explore the various factors influencing the attitudes of prospective teachers toward science.
3. Identify factors that positively contribute to the prospective teachers' attitudes toward science.
4. Identify factors that negatively influence prospective teachers' attitudes toward science.

Research Questions

According to the purpose, the research questions include:

- What factors influence the attitudes of the prospective teachers toward science?
- What factors contribute positively to the attitudes of prospective teachers toward science?
- What factors contribute negatively to the attitudes of prospective teachers toward science?

Study Significance

The study results would be beneficial mainly to educators, administrators, science curriculum makers, and the Higher Education Commission (HEC) of Pakistan. If prospective teachers are familiar with the factors affecting attitudes toward science, they will be able to raise generations and individuals who have positive attitudes toward science. The study results can also be beneficial in ensuring the maximum learning of students in the subject of science. Similarly, curriculum makers in the subject of Education will focus on those factors that develop positive attitudes of prospective teachers towards science. Moreover, administrators in higher educational institutions will also benefit from the results of the study, as they will design and implement policies to make such an environment in the classrooms where all those factors will be focused which develops the positive attitude of prospective teachers towards science. The HEC of Pakistan may arrange training, seminars, and workshops for educators regarding the factors influencing the attitudes of prospective teachers toward science.

Scope and Boundaries of the Study

Given time and resource constraints, the study focused exclusively on students enrolled in the Department of Education at the University of Malakand. The researchers used a self-constructed questionnaire related to factors affecting the attitude of prospective teachers toward science for the collection of data.

Methodology

The study employed a quantitative research approach. This descriptive research aimed to gather pertinent and accurate data regarding the state of the phenomena and whatever broad generalizations might be made about the known facts. The study population comprised all student teachers (both male and female) of the Department of Education at the University of Malakand during the academic year 2022-23. All students enrolled in the Department of Education at the University of Malakand during this specific academic year were included in the study. There were a total of 237 students enrolled in the BS program during the academic year 2022. From these 237 students of the BS program, 125 students from the semesters 1st, 3rd, 5th, and 7th were selected conveniently as samples of the study.

Data from the chosen sample was gathered using a self-made questionnaire as the study tool. Questionnaires were thought to be the ideal instrument for gathering data because of the large sample size. After reviewing the relevant literature, which includes books, papers, magazines, articles, and journals, the research tool was created. The questionnaire was developed utilizing a five-point Likert scale.

For pilot testing, a questionnaire consisting of 09 constructs and 54 items was developed and 30 respondents identical to the sample of the study were selected. The researcher personally met the respondents. Considering the outcomes from the pilot testing of the questionnaire, the questionnaire was improved and finally, 04 constructs and 42 items were finalized for the collection of data.

A panel of four experts was invited to assess the questionnaire's validity. These individuals had Ph.D. degrees and adequate teaching and learning experience in the subject of social sciences at different departments of the University of Malakand. They were requested to critically analyze the research instrument. The reliability of the questionnaire was assessed through Cronbach's alpha, yielding a value of (.90). This value showed that the instrument is excellent and highly reliable.

Structure of the Questionnaire

The researcher used a self-constructed questionnaire having two parts for data collection. The first part of the questionnaire consisted of demographic variables; (Age, Semester, CGPA, Gender, Father's Occupation, Father's Qualification, Mother's Occupation, and Mother's Qualification). The second part of the questionnaire consisted of factors affecting the attitude of prospective teachers towards science which utilized a five-point Likert scale, ranging from “Strongly Disagree” to “Strongly Agree” with point value “1” to “5”.

The researcher constructed a questionnaire for the variable “Factors Affecting the Attitude of Prospective Teachers towards Science” which consisted of 04 constructs and 42 items. The 1st construct was about “Students’ Interest, Age, Ability, Maturity, and Motivation” and consisted of 12 items, the 2nd construct was about “Economic status of the family, Parental Education, Environment at home, and the Amount of Home Work” and consisted of 09 items, the 3rd construct was about “Classroom Environment, Quality of Instructions, Peer Group Work, Practical Work in Science, and the Effects of Curriculum” and consisted of 10 items and the 4th construct was about “Personality and Behavior of Science Teacher, Watching Science Programs, Students’ Self-concept, and Science Career Interest” and consisted of 11 items, as follows:

Table 1: Structure of the Questionnaire

S. No	Items related to various factors affecting student teachers’ attitudes towards science (Constructs)	Number of items
1.	Personal factors	12
2.	Socio-economic Factors	09
3.	Factors Related to Classroom Working Environment and Instructional Strategies	10
4.	Factors related to the Personality and Behavior of Science Teachers during Instruction	11
Total number of items		42

Data Collection

To collect data from selected respondents, the researchers personally visited the department. The researchers requested the head of the department to give consent to the respondents for data collection. The researchers requested the respondents to fill out the questionnaire based on the mentioned directives. The researchers collected data from 125 respondents.

