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ANALYSIS OF SCIENCE EDUCATION AT SECONDARY SCHOOL LEVEL IN DISTRICT ZIARAT

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Abstract
The importance of science education cannot be denied. The purpose of the study is to analyze science education at secondary level in District Ziarat, Balochistan. A mixed method consisting of quantitative and qualitative methods was adopted for conducting the study. The researcher collected the data with the help of questionnaire and semi-structured interview. The structured and closed ended questionnaire consisted of demographic questions and a 5-point likeret scale questions. The questionnaire was distributed among 330 male and female students of the secondary classes of both Government and Private schools located in the urban and rural areas of District Ziarat. It was filled out by 327 (99 percent) students studying in Class IX and X. The semi-structured interviews were held with 28 secondary school science teachers of different schools of District Ziarat. The quantitative data obtained through questionnaire were analyzed with the help of SPSS (Version 21) whereas thematic analysis was used for the interpretation of the semi-structured interview. The study discovered that majority of the secondary schools of District Ziarat do not have well-equipped science laboratory. The quality of the science textbook is also very poor as they contain outdated and irrelevant contents. It was also discovered that the teaching methodologies used by the science teachers are out-fashioned. The science teachers do not conduct regular science experiment. Technology is also not incorporated in the provision of science subjects. There are several challenges faced by students and teachers in the secondary schools of Ziarat. Language barriers, Class size issues, and shortage of qualified science teachers are the challenges. The quality of science education in Ziarat can be improved with the help of certain measures.

INTRODUCTION

The significance of science education in human history is irrefutable. It was science education that laid the foundations of scientific revolution and technological revolution in human history (Zakaria, 2024). The nations that paid special attention to science education were able to dominate other nations. European nations were able to colonize other nations due to the advancement in the science education (Harari, 2024). Great Britain was superpower in 19th Century due to its advancement in science education (Kennedy, 2022). The United States of America was able to replace Great Britain as global Hageman due to its advancement in science education. USSR's rapid advancement in science education enabled it to compete with the USA during cold war (1945-1991). The emergence of China is also attributed to its

advancement in science education (Miller, 2024).

Science education is the secret of development and prosperity of any nation in twenty-first century (Dercon, 2022). The development and prosperity of Japan is attributed to its focus on science education. Science education is key factor that has put the nations of West Europe and North America on the path of development and prosperity. On the other hand, the nations that failed to prioritize science education also failed to witness prosperity and development. The backward and developing nations of Asia and Africa are examples in this regard (Acemoglu & Robinson, 2022).

Science education benefitted human beings in multiple ways. The improvement of average human life expectancy in various parts of the world is rightly associated with science education. The advancement in science education resulted in the comfortable and luxurious life for human beings in different countries of the world (Harari, 21 Lessons for the 21st Century, 2021). Science education benefitted human beings by reducing the infant mortality rate all over the world. It also reduced maternal mortality rate in different countries of the world (World Health Organization, 2024).

Science education is of vital significance in the twenty-first century. It is necessary for scientific and technological advancement. Artificial Intelligence (AI), Robotics, Cloud Computing, and Biotechnology are among the emerging fields in the twenty-first century. These fields are going to cause drastic changes in human life. All these fields are based on science education (Suleman & Bhaskar, 2023). Science education is required for all the scientific and technological inventions. History reveals that all discoveries, inventions, and innovations in human history have one thing in common, that is, science education (Kurzweil, 2024).

Science education has the potential to improve human life. An individual, family, and community can witness prosperity with the help of science education. Science education uplifted millions of human beings out of the poverty line in various countries of the world (Husain, 2023). The reduction of hunger, absolute poverty, and inequality in different parts of the world is attributed to science education (United Nations Organization, 2024). Science education improves the living standard of the people. The students who study Science, Engineering, and Technology, Modern Arts, and Mathematics (STEAM) education are able to witness social mobility very easily. They are highly paid individuals in the society because STEAM education makes them highly productive (Banuri, 2023).

1.1. Background of the Study

Pakistan is a federation where Balochistan is one of the federating units of Pakistan (Khan, 2023). It is the most backward federating unit due to lower socio-economic status of the people (Bengali, 2024). The adult literacy rate in Balochistan is much lower than that of other federating units of Pakistan. The percentage of out of school children in Balochistan is also higher than that of other provinces (Government of Pakistan, 2024). Absence of school infrastructure, teachers' absenteeism, out of school children, learning poverty, gender inequality in education, and absence of good governance in education are some of the problems that deteriorate the situation of education in Balochistan (Siddiqui, 2023).

Ziarat is a district in province Balochistan (BHC, 2024). It is one of the most backward and under-developed districts of the province despite the fact that it has natural sites for tourism. The infrastructure is very poor in the district. The situation of education is also not satisfactory. The schools located in Ziarat lack basic facilities like clean drinking, latrine, boundary wall, sports ground and adequate classrooms. Learning poverty, out of school children, and higher school dropouts are common in Ziarat (Altaf, 2021).

Science students in different schools of Ziarat face different issues and challenges. The absence of science labs in schools, unfriendly school environment, and absence of friendly relationships between teachers and students in school have negative influence on the science education of the students (McFarlane, 2023).

1.2. Benefits of Studying Science at Secondary School Level in Pakistan

There are many benefits of studying science at the secondary school level in Pakistan. The

students who study science subjects at school level are able to solve real world problems in better way because science enables them to do so. In fact, science subjects promote logical reasoning among the students. They also enhance the critical thinking skills of the students. Resultantly, the students are able to solve the real world problems easily as compared to the students who do not study science at school level (Amos & Reiss, 2022).

The students who study science subjects at secondary school level in Pakistan are able to pursue their career in Science, Technology, Engineering, and Mathematics (STEM) (Husain, Governing the Ungovrnable, 2022). In fact, science provides a solid base to the students who want to become doctors, engineers, information technology experts, and scientists in their career. Science subjects enable the students to become successful in the STEM-related fields in accordance with the needs of the twenty-first century (Hali, 2021).

Studying science at secondary school level is beneficial for the students to gain technological literacy. There are no two opinions that the twenty-first century is the century of technology. The students who do not have technological literacy find it very difficult to survive in the competitive market. The students who study science at school level find it very easy to become aware of the use of technology (Harari, 21 Lessons for the 21st Century, 2021).

The students who study science subjects at secondary school level are able to play an essential role in the national development. They are able to pursue careers that contribute in the development of the nation. In fact, science subjects produce skilled professionals who have the capacity to contribute in the different fields like agriculture, industry, and healthcare. Science subjects also prove helpful in generating skilled workforce that plays vital role in the national development of any country including Pakistan (Acemoglu & Robinson, 2022).

1.3. Major Challenges faced by Science students in Pakistan

There are many serious challenges that the science students face in Pakistan at every level including the secondary school level (Haider, Ahmad, & Ali, 2024). Outdated curriculum is one of those challenges that the Pakistani students face when they study science in the educational institutes of Pakistan. The outdated curriculum fails to incorporate modern scientific concepts. The integration of technology also does not take place in science subjects due to the outdated curriculum taught in the secondary schools of Pakistan (Faize, 2021).

Another challenge that is faced by the science students in Pakistan is shortage of the qualified science teachers in schools. The education sector of Pakistan is not attractive for the qualified and well-trained scientific professionals due to lower financial benefits. The qualified individuals do not pursue career in education section. As a result, there is a severe shortage of the qualified teachers. Consequently, the students are unable to learn science subjects in modern method due to lack of qualified science teachers in the educational institutes of Pakistan (Altaf, 2021).

One of the key challenges faced by the science students of the secondary schools in Pakistan is the lack of laboratory facility. There is little disagreement with the fact that many schools in the backward and rural areas of Pakistan do not have well-equipped laboratory facilities. As a result, the students are unable to perform practical work which is the essential part of science subjects. The students are unable to learn science when they are not provided the chance to perform the school practical. Science can be better understood when the practical work is equally given importance at the secondary school level in Pakistan. Moreover, many school laboratories do not have sufficient materials even in the urban area secondary schools of Pakistan (Banuri, 2023).

Rote learning culture is also a major challenge for the science students of the secondary school level in Pakistan. Unfortunately, rote learning culture is common in Pakistan. The students are compelled to memorize the study materials. As a result, the critical thinking skills of the students are badly damaged. Many Pakistan students fail to apply their science subjects on real life problems due to the widespread rote learning culture in the educational institutes of Pakistan. It is the rote learning culture that reduces the analytical skills of the school students in different schools of Pakistan (McFarlane, 2023).

Lack of sufficient funding for science education at secondary school level is also a key challenge faced by the Pakistani students. It is unfortunate fact that Pakistan does not spend enough resources on education. The budget allocated for education is not spent honestly due to widespread corruption and lack of good governance. The shortage of resources badly impacts the academic performance of the science students who do not have the equipments for performing scientific experiments at secondary school level (Akram, 2021).

Gender inequality is also one of the challenges faced by the science students at the secondary school level in Pakistan. Unfortunately, female students face relatively more challenges in the attainment of science education due to their gender in Pakistan. They have to manage both studies and domestic work in many areas of Pakistan. Resultantly, their studies are badly impacted. Moreover, Pakistani girls are under the social pressure due to the gender. They are compelled for early marriages, especially, in the rural and backward areas of the country. Their studies are impacted due to their early marriages (Malik, 2022).

The huge gap between the secondary schools of urban area and rural area of Pakistan is another challenge for the science students. The urban area schools have modern facilities whereas the rural areas schools lack those facilities. The students in the urban areas have access to science labs while the students of the rural areas do not have enough access to science labs. The urban area students have access to well-qualified teachers who teach private tuitions whereas the students of the rural areas are deprived of this facility. Resultantly, the students of the rural areas leg behind in the attainment of science education in Pakistan (Akram, 2021).

1.4. Statement of the Problem

As science education is very important, it is necessary to assess science education in the secondary schools of District Ziarat. The determination of current methodologies used for imparting science education to secondary school students in Ziarat is significant for assessing science education in Ziarat. The presence or absence of different facilities in the secondary schools of Ziarat also helps in the determination of status of science education in Ziarat. The number of science teachers, presence or absence of science labs, the use of science labs and instruments for conducting experiments, and the atmosphere of school are helpful in the determination of science education in the secondary schools of Ziarat. The learning outcomes of science students can also be explored with the assessment of science education. This assessment is vital for determining the challenges faced by the students and teachers in the attainment of science education by the secondary school students of Ziarat.

1.5. Objectives of the Study

1. To observe the presence of different facilities for the provision of science education to the secondary school students in District Ziarat.
2. To investigate the effectiveness of different methodologies used by the teachers for imparting science education to the students in District Ziarat.
3. To explore various challenges faced by the students and teachers in the attainment of science education in the secondary schools of District Ziarat.

1.6. Research Questions

1 What is the status of presence of different facilities for the provision of science education to the secondary school students in Ziarat?

2 What are the main methodologies used for the provision of science education in the secondary school of Ziarat?

3 What is the effectiveness of different methodologies used by the teachers for imparting science education to the students in Ziarat?

4 What are the main challenges faced by the students and teachers in the attainment and provision of science education to the secondary school students in Ziarat?

1.7. Conceptual Framework

There are two types of major variables in this study. Independent variables are the factors that influence other factors while the dependent variables are the factors that are influenced when changes in the independent variables take place.

Teaching methodology, availability of learning resources like science labs, equipments, access to textbook, technology and online resources, teacher competency and training, student engagement and socioeconomic background, and curriculum and policy implementation constitute the independent variables in this study. On the other hand, science education quality and student performance like student achievement in science subjects, conceptual understanding and problem-solving skills, interest and motivation in science learning, and higher-order thinking and practical application of scientific concepts are among the dependent variables that are influenced by independent variables in this study.

1.8. Significance of the Study

This study may prove helpful in finding out the absence of the basic facilities required for science education in the secondary schools of District Ziarat. It may attract the attention of the policymakers and the relevant stakeholders to take practical steps for the provision of the science facilities like the establishment of science labs, the provision of science equipments and the integration of technology for the school for the provision of science education to the students of District Ziarat. The study may also identify the flaws in the teaching methodologies used by the science teachers. This study may also point out the effectiveness of the teaching methodologies used by science teachers in the secondary schools of District Ziarat. This study may identify the challenges faced by the science students and teachers in the secondary schools of District Ziarat. It may also attract the attention and focus of the relevant authorities for the reduction of the challenges so as to pave the path for the better provision of the quality science education at the secondary schools in District Ziarat.

LITERATURE REVIEW

Hofstein and Lunetta (2024) explored the significance of science lab in school. The study revealed that science labs were of vital significance in the schools in the twenty-first century. It was also discovered that science labs prepared the students for scientific and technological inventions in the twenty-first century. The researchers found out positive nexus between presence of science labs in schools and enhancement of critical thinking among the students at the school level. It was recommended that every school should have well-established science lab so as to enable the students to benefit from the scientific experiments that are very significant for the achievement of success in the twenty-first century.

The quality of science education in Pakistan can be improved. According to Bari (2024), Pakistan's educatin system needs drastic reforms if it is to be fixed. The quality of textbooks taught in the public schools need to be enhanced so as to enable the students to have achieve quality education. The decentralization of financial budget in the education sector can yield positive results addressing the problems of Pakistan's education system. The invovment of parents and local communities can improve the quality of education in Pakistan by giving them role in the decision making process in schools in the shape of functional school boards.

Naz et al. (2024) studied the effectiveness of monitoring system in the improvement of the science facilities in the secondary schools of Punjab, Pakistan. The data for the study were taken from the secondary schools of three different districts of Punjab i.e. Rahim Yar Khan, Rawalpindi, and Faisalabad. The study was meant to assess the effectiveness of the government's evaluation on the improvement of the science facilities in the schools. It was revealed the government's monitoring system in Punjab was functional. It was also updated but it failed to result in the betterment of the availability of the science facilities in the secondary schools of Punjab. The researchers recommended various measures for the improvement of the availability of science facilities in the secondary schools of the province.

There is a strong nexus between the education crisis and economic crisis of Pakistan. The out of school children are going to be an economic burden on Pakistan in near future. The learning poverty in Pakistan is a dangerous phenomenon for the country. It deprives Pakistan of the development. The poor quality of science education at the secondary school level results in

the higher dropout rates in Pakistan. The underemployment and unemployment in Pakistan are due to poor quality of education provided to Pakistani students in the educational institutes of Pakistan (Ismail, 2024).

Javed (2023) conducted a study on the reduction of quality of science education at secondary level in Khyber Pakhtunkhwa, Pakistan. The data of the study were taken from the six different districts of the six different divisions of the province. The data were obtained from the secondary school science teachers and students. It was discovered that lack of proper monitoring system, absence of facilities in school, lack of science labs, untrained teaching staff, over-crowed classroom were responsible for the deterioration of the quality of science education in the secondary schools of Khyber Pakhtunkhwa. The researcher proposed various recommendations for the quality of science education at the secondary schools of the province.

Hussain (2023) studied the causes of poor quality of education in the secondary education level in Pakistan. The data for this study were collected through group discussion. A total 37 participants participated in the group discussion. Thematic analysis was used for the interpretation of the data. The study identified several causes of the poor quality of education in secondary level in Pakistan. Different recommendations like recruitment of teachers on meritocracy, the provision of training to teachers and proper evaluation of schools were presented for the improvement of the quality of education. It was also recommended that the financial constraints of the teachers should be eliminated so as to attract talented people towards the profession of teaching.