Data Analysis

The data collected with the help of the aforementioned research questionnaire was compiled, analyzed, and then interpreted in light of the study's objectives. The responses obtained through the aforementioned research questionnaire were scored before statistical analysis and interpretation. The collected data were faded in Statistical Package for the Social Sciences (SPSS) software version 22.0. SPSS is computer software employed for the analysis of data in social sciences.

The data were analyzed by using descriptive statistics such as frequency, percentage, mean, and standard deviation, and inferential statistics such as independent samples t-test, One-way ANOVA, and coefficient of correlation. The perceptions of respondents regarding factors affecting the attitude of prospective teachers toward science were analyzed by using frequency, percentage, mean, and standard deviation scores, while independent samples t-test and One-way ANOVA to check the selected demographic effect on the dependent variable and coefficient of correlation were employed to explore the relationship between selected demographic variables on dependent variable i.e., "Factors Affecting Attitude of Prospective teachers towards Science".

Analysis and Interpretation of Data

Demographic Information of the Respondents

Table 2: Sample Profile of the Respondents

Gender	Frequency	Percent
Male	49	39.2
Female	76	60.8
Total	125	100
Average Age of the Respondents	23	100
Semester in which Students Studying		
1 st	40	32
3 rd	27	21.6
5 th	28	22.4
7 th	30	24
Total	125	100

The above table revealed the information regarding the sample profile of the students. Out of 125 respondents, 39.2 percent of students were female and 60.8 percent were male. The average of the prospective students was 23 years. Among 125 sampled students, 32 percent were studying in 1st semester, 21.6 percent were studying in 3rd semester, 22.4 percent were studying in 5th semester and 24 percent students were studying in 7th semester.

Analysis of the Perceptions of the Respondents towards the Factors Affecting Attitude of Prospective Teachers towards Science

Table

Perceptions of the Respondents towards the Factors Affecting Attitude of Prospective Teachers towards Science

Constructs	Mean	Standard Deviation
Personal factors	3.58	0.80
Socio-economic Factors	3.26	0.97
Factors Related to Classroom Working Environment and Instructional Strategies	3.71	0.92
Factors related to the Personality and Behavior of Science Teachers during Instruction	3.40	0.86
Grand Mean and Standard Deviation scores	3.48	0.74

Note: The cutoff point was 3.00.

The above table revealed the perceptions of prospective teachers regarding the various factors affecting their attitude toward science. The mean and standard deviation scores (3.58 > 3.00) revealed that personal factors related to prospective teachers had an above level of observance effect on their attitude towards science. In the same way, they perceived that socioeconomic factors (3.26 > 3.00), factors related to classroom working environment and instructional strategies used by science teachers

(3.71 > 3.00), and factors related to personality and behavior of the science teachers (3.40 > 3.00) also had above the level of observance effect on their attitude towards science.

Table

Effects of Father's Occupation on the Attitude of Prospective Teachers towards Science

Father Occupation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1196.450	3	398.817		
Within Groups	26118.785	89	408.106	.977	.409
Total	27315.235	92			

The above table depicts the effect of the father's occupation on the attitude of prospective teachers towards science. The value of ANOVA was found greater than that of the value of the level of significance (0.409 > 0.05). The value of F-statistics showed that there is no significant of effect of the father's occupation on the attitude of prospective teachers towards science.

Table

Effects of Father Qualification on the Attitude of Prospective Teachers towards Science

Father Level of Qualification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3528.690	8	441.086		
Within Groups	23786.545	84	403.162	1.094	.380
Total	27315.235	92			

The above table depicts the effect of a father's qualification on the attitude of prospective teachers towards science. The value of ANOVA was found greater than that of the value of the level of significance (0.380 > 0.05). The value of F-statistics showed that there is no significant of effect of the father's qualification on the attitude of prospective teachers towards science.