There are several issues in the science education system of Pakistan. Absence of qualified teachers, lack of quality textbooks, and outdated teaching methodologies are identified as the main problems in the field of science education system of Pakistan. These problems reduce the efficiency of the students to perform well in the field of science education. They are responsible for the poor growth of Pakistan. These problems generate several internal and external challenges for the science students, especially, at the secondary school level. These problems can be addressed with the help of serious measures taken by the government and other relevant stakeholders (Asif, 2023).

McFarlane (2023) conducted a study so as to investigate the challenges faced by the students and teachers in the attainment and provision of science education. The study revealed that there were various challenges that both students and teachers faced in the classroom and science labs. The researcher also identified various causes that were responsible for the generation of those challenges for the science students and teachers. The study recommended various measures for the addressing these challenges. The use of information and telecommunication technology for the provision of science education in the twenty first century was one of the recommendations of this study.

Siddiqui G. K. (2023) investigated the main problems in the public schools in Pakistan. The data for the study were collected from different public schools of Lahore. The data were collected from the school teachers through semi-structured interviews. The study used thematic analysis for the interpretation of the data. It was revealed that basic facilities were available in the public schools of Lahore. However, other facilities were not available. Electric water coolers were not available in majority of schools. The advanced and modern science labs were not available. Many schools did not have grounds. It was recommended by the study to ensure the provision of those facilities to the public schools of Lahore.

Different measures have been recommended for the improvement of quality of science education at the secondary school level in Pakistan. According to Banuri (2023), the enhancement of education budget, the honest spending of allocated funds for education, integration of technology in education can improve the quality of science education in Pakistan. Moreover, the establishment of well-equipped science labortory in secondary schools, the appointment of qualified science teachers in the secodnary schools of Pakistan, and proper monitering of secondary schools can also rescue the deteriorating science education in the secondary schools of Pakistan.

Raviv et al. (2023) studied the benefits of scientific experiments in the schools. It was

revealed that the presence of science labs in the school encouraged the students to study science at school level. The researchers discovered that scientific experiments at school level developed critical thinking among the students. The innovative qualities of the students improved with the help of scientific experiments at school level. The study recommended the enhancement of instruments in school labs so as to enable the students and teachers to conduct scientific experiments at the school level.

The outdated teaching methodologies used in the provision of science education have several negative consequences on the overall educational performance of the students of the secondary schools in Pakistan. They result in the reduction of the critical thinking among the Pakistani students (Nauman, 2023). These methodologies also result in the wastage of public resources as the government utilizes funds but they fail to achieve the required results of the utilization of funds. The best way to avoid the wastage of public funds is to improve the teaching methodologies in the secondary schools while providing science education to the students in Pakistan (Banuri, 2023).

Nawzad et al. (2023) investigated the effectiveness of the integration of technology in the science subjects in Iraq. The researchers collected the data with the help of the questionnaire and testing of the students. It was discovered that majority of the respondents of the questionnaire agreed that the integration of technology enhanced the effectiveness of the teaching methods in science subjects. The results of the tests of the students also verified that the integration of the technology increased the interest of the students in studying different science subjects at school level.

The poor quality of science education in the public schools at the secondary school level in Pakistan is attributed to the flawed educational policies of different governments. The government does not allocate sufficient amount of money for the provision of science education. Moreover, the funds allocated for education are not spent honestly due to weak accountability and transparency. Resultantly, the secondary schools face shortage of science equipments required for performing science experiment. The schools also lack other facilities required for the promotion of science education (Siddiqui S. , 2023).

Liu et al. (2023) explored challenges and promises of science education in China. The researchers comprehensively analyzed the factors that gave birth to various issues and challenges for the students and teachers in the science education in the educational institutions of China. They also explored the promises of science to the students and teachers. It was concluded that science education ensured success to the students in China. It was discovered that science students were destined to have bright future in China due to higher demand of the science students in Chinese economy and market.

Different studies show a strong link between the provision of quality science education and the development of Science education. The studies are about the contribution of science education in the achievement of development of a nation. According to Husain (2023), science education at the secondary school level enables the students to study STEM related subjects in future. STEM education puts a country on the path of development as it is the best way to generate jobs in the local and global market for the students. As a resulty, revenue is generated and economic propsperity and development are achieved.

Newell et al. (2022) investigated the benefits of studying science education at school level. The study discovered that the students who studied science at school level were able to have bright future in their lives. They were able to gain various benefits because of their choice to study science in school. It was revealed that the science students became highly paid individuals in the market owing to their choice of studying science. The study also discovered that science education was best way to witness social mobility in the society. The study presented different measures as recommendations for the improvement of science education at school level.

Cimer (2022) conducted a study on the teaching methods in science in Turkish school. The study identified six principles that could prove helpful in the enhancement of the effectiveness of the teaching methods in science. The study discovered that teaching methods become effective when the teachers engage with the

students at different level. The encouragement of the students by the teachers to ask questions and discuss ideas makes the teaching methods very effective. The researcher recommended the inclusion of those six principles in the Turkish education system so as to make the teaching methods of science education more effective.

The centralization of power in the education system is responsible for the provison of poor quality of education in Pakistan. The higher authorities of education department perform the functions either at provision capitals or divsional headquarters. Resultantly, they are unable to maintin proper monitoring system (Hafeez, 2022). The best way to enhance the accountability and transparancy in the education department so as to improve the delivery of sciency education at the school level is to empower the local governments to look after the schools. Local communities can also be involeved for this purpose (Husain, Governing the Ungovrnable, 2022).

Gujjar (2022) studied the presence of facilities in the secondary schools of Bajour, Khyber Pakhtunkhwa. The purpose of the study was to assess the presence of science facilities in the backward areas of Pakistan. The researher collected the data with the help of the questionnaire. The data were collected from 15 secondary schools of Bajour. Three different questionnaire were distributed among the popultion that consisted of 15 Head Teachers, 130 teachers, and 150 students of the secondary schools. It was discovered that the majority of the schools of Bajour did not have basic science facilities like science labs and equipments required for conducting scientific experiments in secondary schools.

Kaptan and Timurlenk (2022) studied the challenges prevailing in the science education in the developing countries of the world. The researchers identified a number of issues and challenges in science education. The low stipends paid to science teachers, lack of science labs in the educational institutions, workload of science teachers, presence of large number of students in the classrooms, absence of resources for scientific experiments, and low level of motivation for science among the teachers and students were some of the challenges in the science education in the developing nations of the world.

The significance of presence of science laboratory at the secondary school level cannot be denied. The students are able to perform the practical work in the science labs. Well-equipped science labs enable the students to conduct the experiments of science subjects in the science labs under the guidance of their supervisors and teachers. Science labs also play an essential role in the enhancement of the critical skills of the students at the secondary school level. They reduce the tradition of rote learning in the science subjects. Science labs motivate the students to pursue science subjects in future (Wollenberg & Mohan, 2022).

Semali and Mehta (2022) analyzed science education in Tanzania. The researchers studied various factors so as to compare the science education in Tanzania with that of the global standard. It was found out that the standard of science education in Tanzania was lower than that of the developed nations of the world. The studied identified different issues prevailing in the science education of Tanzania. Various recommendations were made for the improvement of the science education in Tanzania. The study highly recommended the integration of STEAM education in the educational system of Tanzania.

Wolk (2022) investigated teaching methodologies used for imparting education in schools. The researcher studied the curriculum and teaching methods used in schools. It was found out that the teaching methods, ecpecially, those used for imparting science education were outdated. They did not prepare the students for the challenges of the digital age. It was also discovered that those teaching methods failed to enable the students to achieve highly paid jobs in the science sector. The researcher presented several recommendations for the improvement of teaching methods of science education in schools.

Karimova and Makhamadaliev (2022) investigated the role of innovative ideas in the enhancement of the effectiveness of the teaching methods in the science education. The study discovered that it was impossible to avoid tough competition due to globalization and advancement of information technology in the

twenty-first century. The researchers concluded that the students of science can only compete in the highly competitive global market when they are imparted education in such a way that innovative ideas are generated in their minds. It was recommended to the policymakers to reform the education system so as to prepare the students for successful survival in the globalized world.

There are various measures that can enhance the effectiveness of teaching methodologies for imparting science education to the students in the classroom. According to Teddlie (2022), the teaching methods can be made effective when the participation of the students in the various activities of the class is enhanced. They students show interests in the science subjects when they themselves participate in the classroom. The open discussion about the topic in the science class also enhance the effectiveness of teaching methodolgies science education, especially, at the secondary school and other higher levels.

Iqbal et al. (2022) studied the views of science teachers about the nature of the science. The researchers collected data from 200 science teachers. The data were collected from both the public and private schools of Lahore. Out of a total 37 schools from where the data were collected, 19 were public schools and 18 were private schools. The purpose of the study was to know the view of the teachers abour different aspects of science education. The researchers discovered that the view of the majority of the science teachers was of traditional nature whereas the view of only three teachers was of the contemporary nature.

Memon and Joubish (2022) investigated the quality of science education imparted to the students in the schools. The study discovered the the quality of science education was very poor due to multiple factors. The outdated curriculum, shortage of trained science teachers, and boring and traditional teaching methods were blamed to be responsible for the poor quality of sceince education in Pakistan. The researchers recommended the policymakers and educationalists to adopt several modern measures for the improvement of the quality of science education in the educational institutes of Pakistan. The integration of technology, the modernization of science curriculum, provision of facilities, and the enhancement of education budget were among the recommendations of the researchers.

Linn and Eylon (2022) explored the use of information technology for the provision of science education. The researchers identified different positive and constructuve uses of the information technolog for the provison of the quality science education to the students. It was revealed that students could gain better understanding of different topic of the various science subjects with the help of the information technology. It was recommended to the policymakers to ensure the integration of the information technology in the eduction sector in order to improve the quality of science education in the education institutes of both the developed and the developing nations of the world.

Teixido (2021) studied the relevance of school pedagogy in twenty-first century. The study explored teaching methods and curriculum of science education in the schools. The researcher found out that traditional teaching model completely failed during pandemics as it did not provide the facility of online education which had become an essential component of the digital age. The study also concluded that the science education imparted on the outdated model did not produce positive results. It was recommended to redesign school pedagogy so as to enable the science students to learn in accordance with the needs of the twenty-first century. The inclusion of online education was also recommended.

Akram (2021) studied the challeges faced by the science students at the secondary level in Pakistan. The study linked the poor quality of science education with the poor education governance in Pakistan. Different challenges were identified by the researcher. The absence of adequate resources, shortage of trained teachers, and lack of well-equipped labs were stated as the key causes of poor quality of education. It was recommended that the provision of equal quality education to students, reduction of socioeconomic gap, and improvement of the governance of education could improve the poor qulaity of science education in the secondary schools of Pakistan.

The ineffective teaching methods used in the public schools of the developing and backward nations for the provision of science education fail to yield any positive results, according to Wiysahnyuy (2021). These methods are outdated. They fail to promote critical thinking among the students of the public schools. They only promte rote learning culture in the science classroom. Resultantly, the students who study science in these nations are hardly able to compete in the global market with the students of the developed nations where modern and effective teaching methods are used for the provison of science education.

Hali (2021) studied the current condition of STEM education in Pakistan at school level. This study was based on the previous studies. The data for the study were taken from 13 studies so as to know the current position of STEM education in Pakistan. The study found out that the performance of the private schools was better than that of the public schools regarding the provision of STEM education. Absence of science labs, equipments required for scientific experiments, and lack of interest of science teachers were identified as the major causes of poor condition of STEM education in the schools of Pakistan. The study recommended the inclusion of different stakeholders for the improvement of the STEM education in both the public and private schools of Pakistan.

Rauf et al. (2021) conducted a study about the significance of science at secondary school level in Pakistan. The data for the study were taken from the secondary school teachers of both public and private schools. The research instrument of the study was questionnaire. It was discovered the aims of science were clear and designed logically. Their quality was also high. The study concluded that science education needed the competent, talented and skilled teachers who could motivate the students to attain science education. It was also concluded that effectiveness of science education could be enhanced when the proper evaluation strategies were used.

Pakistan's ruling elite is responsible for the poor quality of science education in the country, according to Altaf (2021). It is the political choice of the rulers not to provide the quality science eudcation to the people. Shortage of funds for the provision of science education is nothing but a lame excuse. The ruling elite has funds for the maintaining the lavish lifestyle but do not have funds for the provision of science education which can result in the achievement of economic growth and development for Pakistan.The ruling elite needs to revisit its flawed approach about the provision of science education to the students in Pakistan.

Linn (2021) investigated the role of science teachers in the promotion of science education at school level. It was revealed that science teachers played key role in the encouragement and motivation of students to opt science career in future. Different issues faced by science teachers in schools were also identified in this study. The researcher also revealed that science teachers faced various challenges while imparting education to the students at school level. The study presented different recommendations for the promotion of science education at school level.

Faize (2021) investigated the problems and prospects of science education at the secondary schools in Punjab, Pakistan. The data for this study were taken from the population that consisted of secondary school science students, science teacher, headmaster and experts of science education. The researcher collected the data with the help of three different questionnairs. The study revealed that science education was very usful for the students in the twenty-first century. The study also identified several probloms in the attainment of science education. It was discovered that the science books contained irrelvant materials, the science teachers focused on theroy instead of practicals, and the science students did not have the ability to apply science knowledge in daily routine life. Different recommendations were proposed for the improvement of science education at school level in Pakistan.

RESEARCH METHODOLOGY

3.1. Research Design

A research design is that framework which provides detailed map about the research. It contains the basic and necessary information about the procedure of the research (Dannels, 2023). The researcher adopted a mixed-method

approach. Mixed-method is generally used when the research contains both quantitative and qualitative methods (Leech, 2022). Quantitative method is used for the determination of the numerical data (Farhady, 2023). Qualitative data is used for determination of subjective data (Sofaer, 2022). In this study, the quantitative method was used to gather data through questionnaire whereas the qualitative method was used to collect data through interview.

3.2. Research Methodology

The researcher adopted triangulation methodology so as to conduct this study. Triangulation process was used because different respondents in the study usually give different responses based on the personal biasness. They either exaggerate the situation or undervalue it according to their own interests. Triangulation process was used so as to cross-check the responses of the science students and science teachers in the secondary schools of District Ziarat. Triangulation methodology is used when the researchers intend to collect data from different sources on a single aspect of the topic (Heale & Forbes, 2023). The purpose of gathering data from different sources on the same aspect is meant to ensure that the collected data are valid (Oppermann, 2021). The researcher relied on questionnaire and interview in this study according to the demand of the topic and the need of the triangulation methodology.

3.3. Population of the Study

The individuals from whom data is obtained in research constitute the population of the study. The population of the study is usually divided into different strata in order to collect data easily and systematically from all the segments of the population (Casteel & Bridier, 2021). Stratum is said to be the smaller portion of the population of the research (Elliott, 2021). The researcher divided the population of this study into two main strata i.e. the science students of secondary schools of District Ziarat and the science teachers of the secondary schools of District Ziarat. The following table shows the division of population into different strata as:

Table 3.1 Division of Population into Different Strata

No.	Name of Strata
01	Science Students
02	Science Teachers

As the researcher took the data from the secondary schools of district Ziarat, the secondary schools were divided into various categories in order to obtain data in proper manner. The following table shows the division of the secondary schools of Ziarat on the basis of nature of school as:

Table 3.2 Division of Secondary Schools on the basis of Nature of School

No.	Nature of School
01	Public Secondary Schools
02	Private Secondary Schools

The researcher also divided the secondary schools of District Ziarat on the basis of the location of schools. The following table shows the division of the secondary schools of District Ziarat as:

Table 3.3 Division of Secondary Schools on the basis of Location of School

No.	Location of School
01	Urban Secondary Schools
02	Rural Secondary Schools

The researcher also divided the secondary schools of District Ziarat on the basis of the type of school. The following table shows the division of the secondary schools of Ziarat on the basis of the type of schools as following:

Table 3.4 Division of Secondary Schools on the basis of Type of School

No.	Type of School
01	Boys School
02	Girls School
03	Co-Education

Each stratum of the population is further divided into sub-groups in the research so as to ensure the adequate representation of every segment of the population of the study (Westfall & Patterson, 2021). The researcher divided the students of the secondary schools of District Ziarat on the basis of gender so as to ensure the participation of every section of the population of the study. The following table shows the division of the students on the basis of gender as following:

Table 3.5 Division of Students on the basis of Gender

No.	Gender of the Students
01	Boys
02	Girls

The researcher also divided the stratum "students" on the basis of enrollment of the students in class in order to give proper representation to every class. The following table shows the division of the students on the basis of enrollment in classroom as:

Table 3.6 Division of Students on the basis of Enrollment in Classroom

No.	Classroom of the Students
01	IX Class Students
02	X Class Students

Like the stratum "Students", the stratum "Science Teachers" was also divided into various categories in order to ensure the adequate representation of every section of the stratum in the research. The researcher divided the stratum "Science Teachers" on the basis of gender. The following table shows the division of science teacher on the basis of gender as:

Table 3.7 Division of Science Teachers on the basis of Gender

No.	Gender of the Teacher
01	Male Science Teachers
02	Female Science Teachers

The researcher also divided the stratum "Science Teachers" on the basis of their teaching experience. The following table shows the division of science teachers on the basis of teaching experience as:

Table 3.7 Division of Science Teachers on the basis of Teaching Experience

No.	Experience of Teacher
01	Less than 5 Years
02	5-10 Years
03	10-15 Years
04	More than 15 Years

3.4. Sample and Sampling Technique

When the population of the study is narrowed down to the particular number of respondents in a research, this mini-population is called sample (Gruijters, 2022). Sample size is the number of the respondents from whom the data are taken in a research (Ahmed, 2024). The researcher selected 330 respondents for the questionnaire and 28 respondents for the semi-structured interviews on the basis of 10 percent formula.

Sampling technique is the method of selection of the respondents from the entire population (Taherdoost, 2022). The researcher used multi-sampling technique in this research. Multi-sampling technique means the selection of more than one methods of sampling in the research (Sharma, 2023). The researcher adopted two different sampling techniques at two different stages of the research. At stage I, the stratified random sampling was used. The basic aim of the use of the stratified random sampling in research is to ensure the representation of all segments of the population (Alvi, 2023). The researcher used the stratified random sampling when the structured questionnaires were filled out by the secondary school science students of District Ziarat. At stage II, the researcher adopted purposive sampling technique. The researchers adopt purposive sampling technique when they intend to obtain data from the specific respondents instead of all types of respondents (Singh & Masuku, 2022). The researcher adopted purposive sampling technique while conducting semi-structured interviews with the science teachers of the secondary schools in District Ziarat.

3.5. Data Collection

The process of obtaining the relevant data from the respondents in the research is called data collection (Willson & Miller, 2022). The researcher collected the data with the help of the primary sources. When the researchers obtain data directly from the respondents of the research, this process is called primary data collection (Mazhar, 2021). Questionnaire and semi-structured interview were the primary sources used by the researcher for the collection of data in this research.

3.5.1. Quantitative data collection (Survey/Questionnaire)

The researcher adopted questionnaire for the collection of the quantitative data in this research. The questionnaire was structured and closed-ended. The structured questionnaire means that the questions in the questionnaire are already designed by the researcher before the collection of the data from the respondents (Cheung, 2021). When a questionnaire restricts the respondents to choose the answer to the questions given in the questionnaire, this type of the questionnaire is known as closed-ended questionnaire (Reja, 2022). The structured and closed-ended questionnaire used in this research consisted of two parts. The part I contained questions about the demographic background of the respondents whereas the part II consisted of a 5-point likeret scale questions from strongly disagree to strongly agree. There was total four sections in Part II and each section contained five questions.

The researcher distributed the questionnaire among 330 secondary school science students of the District Ziarat. The 327 (99 percent) students filled out the questionnaire. The questionnaire was filled out by the students of public schools and private schools. It was filled out by boys and girls. It was also filled out by the students studying in the boys' school, girls' school and co-education. The questionnaire was filled out by the students of urban schools and rural schools of District Ziarat. It was also filled out by the science students of class IX and X of secondary schools of District Ziarat. In short, the representation of all strata and sub-groups was ensured while obtaining the data from the science students with the help of the questionnaire.

3.5.2. Qualitative data collection (Interviews)

In order to collect qualitative data, the researcher held semi-structured interviews with the respondents. The pattern of the semi-structured interview is different from that of the structured questionnaire in two ways. First, some questions of the semi-structured interviews are planned before the interview is started while other questions are asked on the spot from the respondents (Dearnley, 2022). Second, the

nature of semi-structured interview is open-ended where the respondents are free to answer the questions according to their own free will (Adams, 2023).

The researcher held 28 interviews with the science teachers of the secondary schools of District Ziarat. The interviews were held with male science teachers and female science teachers. The researcher conducted the semi-structured interviews of the teachers of public schools and private schools. The respondents of the interviews consisted of secondary school teachers of urban areas and rural areas of District Ziarat. The respondents of the interviews were teachers in boys' school, girls' school and co-education schools of Ziarat.

3.6. Research Instrument

The tools that the researchers use for the collection of data in research are known as the research instruments (Hinds, 2022). The researcher used various tools for the collection of data in this research. Questionnaire and semi-structured interviews were used in this research as research instruments. The researcher used structured and closed-ended questionnaire for the collection of the quantitative data. Semi-structured interview was used as a research instrument for the collection of quantitative data.

3.6.1. Pilot Test

In order to check the relevance of the questionnaire to the research, the researchers conduct pilot test of the questionnaire. The designed questionnaire is distributed among the smaller number of the respondents in pilot test (Christodoulou, 2022). The researcher distributed the questionnaire among 16 respondents. The pilot test for each section of the questionnaire was conducted on Cronbach's Alpha on SPSS (Version 21). The following table shows the result of the pilot test as:

Table 3.8 Results of Pilot Test

Section	No. of Cases	%age	Cronbach's Alpha	No. of Item
Facilities for Science Education	16	100	.947	5
Teaching Methodologies Used	16	100	.960	5
Effectiveness of Methodologies	16	100	.959	5
Challenges in Science Education	16	100	.942	5

3.6.2. Validity Test

The purpose of the validity test is to include the opinion of the experts in the designing of the questionnaire. It is meant to enhance the relevance of the questionnaire to the research (Del-Greco, Walop, & McCa, 2022). In this study, the researcher reviewed the questionnaire after seeking the opinion of the five experts whose names are mentioned in Appendix III.

3.6.3. Reliability Test

The researchers conduct the reliability test of the questionnaire so as to ensure that the questionnaire is completely relevant to the research. It is conducted when the researchers collect the data from all the respondents of the questionnaire (Bolarinwa, 2023). The researcher conducted the reliability test of the questionnaire when the questionnaires were filled out by 327 (99 percent) respondents out of a total 330 (100) respondents. The following table shows the results of the reliability test as:

Table 3.9 Results of Reliability Test

Section	No. of Cases	%age	Cronbach's Alpha	No. of Item
Facilities for Science Education	327	99.1	.959	5
Teaching Methodologies Used	327	99.1	.964	5
Effectiveness of Methodologies	327	99.1	.967	5
Challenges in Science Education	327	99.1	.951	5

DATA ANALYSIS

Introduction

The data collected with the help of questionnaire and semi-structured interview were analyzied in the following two ways.

Descriptive Statistics

One of the methods of interpretation of the quantitative data is descriptive statistics (Bhandari, 2023). The researcher used three different scales of the descriptive statistics for the interpretation of the data that were obtained from the science students of the secondary schools of District Ziarat through the structured and closed-ended questionnaire. These three scales were measure of frequency, measurers of central tendency and measures of dispersion or measures of variability. The researcher did not use all the three scales of the measures of central tendency. Only "Mean" was determined whereas "Mode" and "Median" were not used in accordance with the need of the research. Similarly, the researcher did not use all three scales of the measures of dispersion. Only "Standard Deviation" was used while "Range" and "Variance" were not used because they were not required to be measured in this research.

The researcher used Statistical Package for Social Sciences (SPSS) for the interpretation of the questionnaire. In short, the Frequency Distribution, Mean and Standard Deviation for each statement of the structured and closed-ended questionnaire were determined with the help of SPSS (Version 21). The data were presented in the form of tables for the better understanding. The tables contained frequency, percentage, mean, and standard deviation for each statement. The bar graphs were also included to further highlight the frequency distribution of each statement of the closed-ended questionnaire of the research.

Thematic Analysis

The researchers use the thematic analysis for the interpretation of the qualitative data in the research (Joffe, 2021). The thematic analysis of the qualitative data is generally conducted in six steps (Clarke & Braun, 2021). The researcher adopted the thematic analysis for the interpretation of the semi-structured interviews that had been held with the science teachers of the secondary schools of District Ziarat. The thematic analysis was conducted in six steps in this research.

4.1. Analysis of the responses of the respondents of the Questionnaire

4.1.1. Gender of the Students

Table 4.1: Gender of the Student

Statement		1	2
The gender of the Student is:	f	179	148
	%	54.2	44.8

Note: 1= Boy, 2= Girl

Table 4.1 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 179 (54.2 percent) students were boys whereas 148 (44.8 percent) students were girls.

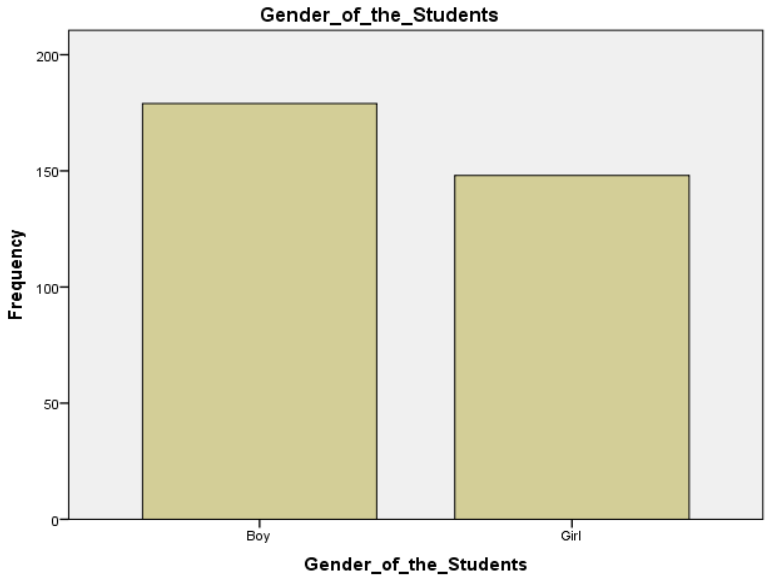

Chart 4.1: Gender of the Students

4.1.2. Class Enrollment of the Student

Table 4.2: Class Enrollment of the Student

Statement		1	2
The Student is enrolled	f	133	194
In Class:	%	40.3	58.8

Note: 1= IX, 2= X

Table 4.2 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 133 (40.3 percent) students were the students of class ninth whereas 194 (58.8 percent) students were the students of class tenth.

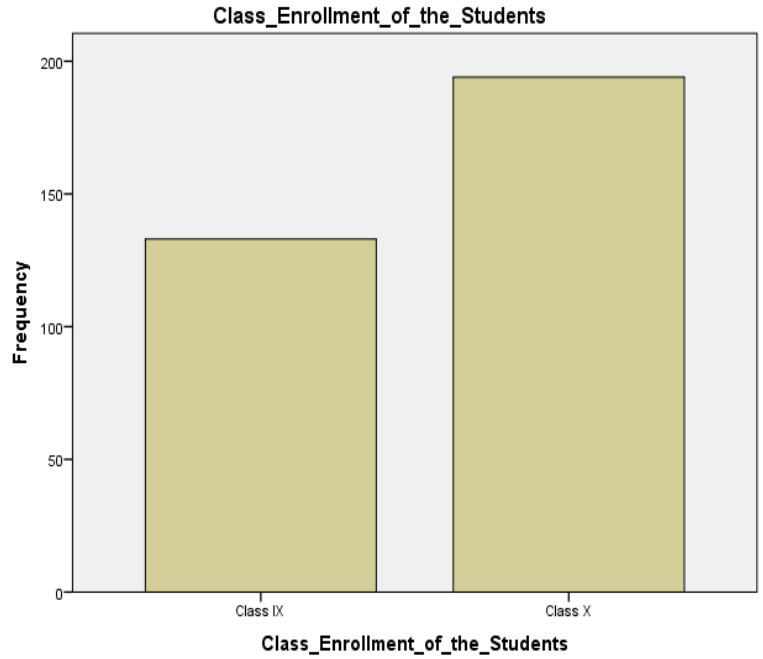

Chart 4.2: Class Enrollment of the Students

4.1.3. Nature of the School

Table 4.3: Nature of the School

Statement		1	2
The Nature of the School Where the Student is Enrolled is:	f	205	122
	%	62.1	37.0

Note: 1= Government Schools, 2= Private Schools

Table 4.3 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 205 (62.1 percent) students were the students of Government schools whereas 122 (37.0 percent) students were the students of private school.

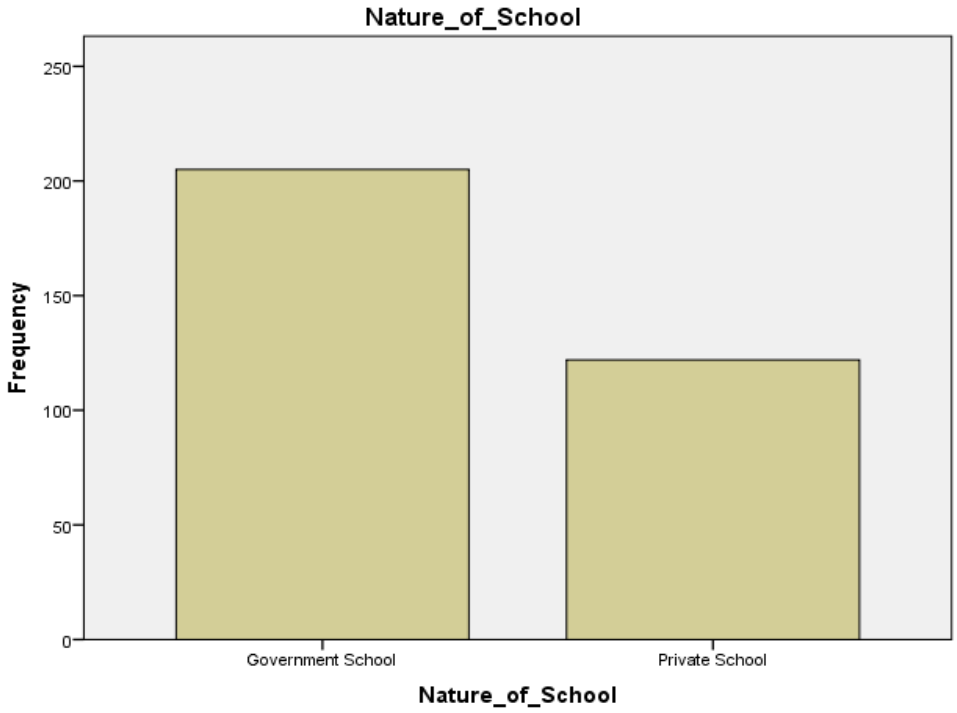

Chart 4.3: Nature of School

4.1.4. Type of School

Table 4.4: Type of the School

Statement		1	2	3
The Type of the School Where the Student is Enrolled is:	f	164	133	30
	%	49.7	40.3	9.1

Note: 1= Boys' School, 2= Girls' School 3= Co-Education

Table 4.4 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 164 (49.7 percent) students were studying in Boys' schools, 133 (40.3 percent) students were studying in Girls' schools, and 30 (9.1 percent) students were studying in Co-education schools.