Table

Effects of Mother's Occupation on the Attitude of Prospective Teachers towards Science

Mother Occupation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	578.383	2	289.191		
Within Groups	26736.852	90	411.336	.703	.499
Total	27315.235	92			

The above table depicts the effect of a mother's occupation on the attitude of prospective teachers towards science. The value of ANOVA was found greater than that of the value of the level of significance (0.499 > 0.05). The value of F-statistics showed that there is no significant effect of a mother's occupation on the attitude of prospective teachers toward science.

Table

Effects of Mother Qualification on Attitude of Prospective Teachers towards Science

Mother Level of Qualification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	581.950	6	96.992		
Within Groups	26733.285	86	438.251	.221	.968
Total	27315.235	92			

The above table depicts the effect of a mother's qualification on the attitude of prospective teachers towards science. The value of ANOVA was found greater than that of the value of the level of significance (0.409 > 0.05). The value of F-statistics showed that there is no significant of effect of a mother's qualification on the attitude of prospective teachers toward science.

Table

Effect of Semester on the Attitude of Prospective Teachers towards Science

Semester	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3007.907	4	751.977		
Within Groups	24307.329	88	385.831	1.949	.113
Total	27315.235	92			

The above table depicts the effect of the semester in which students study on the attitude of prospective teachers towards science. The value of ANOVA was found greater than that of the value of the level of significance (0.113 > 0.05). The value of F-statistics showed that there is no significant of effect of students' studying on the attitude of prospective teachers towards science.

Table
Effects of Gender on the Attitude of Prospective Teachers towards Science

Gender	N	Mean	Std. Deviation	Std. Error Mean	t	p
Male	49	141.63	28.89	6.16		
Female	76	151.43	13.62	2.00	1.909	0.06

df= 123 Level of Significance= 0.05

The above table depicts the effect of gender on the attitude of prospective teachers towards science. The value of t-statistics was found greater than that of the value of the level of significance (0.06 > 0.05). The value of t-statistics showed that there is no significant effect of students' gender on the attitude of prospective teachers towards science.

Table
Relationship between Age, CGPA, and the Attitude of Prospective Teachers towards Science

Variables	Co-efficient Correlation	of	Age	CGPA	The attitude of Prospective Teachers towards science
Age	Pearson Correlation Sig. (2-tailed) N		1 123		
CGPA	Pearson Correlation Sig. (2-tailed) N		.027 .814 104	1	
The attitude of Prospective Teachers towards science	Pearson Correlation Sig. (2-tailed) N		.119 .340 91	.294* .026 82	1

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

The above table shows the relationship between the age, CGPA, and attitude of prospective teachers towards science. The value of the coefficient of correlation showed that there was a non-significant correlation between the age and CGPA of students ($r = .027$). Similarly, the value of the coefficient of correlation showed that there was a non-significant weak correlation between CGPA and the attitude of students towards science ($r = .119$). The value of the coefficient of correlation showed that there was a significant positive weak relationship between the CGPA and the attitude of prospective teachers towards science ($r = .29$).

Discussions

The current study aimed to investigate the factors affecting the attitude of prospective teachers towards science. The results revealed that there were four major factors including personal factors, socio-economic factors, factors related to classroom working environment and instructional strategies, and factors related to the personality and behavior of the science teachers which affect the attitude of prospective teachers towards science. The results also found no significant effect of parents' qualifications and occupation on the attitude of prospective teachers' attitudes towards science. Similarly, no significant effect of gender and semester in which prospective teachers are studying was found on their attitude towards science. The results found no significant relationship between age and prospective teachers' attitudes towards science. Similarly, no significant weak relationship was found between CGPA and the age of prospective teachers. The study found a significant positive relationship between CGPA and student attitude towards science of prospective teachers.

According to Cermik and Fenli-Aktan (2020), it's crucial to produce a generation of productive and inquisitive people as well as people who have positive attitudes toward science. Furthermore, they suggested that early intervention in assessing students' attitudes toward science could involve identifying and addressing potential factors that may shift attitudes from positive to negative or diminish the overall positive stance.

Numerous factors contribute to students' attitudes toward science, as indicated by research in science education. The findings from the present study indicate that the father's occupation, father's qualification, mother's occupation, and mother's qualification, semester, and gender do not exert any significant effects on the attitude of prospective teachers towards science. These results are opposite to the results of the studies that have linked the attitude of individuals with parental education (Mordi, 1991), socio-economic status (Okebukola & Jegede, 1990; Rana, 2002), grade (Ye, Wells, Talkmitt,

& Ren, 1998), and gender (Schibeci and Riley, 1986; Greenfield, 1996; Schibeci & Riley, 1986; Stables, 1990).