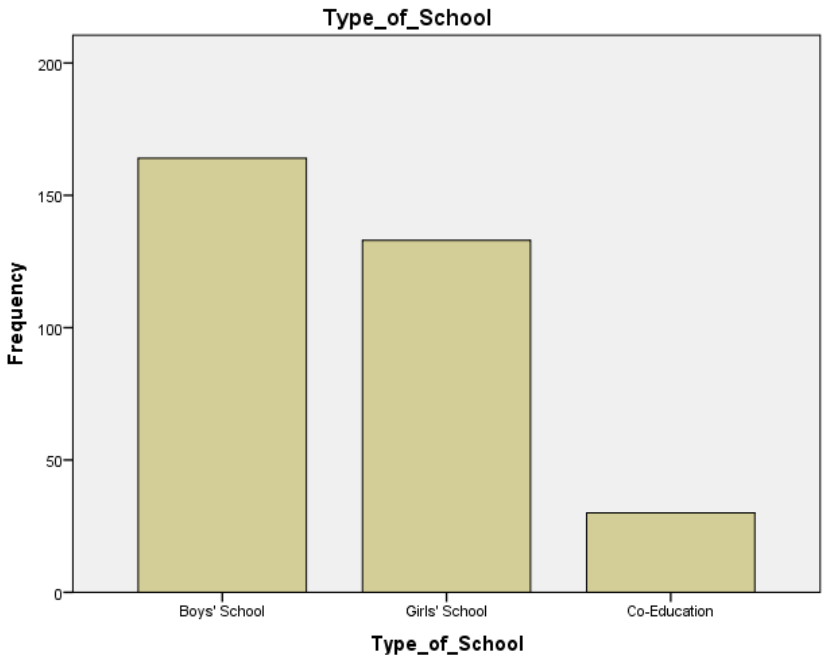

Chart 4.4: Type of School

4.1.5. Location of the School

Table 4.5: Location of the School

Statement		1	2
The Location of the School Where the Student is Enrolled is:	f	150	177
	%	45.5	53.6

Note: 1= Urban Area Schools, 2= Rural Area Schools

Table 4.5 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 150 (45.5 percent) students were the students of the schools located in the urban areas of District Ziarat whereas 177 (53.6 percent) students were the students of the schools located in the rural areas of District Ziarat.

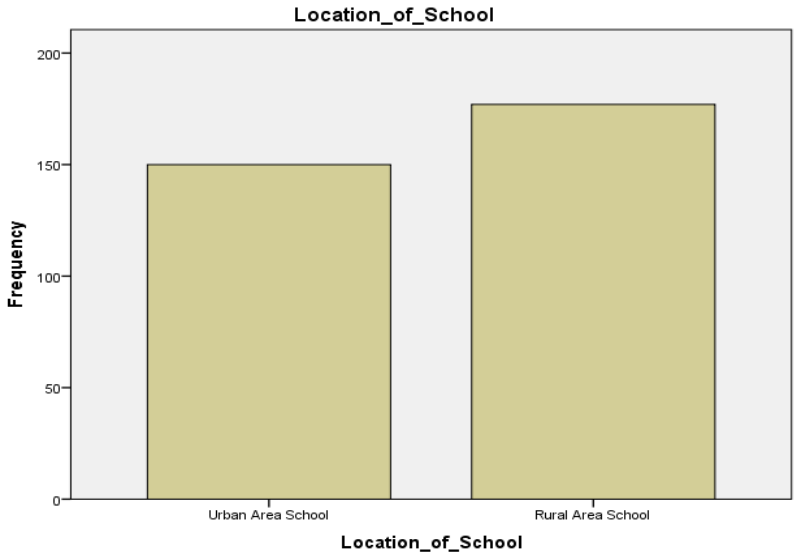

Chart 4.5: Location of School

4.1.6. Availability of Science Laboratories

Table 4.6: Availability of Science Laboratories

Statement		SD	D	N	A	SA	Mean	St.D
Our school provides well-equipped science laboratories for practical experiments.	f	161	58	11	64	33	2.23	1.47
	%	48.8	17.6	3.3	19.4	10.0		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.6 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 161 (48.8 percent) students strongly disagreed whereas 58 (17.6 percent) students disagreed to the statement about the availability of well-equipped science laboratories in their schools. 11 (3.3 percent) students remained neutral to the statement. 64 (19.4 percent) students agreed while 33 (10.0 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.23 while the "Standard Deviation" of the statement was recorded 1.47 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

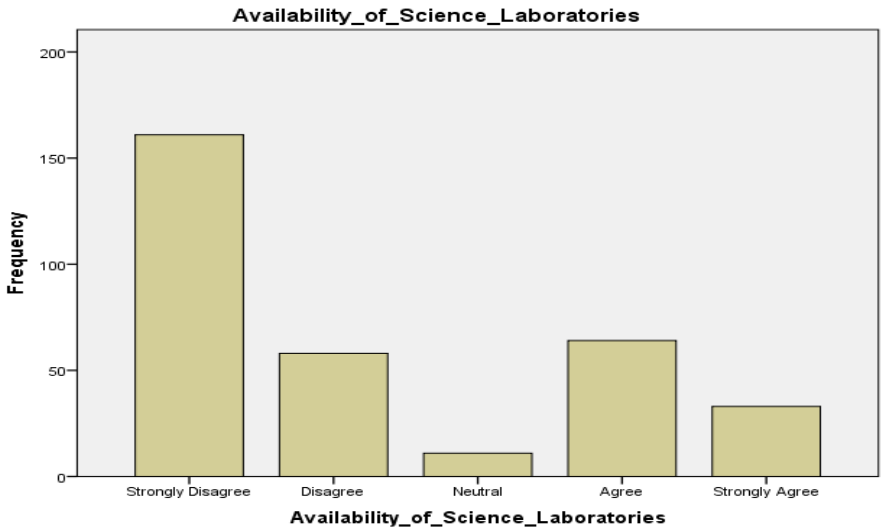

Chart 4.6: Availability of Science Laboratories

4.1.7. Adequacy of Science Materials

Table 4.7: Adequacy of Science Materials

Statement		SD	D	N	A	SA	Mean	St.D
There are sufficient science materials and equipment available for all students.	f	57	173	13	49	35	2.48	1.24
	%	17.3	52.4	3.9	14.8	10.6		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.7 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 57 (17.3 percent) students strongly disagreed whereas 173 (52.4 percent) students disagreed to the statement about the adequacy of science materials in their schools. 13 (3.9 percent) students remained neutral to the statement. 49 (14.8 percent) students agreed while 35 (10.6 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.48 while the "Standard Deviation" of the statement was recorded 1.24 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

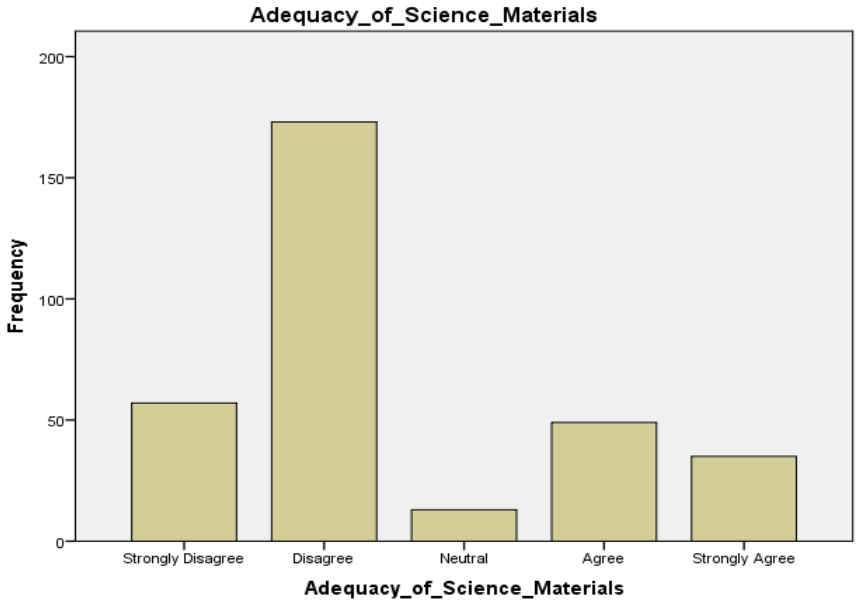

Chart 4.7: Adequacy of Science Materials

4.1.8. Quality of Science Textbooks

Table 4.8: Quality of Science Textbooks

Statement		SD	D	N	A	SA	Mean	St.D
The science textbooks we use are current and comprehensive.	f	98	119	13	78	19	2.39	1.29
	%	29.7	36.1	3.9	23.6	5.8		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.8 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 98 (29.7 percent) students strongly disagreed whereas 119 (36.1 percent) students disagreed to the statement about the quality of science books they studied in their schools. 13 (3.9 percent) students remained neutral to the statement. 78 (23.6 percent) students agreed while 19 (5.8 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.39 while the "Standard Deviation" of the statement was recorded 1.29 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

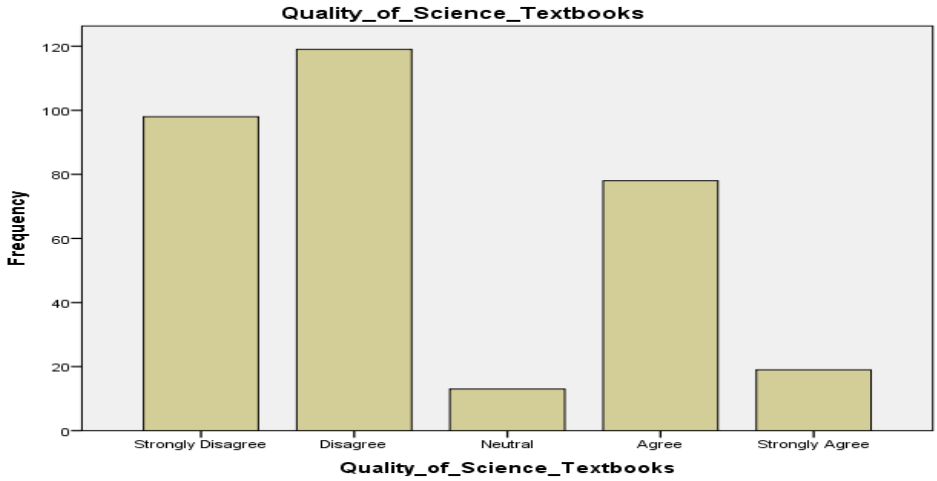

Chart 4.8: Quality of Science Textbooks

4.1.9. Library Resources for Science

Table 4.9: Library Resources for Science

Statement		SD	D	N	A	SA	Mean	St.D
The school library has ample resources for studying science subjects	f	86	144	14	32	51	2.44	1.38
	%	26.1	43.6	4.2	9.7	15.5		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.9 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 86 (29.7 percent) students strongly disagreed whereas 144 (36.1 percent) students disagreed to the statement about the quality of science library resources for science in their schools. 14 (4.2 percent) students remained neutral to the statement. 32 (9.7 percent) students agreed while 51 (15.5 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.44 while the "Standard Deviation" of the statement was recorded 1.38 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

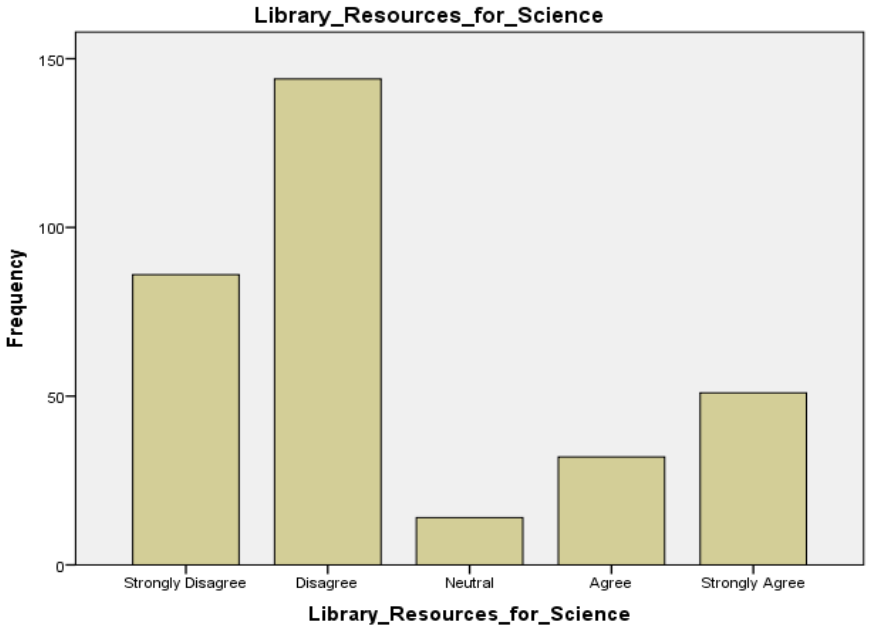

Chart 4.9: Library Resources for Science

4.1.10. Suitability of Classrooms

Table 4.10: Suitability of Classrooms

Statement		SD	D	N	A	SA	Mean	St.D
Our classrooms are suitable and well-equipped for learning science.	f	109	105	16	67	30	2.40	1.36
	%	33.0	31.8	4.8	20.3	9.1		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.10 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 109 (33.0 percent) students strongly disagreed whereas 105 (31.8 percent) students disagreed to the statement about the suitability of classrooms for science in their schools. 16 (4.2 percent) students remained neutral to the statement. 67 (20.3 percent) students agreed while 30 (9.1 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.40 while the "Standard Deviation" of the statement was recorded 1.36 when they were

measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

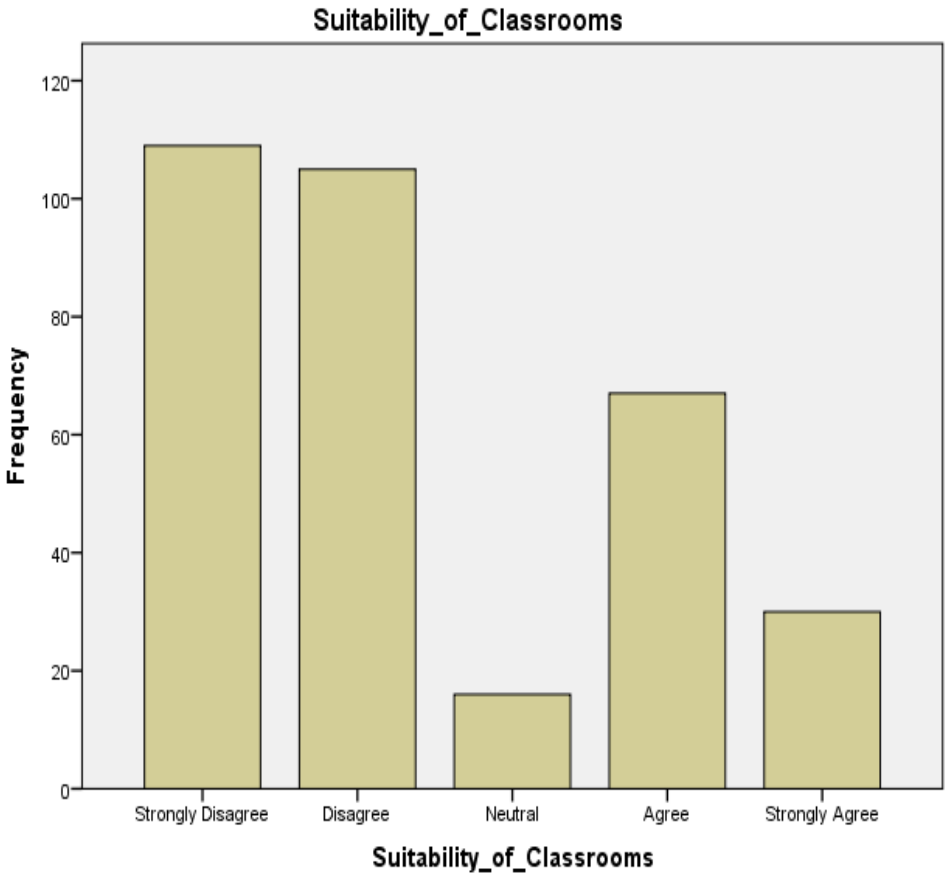

Chart 4.10: Suitability of Classrooms

4.1.11. Interactive Teaching Methods

Table 4.11: Interactive Teaching Methods

Statement		SD	D	N	A	SA	Mean	St.D
Science teachers use interactive teaching methods like group discussions and activities.	f	129	90	11	38	59	2.41	1.53
	%	39.1	27.3	3.3	11.5	17.9		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.11 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 129 (39.1 percent) students strongly disagreed whereas 90 (27.3 percent) students disagreed to the statement about the interactive teaching methods in their schools. 11 (3.3 percent) students remained neutral to the statement. 38 (11.5 percent) students agreed while 59 (17.9 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.41 while the "Standard Deviation" of the statement was recorded 1.53 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