Furthermore, the findings of the current study reveal a correlation between the attitude of prospective teachers toward science and age. The attitude of prospective teachers toward science demonstrates an increase corresponding to age progression. These results are similar to those of You, Wells, Talkmitt, and Ren (1998), Cermik, & Fenli-Aktan, (2020), who have linked the attitude of individuals towards science with age. Likewise, the findings indicate a connection between the attitude of prospective teachers toward science and CGPA. As academic performance (CGPA) rises, the attitude of prospective teachers toward science also demonstrates an increase.

Conclusions

The study explored factors influencing prospective teachers' attitudes toward science. Based on findings, it was concluded that among the demographic variables, students' gender, age, semester in which students are studying, father's occupation, father's qualification, mother's occupation, and mother's qualification did not significantly affect the attitude of prospective teachers toward science. Notably, gender and CGPA emerged as the key factors associated with the development of positive attitudes among prospective teachers toward science.

Recommendations and Suggestions

It is recommended to organize training, workshops, and seminars to train parents, teachers, and administration of higher educational institutions to provide a conducive environment at home and in the classroom to prospective teachers. A culture of recognition, encouragement, and reward should be promoted to develop positive attitudes in prospective teachers towards science. It is also recommended to include interesting topics, facts, and knowledge in the science curriculum. Prospective teachers must spend time watching science-related programs so that they can build a self-concept about science. Likewise, peer groups and practical work in science subjects contribute significantly to fostering a positive attitude toward science. It is recommended that peer groups and practical work in science should be encouraged among prospective teachers. In the current study, the researcher adopted a quantitative research design. It is recommended to employ a qualitative research design to assess the factors influencing prospective teacher's attitudes toward science. Likewise, a self-constructed research questionnaire was used in the study. It is suggested to adopt different research instruments to collect data from the respondents. Furthermore, the study's sample was restricted to students enrolled at the Department of Education, University of Malakand. It is suggested to include more respondents from different universities, departments, and geographical areas.

References

- Ali, A. A. (2008). *Perceptions, difficulties, and working memory capacity related to mathematics performance* (Doctoral dissertation, University of Glasgow).
- Anwer, Iqbal, & Harrison. (2012). Students' Attitude towards Science: A Case of Pakistan Pakistan. *Journal of Social and Clinical Psychology, 10*(1), 3-9.
- Asrial, Syahrial, D. A. Kurniawan, & R. Septiasari. (2019). Relationship of pedagogical competence and science competency of elementary school teacher education (in Bahasa). *Pedagogia: Jurnal Pendidikan, 8*(2), 149-156.
- Kurniawan, D. A., Astalini, A., & Sari, D. K. (2019). An evaluation analysis of students' attitude towards physics learning at senior high school. *Jurnal penelitian dan evaluasi pendidikan, 23*(1), 26-35.
- Bakırcıoğlu, R. (2014). *Ansiklopedik eğitim ve psikoloji sözlüğü*. Nostalji.
- Bennett, J. (2003). *Teaching and learning science*. New York: Continuum.
- Cermik, H., & Fenli-Aktan, A. (2020). Primary school students' attitudes towards science. *International Journal of Educational Methodology, 6*(2), 355-365.
- Darmaji, D. A. Kurniawan, H. Parasdila, & Irdianti. (2018). Description of science process skills' physics education students at Jambi University in temperature and heat materials. The USA. *The Educational Review, 2*(9), 485-498.
- Denessen, E., Vos, N., Hasselman, F., & Louws, M. (2015). The relationship between primary school teacher and student attitudes towards science and technology. *Education Research International, 2015*, 1-7.
- Eagly, A., & Chaiken, S. (1998). Attitude structure. *Handbook of Social Psychology, 1*, 269-322.
- Gardner, P. L. (1975). Attitude to science: A review. *Studies in Science Education, 2*, 1-41.

- George, R. (2000). Measuring change in students' attitudes toward science over time: An application of latent variable growth modeling. *Journal of Science Education and Technology*, 9(3), 213-225.
- George, R. (2003). Growth in students' attitudes about the utility of science over the middle and high school years: Evidence from the Longitudinal Study of American Youth. *Journal of Science Education and Technology*, 12(4), 439-448.
- Greenfield, T. A. (1996). Gender, ethnicity, science achievement, and attitudes. *Journal of Research in Science Teaching*, 33(8), 901-933.
- Hausler, P. (1987). Measuring students' interest in physics—Design and results of a cross-sectional study in the Federal Republic of Germany. *International Journal of Science Education*, 9, 79-92.
- Jegede, O. J., & Fraser, B. (1989). Influence of social-cultural factors on secondary school students' attitude towards science. *Research in Science Education*, 19(1), 155-163.
- Johnstone, A. H., & Reid, N. (1981). Toward a model of attitude change. *European Journal of Science Education*, 3(2), 205-212.
- Joyce, B. A., & Farenga, S. J. (2000). Young girls in science: Academic ability, perceptions, and future participation in science. *Roper Review*, 22(4), 261-262.
- Kapici, H.O., & Akcay, H. (2016). Middle school students' attitudes toward science, scientists, science teachers, and classes. *The Asia-Pacific Forum on Learning and Teaching*, 17(1), 1-22.
- Karasar, N. (1995). Bilimsel arastirma yontemi. *Scientific research method. 3A Research Education and Consultancy*.
- Koballa, E. R. Jr., Crawley, F. E., & Shrigley, R. L. (1990). A summary of science education-1988. *Science Education*, 74(3). 253-256.
- Linn, M. C. (1992). Science education reform: Building the research base. *Journal of Research in Science Teaching*, 29, 821-840.
- Khoiruddin, M. A., & Sholehah, D. D. (2019). Implementasi Pendidikan Agama Islam Dalam Membentuk Karakter Religius Siswa. *PEDAGOGIK: Jurnal Pendidikan*, 6(1), 123-144.
- Mcmillan, J. H., & May, M. J. (1979). A study of the factors influencing attitudes toward science of junior high school students. *Journal of Research in Science Teaching*, 16, 217-222.
- Mordi, C. (1991). Factors associated with pupils' attitudes towards science in Nigerian primary schools. *Research in Science and Technological Education*, 9, 39-49.
- Nieswandt, M. (2005). Attitudes toward science: A review of the field. *Beyond Cartesian dualism: Encountering affect in the teaching and learning of science*, 41-52.
- Okebukola, P. A. O., & Jegede, O. J. (1990). Eco-cultural influences on students' concept attainment in science. *Journal of Research in Science Teaching*, 27(7), 661-669.
- Osborne, J., Simon, S., & Collins, S. (2003). Attitude towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049-1079.
- Radhamani. (2020). The Attitude of Urban and Rural Adolescents towards Science. *Bhartiyam International Journal of Education & Research*, 1(7), 1-18.
- Rana, R. A. (2002). *Effect of parents, socioeconomic status, students, self-concept, and gender on science-related attitudes and achievement* (Doctoral Thesis). Institute of Education and Research, University of the Punjab, Lahore.
- Salta, K., & Tzougraki, C. (2004). Attitudes toward Chemistry among 11th grade students in high schools in Greece. *Science Education*, 88(4), 535-547.
- Schibeci, R. A., & Riley, J. P. (1986). Influence of students' background and perceptions on science attitudes and achievement. *Journal of Research in Science Teaching*, 23(3), 177-187.
- Simpson, R. D., & Oliver, J. S. (1990). A summary of major influences on attitude towards and achievement in science among adolescent students. *Science Education*, 74(1), 1-18.
- Stables, A. (1990). Differences between pupils from mixed and single-sex schools in their enjoyment of school subjects and their attitudes to science and school. *Educational Review*, 42(3), 221-230.
- Walberg, H. J. (1984). Improving the productivity of American schools. *Educational Leadership*, 41, 19-27.
- Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of literature from 1970 to 1991. *Journal of Research in Science Teaching*, 32(4), 387-398.

- Yara, O. P. (2009). Students' attitude towards mathematics and academic achievement in some selected secondary schools in South Western Nigeria. *European Journal of Scientific Research*, 36(3), 336-341.
- Ye, R., Wells, R. R., Talkmitt, S., & Ren, H. (1998). Student attitudes toward science learning: A cross-national study of American and Chinese secondary school students. *ERIC*.
- Zembylas, M. (2005). Three perspectives on linking the cognitive and the emotional in science learning: Conceptual change, socio-constructivism, and poststructuralism. *Studies in Science Education*, 41, 91-116.