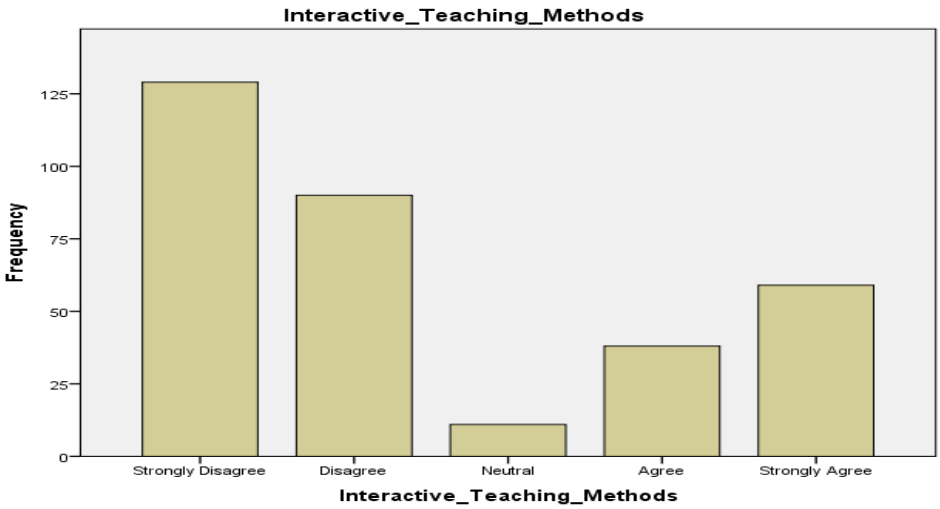

Chart 4.11: Interactive Teaching Methods

4.1.12. Use of Visual Aids

Table 4.12: Use of Visual Aids

Statement		SD	D	N	A	SA	Mean	St.D
Visual aids such as charts and videos are frequently used in science classes.	f	109	108	13	52	45	2.43	1.43
	%	33.0	32.7	3.9	15.8	13.6		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.12 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 109 (33.0 percent) students strongly disagreed whereas 108 (32.7 percent) students disagreed to the statement about the use of visual aids in their schools. 13 (4.2 percent) students remained neutral to the statement. 52 (15.8 percent) students agreed while 45 (13.6 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.43 while the "Standard Deviation" of the statement was recorded 1.43 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

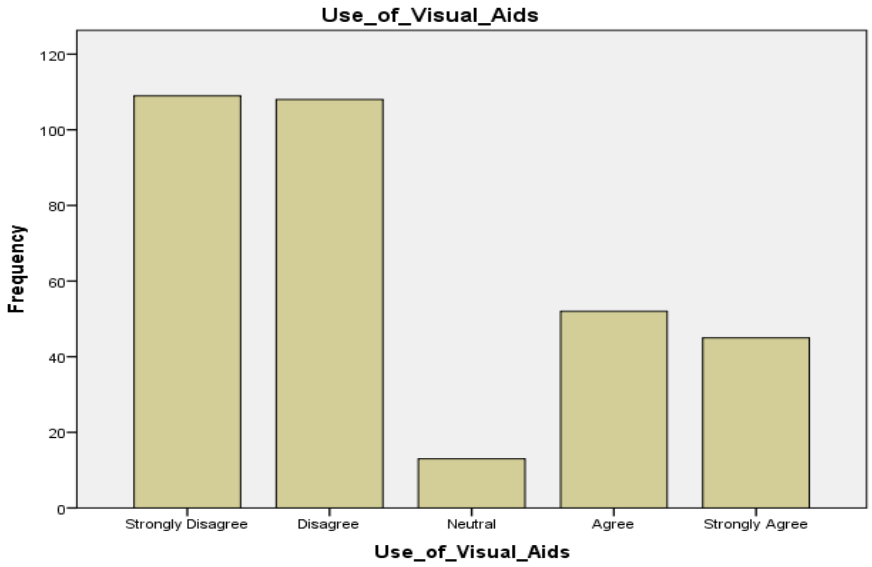

Chart 4.12: Use of Visual Aids

4.1.13. Regular Practical Experiments

Table 4.13: Regular Practical Experiments

Statement		SD	D	N	A	SA	Mean	St.D
Practical experiments are a regular part of our science curriculum.	f	96	121	13	32	65	2.53	1.49
	%	29.1	36.7	3.9	19.7	19.9		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.10 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 96 (29.1 percent) students strongly disagreed whereas 121 (36.7 percent) students disagreed to the statement about the regular practical experiments in their schools. 13 (3.9 percent) students remained neutral to the statement. 32 (19.7 percent) students agreed while 65 (19.9 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.53 while the "Standard Deviation" of the statement was recorded 1.49 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

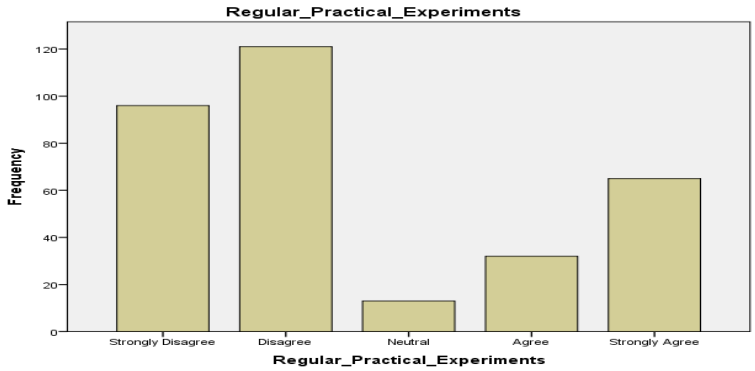

Chart 4.13: Regular Practical Experiments

4.1.14. Real Life Applications

Table 4.14: Real Life Applications

Statement		SD	D	N	A	SA	Mean	St.D
Teachers connect science lessons to real-life situations.	f	109	108	13	71	26	2.37	1.34
	%	33.0	32.7	3.9	21.5	7.9		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.14 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 109 (33.0 percent) students strongly disagreed whereas 108 (32.7 percent) students disagreed to the statement about the real-life application of science lesson in their schools. 13 (3.9 percent) students remained neutral to the statement. 71 (21.5 percent) students agreed while 26 (7.9 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.37 while the "Standard Deviation" of the statement was recorded 1.34 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

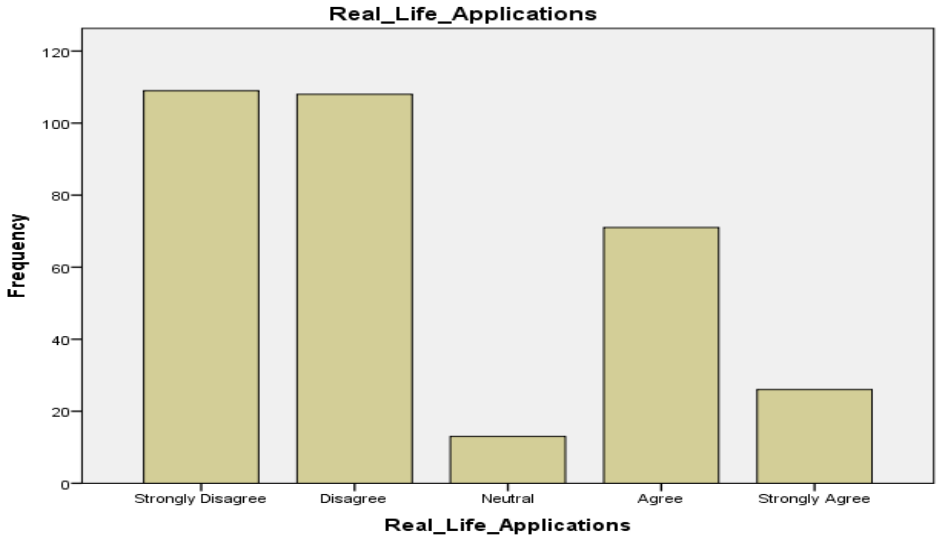

Chart 4.14: Real Life Applications

4.1.15. Incorporation of Technology

Table 4.15: Incorporation of Technology

Statement		SD	D	N	A	SA	Mean	St.D
Technology is utilized during science lessons.	f	114	116	12	30	55	2.37	1.45
	%	34.5	35.2	3.6	9.1	16.7		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.15 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 114 (34.5 percent) students strongly disagreed whereas 116 (35.2 percent) students disagreed to the statement about the incorporation of technology during science lessons in their schools. 12 (3.6 percent) students remained neutral to the statement. 30 (9.1 percent) students agreed while 55 (16.7 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.37 while the "Standard Deviation" of the statement was recorded 1.45 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

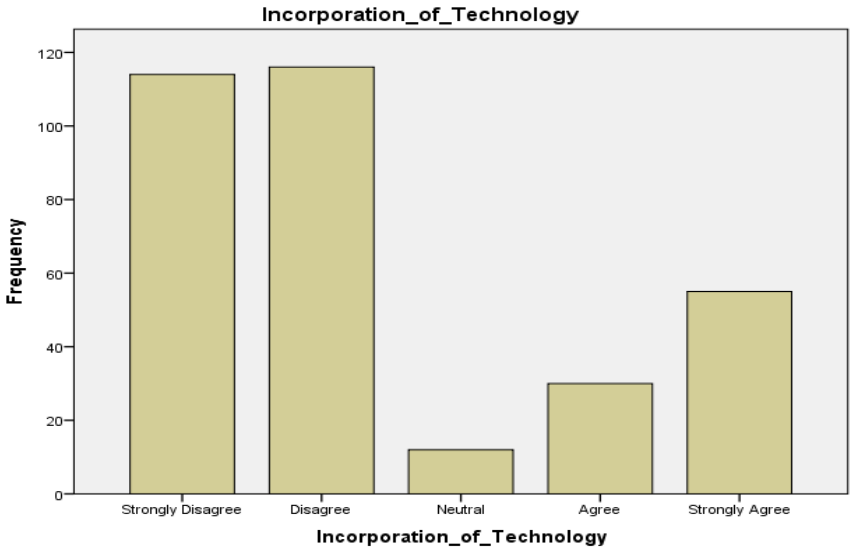

Chart 4.15: Incorporation of Technology

4.1.16. Engagement in Science Subjects

Table 4.16: Engagement in Science Subjects

Statement		SD	D	N	A	SA	Mean	St.D
The teaching methods make science subjects engaging and interesting.	f	156	63	11	81	16	2.19	1.38
	%	47.3	19.1	3.3	24.5	4.8		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.16 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 156 (47.3 percent) students strongly disagreed whereas 63 (19.1 percent) students disagreed to the statement about the engagement in science subjects in their schools. 11 (3.3 percent) students remained neutral to the statement. 81 (24.5 percent) students agreed while 16 (4.8 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.19 while the "Standard Deviation" of the statement was recorded 1.38 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

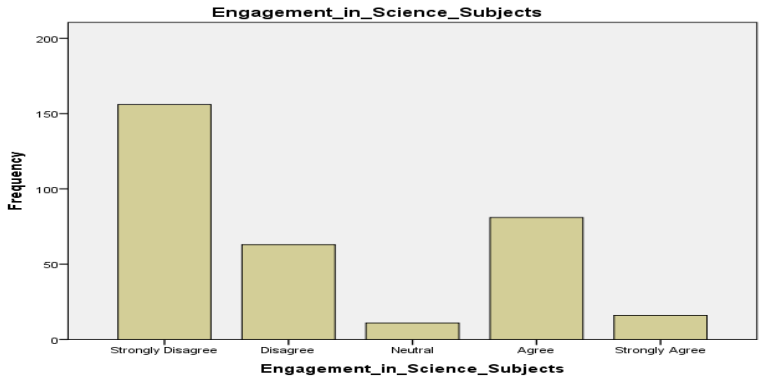

Chart 4.16: Engagement in Science Subjects

4.1.17. Understanding the Concept

Table 4.17: Understanding the Concept

Statement		SD	D	N	A	SA	Mean	St.D
I find it easier to understand science concepts because of the teaching methods used.	f	90	127	13	38	59	2.53	1.45
	%	27.3	38.5	3.9	11.5	17.9		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.17 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 90 (27.3 percent) students strongly disagreed whereas 127 (38.5 percent) students disagreed to the statement about understanding the concepts of science in their schools. 13 (3.9 percent) students remained neutral to the statement. 38 (11.5 percent) students agreed while 59 (17.9 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.53 while the "Standard Deviation" of the statement was recorded 1.45 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

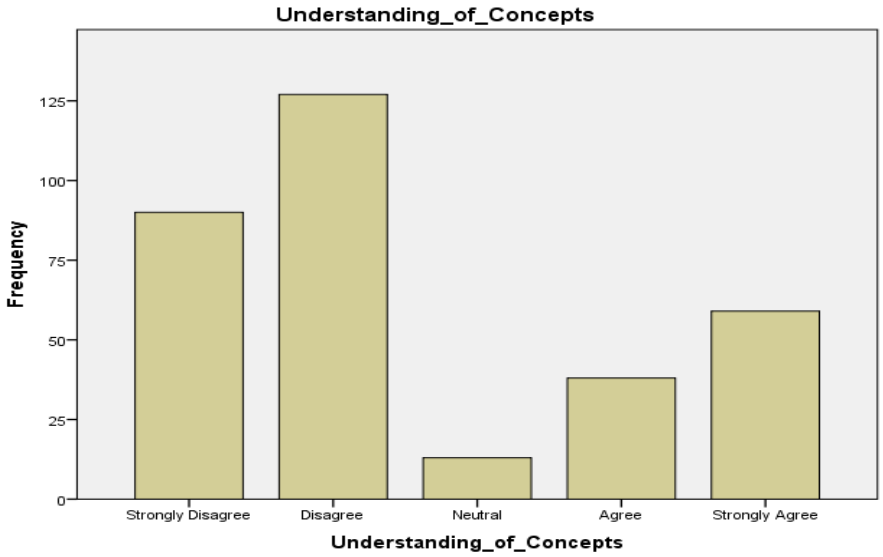

Chart 4.17: Understanding of Concepts

4.1.18. Benefit of Experiments

Table 4.18: Benefit of Experiments

Statement		SD	D	N	A	SA	Mean	St.D
Conducting experiments by my teachers helps me grasp scientific principles better.	f	92	124	14	78	19	2.41	1.27
	%	27.9	37.6	4.2	23.6	5.8		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.18 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 92 (27.9 percent) students strongly disagreed whereas 124 (37.6 percent) students disagreed to the statement about the benefit of experiments in their schools. 14 (4.2 percent) students remained neutral to the statement. 78 (23.6 percent) students agreed while 19 (5.8 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.41 while the "Standard Deviation" of the statement was recorded 1.27 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

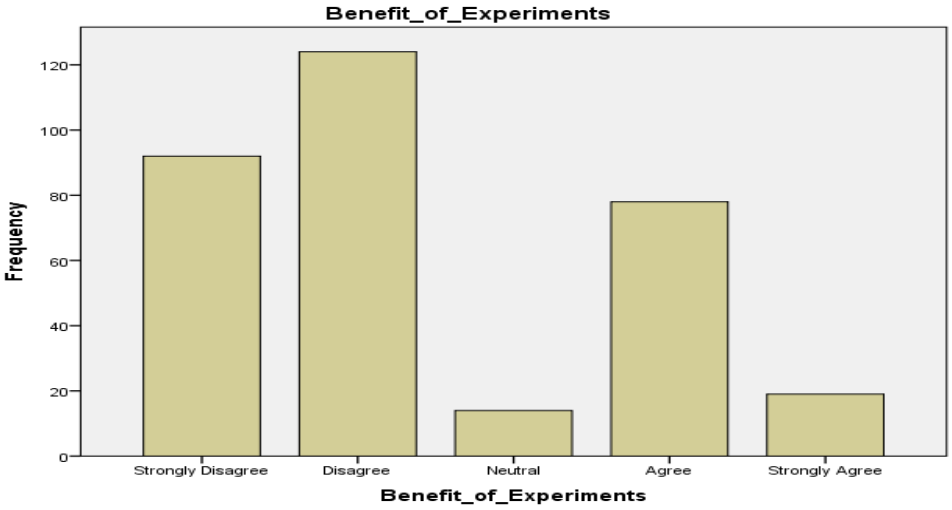

Chart 4.18: Benefits of Experiments

4.1.19. Class Participation

Table 4.19: Class Participation

Statement		SD	D	N	A	SA	Mean	St.D
Interactive classes encourage me to participate and ask questions.	f	93	125	12	30	67	2.55	1.49
	%	28.2	37.9	3.6	9.1	20.3		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.19 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 93 (28.2 percent) students strongly disagreed whereas 125 (37.9 percent) students disagreed to the statement about the class participation in their schools. 12 (3.6 percent) students remained neutral to the statement. 30 (9.1 percent) students agreed while 67 (20.3 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.55 while the "Standard Deviation" of the statement was recorded 1.49 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

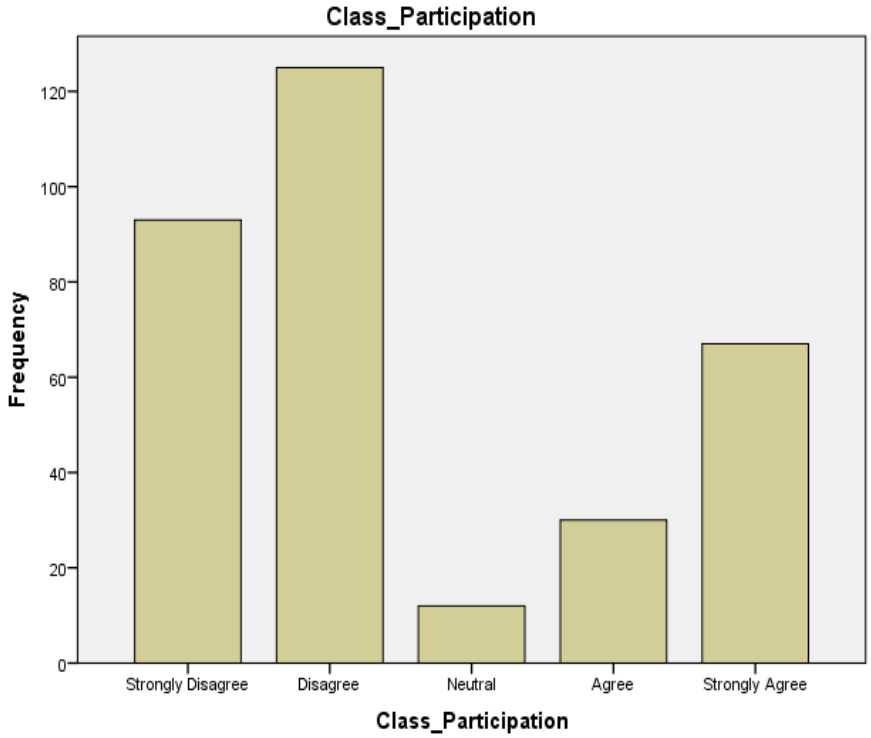

Chart 4.19: Class Participation

4.1.20. Motivation for Future Studies

Table 4.20: Motivation for Future Studies

Statement		SD	D	N	A	SA	Mean	St.D
The current teaching approaches motivate me to pursue further studies in science.	f	110	120	13	57	27	2.29	1.31
	%	33.3	36.4	3.9	17.3	8.2		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.20 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 110 (33.3 percent) students strongly disagreed whereas 120 (36.4

percent) students disagreed to the statement about the motivation for future studies in science. 13 (3.9 percent) students remained neutral to the statement. 57 (17.3 percent) students agreed while 27 (8.2 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.29 while the "Standard Deviation" of the statement was recorded 1.31 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

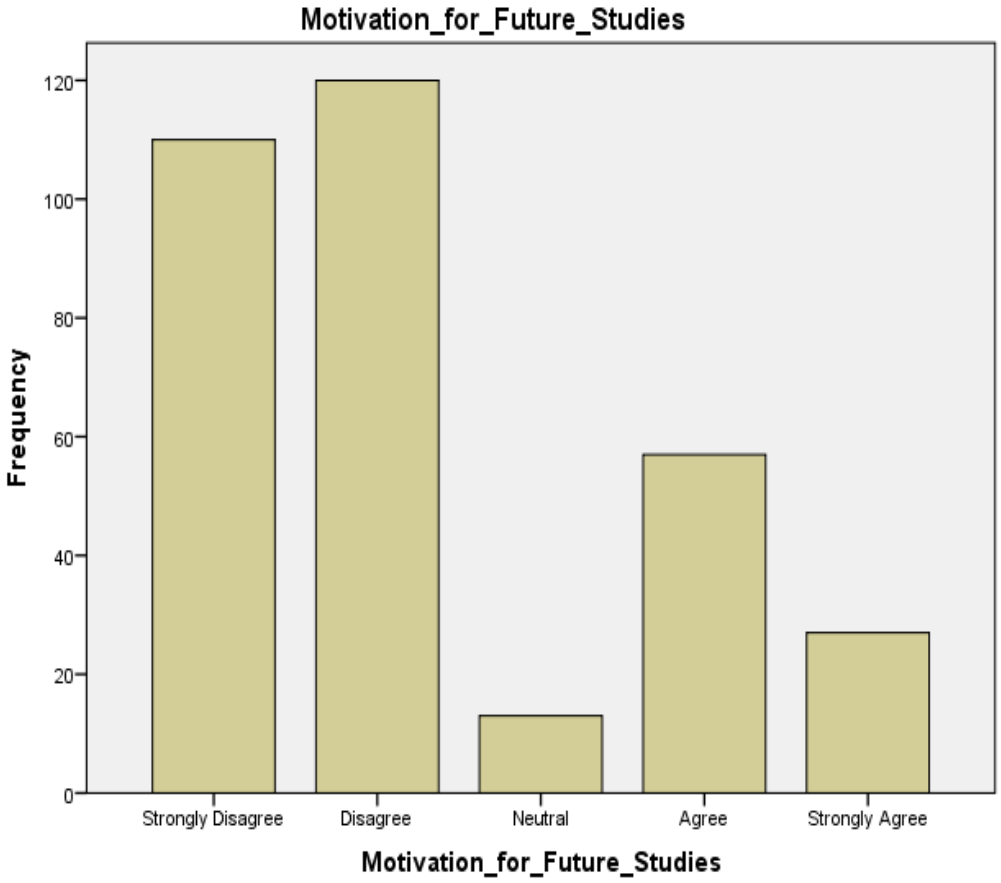

Chart 4.20: Motivation for Future Studies

4.1.21. Impact of Inadequate Facilities

Table 4.21: Impact of Inadequate Facilities

Statement		SD	D	N	A	SA	Mean	St.D
Inadequate facilities hinder my ability to learn science effectively.	f	14	54	13	183	63	3.69	1.09
	%	4.2	16.4	3.9	55.5	19.1		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.21 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 14 (4.2 percent) students strongly disagreed whereas 54 (16.4 percent) students disagreed to the statement about the impact of inadequate science facilities in their schools. 13 (3.9 percent) students remained neutral to the statement. 183 (55.5 percent) students agreed while 63 (19.1 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 3.69 while the "Standard Deviation" of the statement was recorded 1.09 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

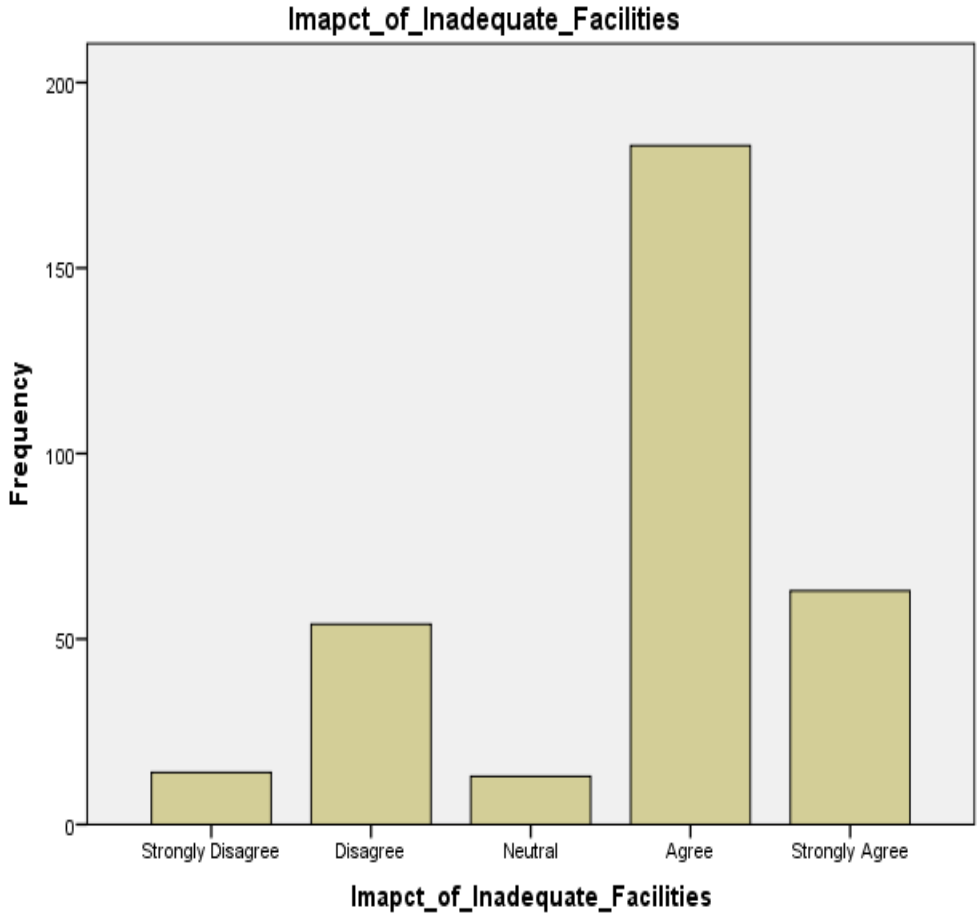

Chart 4.21: Impact of Inadequate Facilities

4.1.22. Language Barriers

Table 4.22: Language Barriers

Statement		SD	D	N	A	SA	Mean	St.D
Language barriers make understanding science concepts difficult.	f	47	18	13	112	137	2.83	1.39
	%	14.2	5.5	3.9	33.9	41.5		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.22 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 47 (14.2 percent) students strongly disagreed whereas 18 (5.5 percent) students disagreed to the statement about the impact of language barriers for understanding science in their schools. 13 (3.9 percent) students remained neutral to the statement. 112 (33.9 percent) students agreed while 137 (41.5 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.83 while the "Standard Deviation" of the statement was recorded 1.39 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

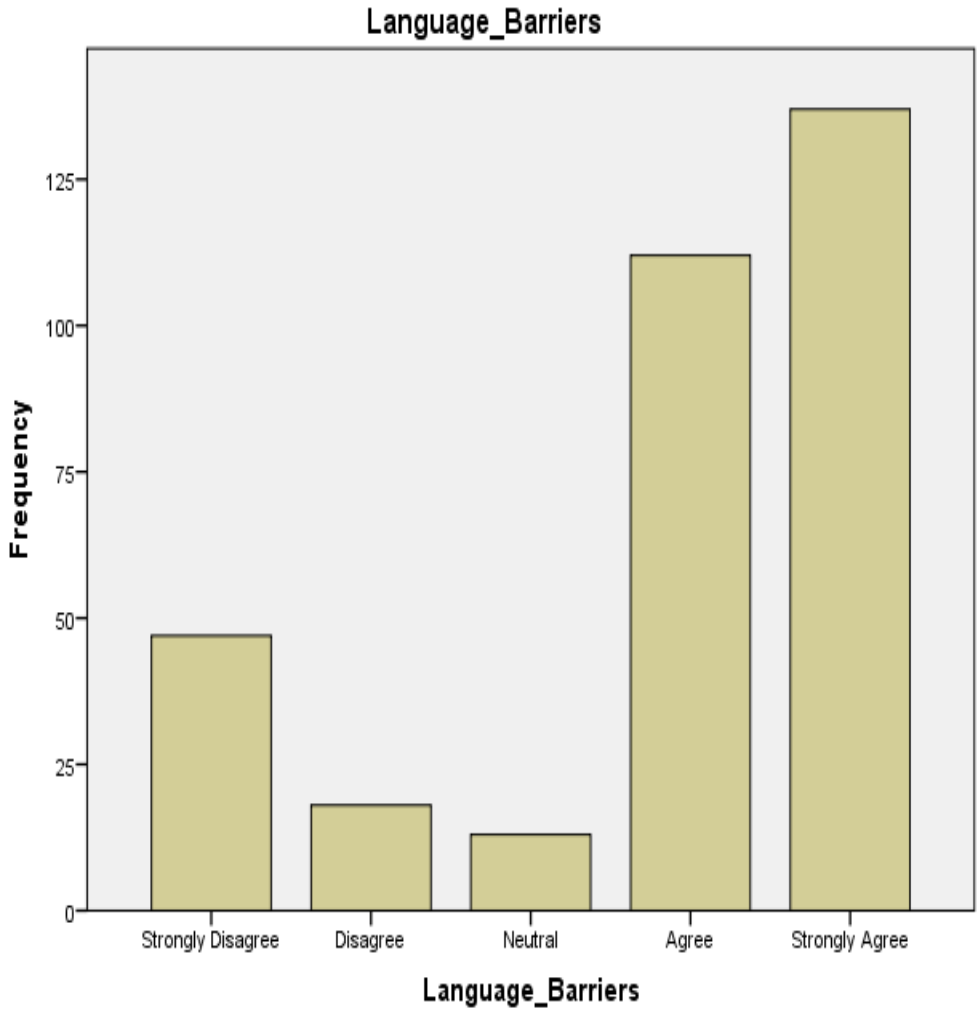

Chart 4.22: Language Barriers

4.1.23. Time for Practical Sessions

Table 4.23: Time for Practical Sessions

Statement		SD	D	N	A	SA	Mean	St.D
There is not enough time allocated for science practical sessions.	f	33	32	12	145	105	3.78	1.27
	%	10.0	9.7	3.6	43.9	31.8		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.23 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 33 (10.0 percent) students strongly disagreed whereas 32 (9.7 percent) students disagreed to the statement about the impact of less time for practical sessions on science learning in their schools. 12 (3.6 percent) students remained neutral to the statement. 145 (43.9 percent) students agreed while 105 (31.8 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 3.78 while the "Standard Deviation" of the statement was recorded 1.27 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

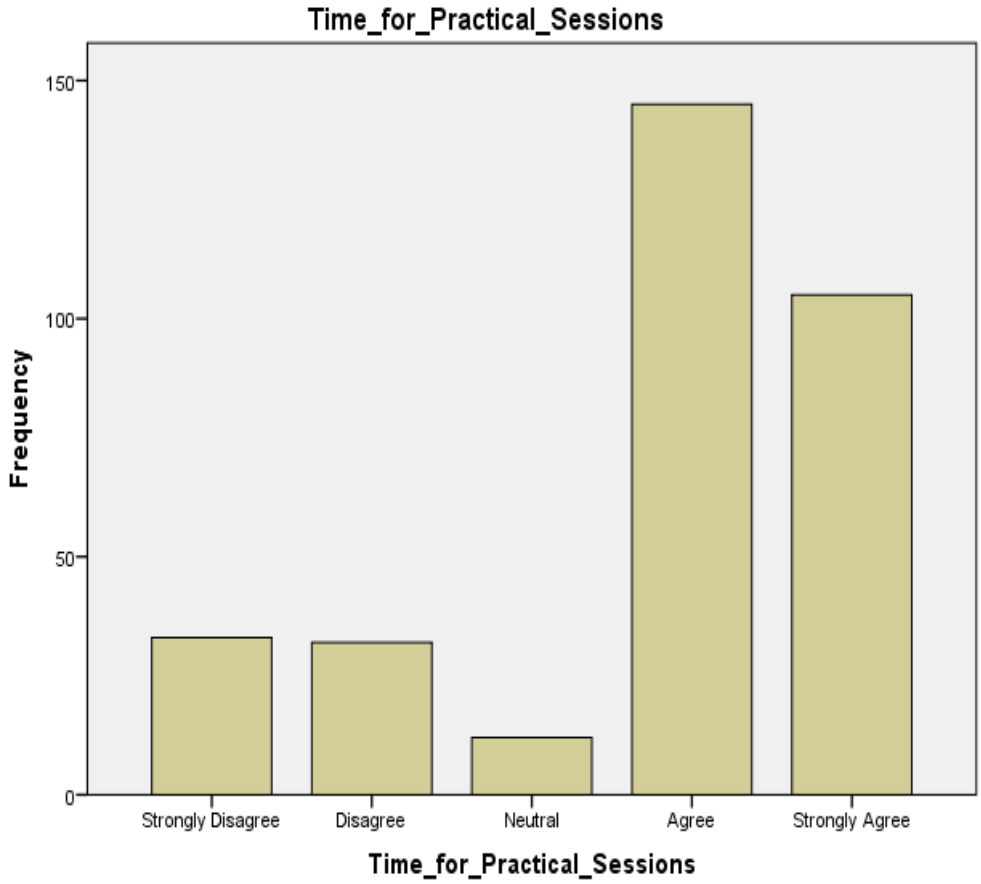

Chart 4.23: Time for Practical Sessions

4.1.24. Class Size Issues

Table 4.24: Class Size Issues

Statement		SD	D	N	A	SA	Mean	St.D
Large class sizes limit individual attention from science teachers.	f	32	33	11	108	143	2.90	1.32
	%	9.7	10.0	3.3	32.7	43.3		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.24 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 32 (9.7 percent) students strongly disagreed whereas 33 (10.0 percent) students disagreed to the statement about the class size issues in their schools. 11 (3.3 percent) students remained neutral to the statement. 108 (32.7 percent) students agreed while 143 (43.3 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.90 while the "Standard Deviation" of the statement was recorded 1.32 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

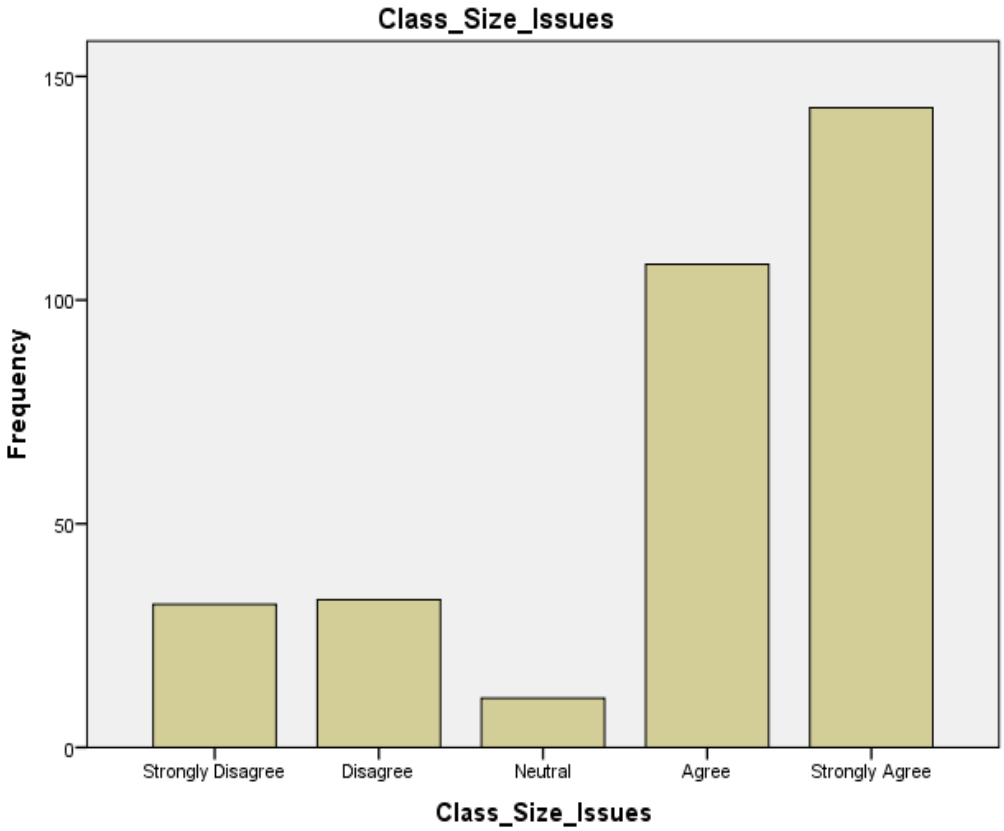

Chart 4.24: Class Size Issues

4.1.25. Availability of Qualified Teachers

Table 4.25: Availability of Qualified Teachers

Statement		SD	D	N	A	SA	Mean	St.D
There is a shortage of qualified science teachers at our school.	f	49	16	12	123	127	3.80	1.39
	%	14.8	4.8	3.6	37.3	38.5		

Note: SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 4.25 shows that out of a total 327 science students who filled out the questionnaire from different secondary schools of District Ziarat, 49 (14.8 percent) students strongly disagreed whereas 16 (4.8 percent) students disagreed to the statement about the availability of qualified science teachers in their schools. 12 (3.6 percent) students remained neutral to the statement. 123 (37.3 percent) students agreed while 127 (38.5 percent) students strongly agreed to the statement. The "Mean" of the statement was recorded 2.80 while the "Standard Deviation" of the statement was recorded 1.39 when they were measured on the scales of "Measure of Central Tendency" and "Measure of Variability" respectively on SPSS (version 21).

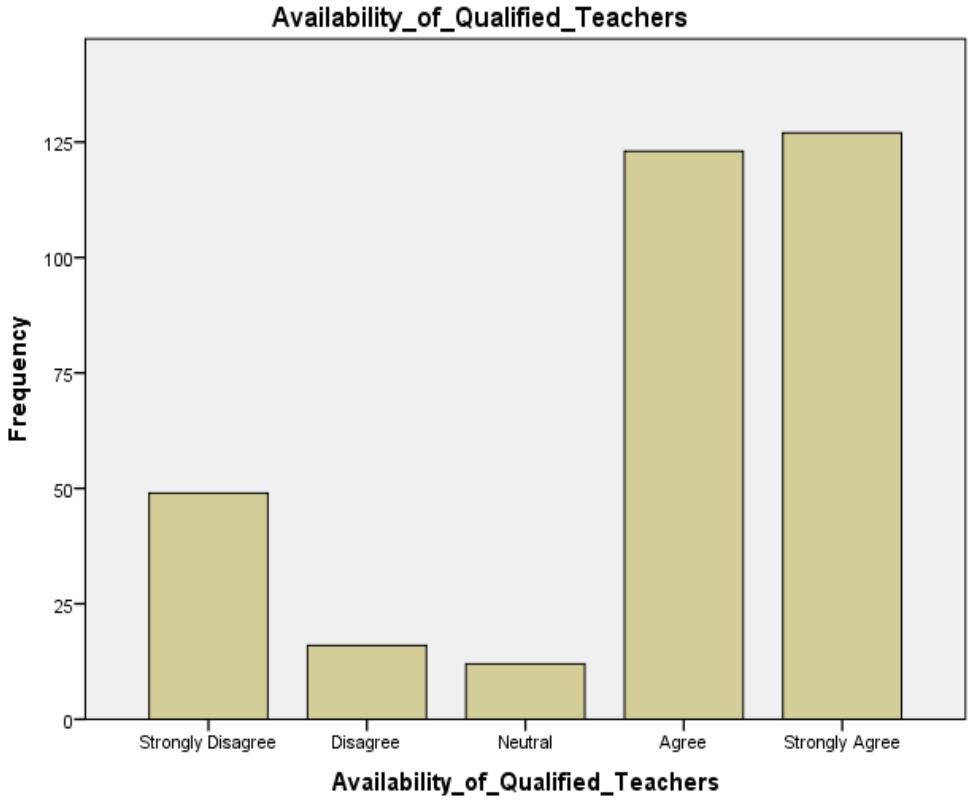

Chart 4.25: Availability of Qualified Teachers

4.2. Thematic Analysis of Semi-Structured Interview

The researcher held a total 28 semi-structured interviews with the secondary school science teachers of District Ziarat. The researcher held interviews with both male and female science teachers of Ziarat. The respondents of the semi-structured interviews consisted of the teachers from both the Government schools and Private schools of District Ziarat. The researcher held interviews with the science teachers teaching in the urban area secondary schools and rural area secondary schools in District Ziarat. The researcher used thematic analysis for the interpretation of the semi-structured interviews. The following six steps were adopted for conducting the thematic analysis of the semi-structured interviews held with the secondary school science teachers of District Ziarat.

4.2.1. Familiarization

Familiarization with the data is said to be the first step of the thematic analysis of the semi-structured interviews. The researcher reviewed the data several times for the purpose of getting familiar with the data. The researcher transcribed the interviews in order to make notes from those transcriptions at the first stage of the thematic analysis.

4.2.2. Coding

The second step of the thematic analysis is coding. The researcher identified several jargon, phrases, sentences, and ideas during the interview. The research used different codes for those phrases and sentences for the purpose of explanation of the contents of the interview at this stage of the thematic analysis.

4.2.3. Generating Themes

The next step after coding is generating themes in the thematic analysis of the semi-structured interviews. The researcher combined similar codes in one theme in order to generate themes from the content of the semi-structured interviews held with the secondary school science teachers of District Ziarat. The repeated codes were excluded when the similar codes were combined with one another in the form of themes.

4.2.4. Reviewing Themes

The fourth step of the thematic analysis of the semi-structured interviews is reviewing themes. The researcher reviewed the themes for several times. Various changes were made to those themes in order that they might be improved. One of the purposes of reviewing themes was to make those themes relevant to the research questions and research objectives.

4.2.5. Defining and Naming Themes

The themes are defined and named at the fifth stage of the thematic analysis of the semi-structured interviews. The researcher defined the themes in order to make them understandable at this stage. The themes were also named by using specific words for them. The purpose of defining and naming the themes was to make them understandable.

Generated Themes

Themes	Codes
1. Facilities for Science Education	1.1. Availability of Science Laboratories
1.2. Adequacy of Science Materials	
1.3. Quality of Science Textbooks	
1.4. Library Resources for Science	
2. **Teaching Methodologies Used**	2.1. Use of Visual Aids
	2.2. Regular Practical Experiments
	2.3. Real-Life Applications
	2.4. Incorporation of Technology
3. Effectiveness of Teaching Methodologies	3.1. Understanding of Concepts
	3.2. Benefit of Experiments
	3.3. Class Participation
	3.4. Motivation for Future Studies
4. Challenges in Science Education	4.1. Impact of Inadequate Facilities
	4.2. Language Barriers
	4.3. Time for Practical Work
	4.4. Large Class Size

4.2.6. Writing Up

This is the last stage of the thematic analysis of the semi-structured interview. All the codes and themes of the interview are discussed in the last stage. The researcher also discussed every code and every theme of the semi-structured interview in detail at this stage.

4.2.7. Theme 1

Facilities for Science Education

Question: Is science laboratory available in your school?

Out of a total 28 secondary school science teachers, 12 (42.86 percent) teachers said that science laboratory was available in their respective schools where as 16 (57.14 percent) said that their secondary schools in District Ziarat did not have science laboratory for performing experiments at the secondary school level.

A respondent said, “Our school has science laboratory where students are allowed to go for the purpose of practical work. We try our level best to ensure that the students benefit from the science laboratory”. Another science teacher said, “Although we have a science lab in our school, it is not a modern lab. It fails to fulfill the needs of the science students according to the needs of the modern time. One of the respondents said, “Like most of the secondary schools of District Ziarat, our school also does not have science laboratory. We are unable to teach the science subjects with practical examples due to absence of science labs”. Another science teacher said that the school, where she was posted, neither had enough rooms for students nor a well-established science laboratory. A teacher of the private school said that his school did not have science laboratory for the secondary school students despite the

fact that the school charges enough monthly fees.

Question: Does your school have sufficient science equipment's and materials for the use of students?

Out of a total 28 secondary school teachers, 6 (21.42 percent) teachers said that the secondary schools in District Ziarat, where they were teaching science, had sufficient science equipments and materials for the use of students while 22 (78.58) said that their respective secondary schools did not have sufficient science equipments and materials for the use of students.

One of the secondary school teachers said, "As our school is located in the urban area of District Ziarat, we have sufficient science equipments and materials for the use of students. Our school is the center of attention of the education department, so we receive enough amount of annual budget to maintain the science laboratory by supplying it equipments and materials". Another respondent said desperately, "Most of the secondary schools of District Ziarat face the shortage of science equipments and materials. Unfortunately, our school is one of those schools where sufficient science equipments and materials are not available". A respondent added that the schools did not receive enough amount of annual budget in Balochistan. Resultantly, the secondary schools in Ziarat faced the shortage of science equipments.

Question: Do you think that the science textbooks that you teach are of good quality?

Out of a total 28 secondary school teachers, 7 (25 percent) teachers that the quality of the science books taught in the secondary schools of District Ziarat were of good quality whereas 21 (75 percent) teachers that the quality of books that they taught to the students at the secondary schools of District Ziarat was not good.

A respondent said that, "The quality of the science textbooks is very good. These books are comprehensive. They contain modern scientific concepts". Another respondent said, "Although the quality of our science textbooks is not as good as that of developed world, it is better than quality of the textbooks taught in the secondary schools of many developing nations". One of the respondents said, "The quality of the science textbooks is very poor. It fails to develop analytical skill among the students. These books do not have modern scientific concepts. It looks as if these books were written in Eighteenth Century". Another respondent blamed the poor quality of science textbooks for promoting the culture of rote learning at the secondary school level in District Ziarat. A science teacher of a private school said, "The quality of science books we teach at lower level is better than that of science books published by Balochistan Textbook Board. We teach the science books of well-known publishers like Oxford and Gaba etc. At the secondary level, we are compelled to teach the books published by Balochistan Textbook Board as they students have to appear in the exams where question papers are made from the these books".

Question: Does your school library have enough materials about science subjects for the use of students?

Out of a total 28 secondary school teachers of District Ziarat, 5 (17.86 percent) teachers said that their respective school library had sufficient materials about science subjects for the use of students while 23 (82.14) teachers said the school library in their respective schools did not have enough materials about science subjects.

A respondent said, "Our school has well-established library where books are available for the students. The library also contains enough materials about science subjects. We encourage the students to read books about different subjects including science subjects". Another school teacher said, "Unfortunately, majority of the secondary schools of District Ziarat do not have enough materials about science subjects in the school library. As a result, the students are unable to read relevant books". A female teacher of the rural area of Ziarat said, "We do not have library in school". "How we can provide science subject books to the students in the absence of library", she wondered. Another respondent said that the schools that had library failed to provide modern books about science subjects to the students because the books they provided were outdated and irrelevant.

4.2.8. Theme 2

Teaching Methodologies Used

Question: Do you use visual aids while using science subjects?

Out of a total 28 secondary school teachers of District Ziarat, 14 (50 percent) teachers said that they used visual aids when they taught science subjects to the students whereas 14 (50 percent) teachers said that they did not use visual aids while using science subjects in the class at the secondary school level.

One of the secondary school science teachers said, "We use visual aids in our school so as to enable the students to understand science very well. We use video and charts for this purpose". Another respondent said, "We rely only on charts while teaching science subjects. We do not have enough resources to arrange the videos for teaching science subjects in our school". A science teacher who teaches in a secondary school located in the far-flung area of District Ziarat said, "We do not use visual aids when we teach science subjects. We neither use video nor charts. We only depend on the textbooks for teaching science in the secondary level". Another respondent said, "The schools do not have enough amount of budget to use visual aids for teaching science subjects".

Question: Do you perform regular practical experiments in science classes?

Out of a total 28 secondary school science teachers of District Ziarat, 10 (35.71 percent) teachers said that they performed regular practical experiment in science classes while 18 (64.29 percent) teachers said that they did not perform regular practical experiments in science classes at the secondary school level.

A respondent said, "Our science laboratory is equipped with scientific equipments. We take the secondary school students to the lab where the experiments are performed. Our aim is to cover both the theoretical and practical parts of the syllabus". Another respondent said, "The practical experiments are hardly performed in most of the secondary schools of District Ziarat. The primary reason is the absence of equipments and materials required for the practical experiments". One of the respondents said, "When we do not have science labs. We do not have enough science equipments. We cannot perform practical work despite the fact that they are an essential part of our course". A science teacher blamed the financial constraints and lack of equipments as the causes of lack of practical experiment in science classes in the secondary schools of District Ziarat.

Question: Do you connect science lessons to real-life situations?

Out of a total 28 secondary school science teachers of District Ziarat, 7 (25 percent) teachers said that they connect science lessons to real life situations when they teach the secondary level class whereas 21 (75 percent) teachers said that they did not connect science lesson to real life situations in their class.

One of the secondary school science teachers said, "Science lessons become interesting for the students when they are connected with the real life situations. Otherwise, science subjects become boring. It is necessary for a science teacher to establish a link between the two so as to enable the students to have the ability to apply the lesson they learn at science class to the real life examples". Another respondent said, "There is a huge gap between what we teach in the science class and the real life situations around us. The textbooks we teach are redundant. The contents they contain cannot be applied to real life situations under any circumstances". A secondary school teacher who teaches in a school located in the mountainous area of District Ziarat said, "The educational background of our students is so poor that they fail to comprehend if we try to connect the science lessons to the real life situation. We, therefore, do not do so in order not to create further confusion for the students".

Question: Do you incorporate technology in science classes?

Out of a total 28 secondary school science teachers of District Ziarat, 3 (10.7 percent) teachers said that they incorporated technology in science classes in the secondary schools of Ziarat while 25 (89.3 percent) teachers said that they did not incorporate technology while teaching science in the secondary schools of District Ziarat.

A respondent said, "Although there are several challenges in the incorporation of technology in

science subjects, we try our level best to incorporate it. We have a computer lab where technology is used to for teaching science subjects". Another respondent said, "The idea of incorporation of technology in science classes is strange in the secondary schools of District Ziarat where the schools are deprived of other basic needs. The incorporation of technology requires huge amount of money which is not available with the schools in Ziarat". One of the secondary school science teacher said, "Internet connectivity is very poor in District Ziarat. The price of the digital devices is also high. It is, therefore, impossible for the secondary school teachers to encourage the secondary school students to use technology for the purpose of learning science subjects". Another teacher stated that most of the science teachers in District Ziarat did not have digital literacy, so it was very difficult to incorporate technology in science subjects in District Ziarat.

4.2.9. Theme 3

Effectiveness of Teaching Methodologies

Question: Do you think that the teaching methodologies you use in the class help the students to understand the science concepts?

Out of a total 28 secondary school science teachers of District Ziarat, 14 (50 percent) teachers said that the teaching methods they used in the class were helpful for the students to understand the science concepts while 14 (50 percent) teachers said that their teaching methodologies did not help the students to understand science concepts in the secondary schools of District Ziarat.

One of the respondents said, "Yes, the methods we use in the science class help the students to understand the concepts of the science subjects. We try to ensure that the students learn both the theoretical and practical parts of the syllabus of science". Another teacher said, "Although our teaching methods are not as well-developed as those of the advanced nations of the world, they are helpful to enable the science students of the secondary class to understand science concepts easily". A respondent said, "The teaching methods used in the secondary schools of District Ziarat are so outdated that they are unable to help the students understand the concepts of the science subjects". A female science secondary teacher blamed the rote learning culture as the main cause of the ineffectiveness of the teaching methods used in the science subjects in the secondary schools of District Ziarat. She also blamed the outdated examination system in the province for the ineffectiveness of the modern concepts of teaching in science subjects.

Question: Do you think that the science experiments have benefits?

Out of a total 28 secondary school teachers of District Ziarat, 23 (82.14 percent) teachers said that science experiments performed in the secondary schools of District Ziarat are beneficial for the students whereas 5 (17.86 percent) teachers said that the science experiments did not benefit the students a lot in the secondary schools of District Ziarat.

One of the secondary school science teachers said, "There is little disagreement with the fact that science experiments are of vital use when they are performed in the secondary schools. They enable the students to understand the science subjects very well". Another interviewee said, "The significance of the science experiments cannot be ignored as they enhance the interest of the students in the subjects". A respondent linked the success of science subjects with the science experiments performed in the science laboratories. A science teacher who strongly disagree said, "The benefit of the science experiments is an uncontested fact but the ground reality in the secondary schools of District Ziarat is very different. The students, who are not taught the theoretical part of the syllabus, are unable to benefit from the science experiments in the secondary schools of District Ziarat".

Question: Does interactive classes encourage the students to participate in the class?

Out of a total 28 secondary school science teachers of District Ziarat, 10 (35.71 percent) teachers said that the interactive classes encourage the students to participate in class in the secondary schools of District Ziarat while 18 (64.29 percent) teachers said that the interactive classes did not encourage the students to participate in the class in the secondary schools of District Ziarat.

One of the interviewees said, "The interactive classes, undoubtedly, encourage the students to participate in the class. The students participate in discussion when they are given chance in the interactive classes. They also participate in several activities that enable them to show positive academic results in the science subjects". Another respondent said, "Although the importance of the interactive classes cannot be turned down, they do not encourage the students to participate in the backward areas like District Ziarat. A secondary school science teacher who teaches in a school located in the rural area of District Ziarat said, "The educational background of our students is so poor that they do not participate in the class when we use interactive methods. They hardly understand the concepts of science subjects. They fail to express the views about the topic due to weak educational background".

Question: Do you think that your teaching methodologies motivate the science students for future studies?

Out of a total 28 secondary school science teachers, 14 (50 percent) teachers said that their teaching methodologies motivated the science students to study science in future whereas 14 (50 percent) teachers said that their teaching methodologies did not motivate the science students for the future studies in science subjects.

A respondent said, "Of course, the teaching methodologies we use in the secondary schools of District Ziarat motivate science students to study science subjects in future. Our teaching methodologies, after all, are not very boring that the students give up studying science subjects". Another teacher said, "The doctors, engineers, IT experts and the science graduates from District Ziarat are our students. They pursued science as their career. Our teaching methodologies did not discourage them to quit studying science". One of the secondary school teachers said, "It is an unfortunate fact that our teaching methodologies are outdated. They do not have the ability to motivate the students to study science in future. Our teaching methodologies also contribute in the huge dropout rate in the secondary schools of District Ziarat". Another respondent said, "Many science students do not understand science subjects due to our outdated teaching methodologies. Resultantly, they either switch the field or drop out of school. Consequently, their chances to pursue STEM studied diminish".

4.2.10. Theme 4
Challenges in Science Education

Question: Do you think that the inadequate facilities hinder the ability of the students to learn science subjects effectively?

Out of a total 28 secondary school science teachers of District Ziarat, 7 (25 percent) teachers said that the inadequate facilities did not hinder the ability of the students to learn science subject effectively in the secondary schools of Disstrict Ziarat whereas 21 (75 percent) teachers said that the inadequate facilities hindered the ability of the students to learn science subjects effectively in the secondary schools of District Ziarat.

A respondent said, "Although inadequate facilities are among the huge challenges in the secondary schools of District Ziarat, they do not hinder the ability of the students to learn science effectively. We have multiple examples that the students of the secondary schools of District Ziarat became successful in life despite the absence of facilities in the schools". One of the interviewees said, "It is an open secret that inadequate facilities act as obstacles in the path of the students. They reduce the abilities of the students to learn science subjects effectively". Another respondent said, "Inadequate facilities at the secondary schools of District Ziarat hinder the ability of the students to learn science effectively. As a result, most of these students fail to become successful in the life despite studying science in the secondary schools".

Question: Do you think that language barriers make understanding science difficult for the students?

Out of a total 28 secondary school science teachers of District Ziarat, 10 (35.71 percent) teachers said that the language barriers did not make understanding science difficult for the students inthe secondary schools of District Ziarat whereas 18 (64.29 percent) teachers said that the language barriers made understanding

science difficult for the students in the secondary schools of District Ziarat.

A secondary school teacher said, "Language barriers are of little significance in understanding science subjects at the secondary schools of District Ziarat. At the secondary level, the students have good command over the language. Resultantly, the language barriers hardly act as obstructions in the effective learning of science subjects." A science teacher who teaches in a private school said, "We impart science education to the student in English. The base of our students is good enough to enable to understand science subjects in English. Language barriers do not matter in our school". Another respondent said, "Language barriers hinder the ability and understanding of the secondary school students in District Ziarat. The mother language of the majority of the students is Pashto but they are imparted science education either in Urdu or English. As a result, it becomes difficult for them to understand science subjects". A science teacher who teaches in a school located in the rural area of District Ziarat said, "Language barriers are serious issues. The students in our school are very weak in both Urdu and English. When we teach them in these two languages, they face difficulty understanding the subjects".

Question: Is low allocation of time for practical work a challenge in learning of science subjects for the students?

Out of a total 28 secondary school science teachers of District Ziarat, 3 (10.7 percent) teachers said that low allocation of time for practical work was not a challenge in learning of science subjects for the students in the secondary schools of District Ziarat while 25 (89.3 percent) teachers said that the low allocation of time for practical work was a challenge in the learning of science subjects for the students of the secondary schools of District Ziarat.

One of the interviewees said, "Although practical work is important in enabling the students to learn science subjects effectively, the low allocation of time for practical work is not a big challenge. Many schools in District Ziarat allocate very low time for the practical work of the science subjects, yet the students of these secondary schools excel in different fields of life". Another respondent said, "It is an uncontested fact that the low allocation of time for practical work reduces the ability of the students to learn science subjects at the secondary schools in District Ziarat". A secondary school science teacher said, "There is a strong nexus between the poor quality of science education and the low allocation of time for the practical work in the secondary schools of District Ziarat. Majority of the students, who do not take interest in science subjects at the secondary schools, do not have the chance to see proper practical work of the science subjects in the school".

Question: Do you think that large class size in science subjects is a challenge for the teachers to teach effectively?

Out of a total 28 secondary school science teachers of District Ziarat, 7 (25 percent) teachers said that large class size in science subject was a challenge for them to teach effectively whereas 21 (75 percent) teachers said that the large class size was not a challenge for them to teach effectively in the secondary schools of District Ziarat.

One of the respondents said, "Large class size is really a big challenge for any science teacher. We are unable to give proper time to each student due to large size of the class. It is the large size that we fail to focus on the practical work of the students in the secondary schools of District Ziarat". Another interviewee said, "Large class size is not a serious challenge for the science teachers of secondary schools of District Ziarat. In fact, most of the secondary schools of the district do not have very large size. The science teachers can easily control the class due to its small size". A respondent who teaches in a school located in the rural area of the District Ziarat said, "Large class size is not an issue in the rural areas because of the lower enrollment of the students in the secondary school of District Ziarat. We face so many other challenges that large class size seems normal to us".

SUMMARY, FINDINGS, DISCUSSION AND CONCLUSION

5.1. Summary

The study analysis of the science education at the secondary school level in District Ziarat was

aimed to observe the presence of different facilities for the provision of science education, to investigate the effectiveness of different methodologies used by the teachers for imparting science education, and to explore various challenges faced by the students and teachers in the attainment of science education in the secondary schools of District Ziarat. A mixed-method research was adopted for the analysis of science education at secondary school level in District Ziarat. The quantitative data were collected with the help of structured and closed-ended questionnaires that were filled out by 327 male and female students of Class IX and Class X of both the Government and private secondary schools located in the urban and rural areas of District Ziarat. The semi-structured interviews were held with 28 teachers of the same schools. It was discovered that the majority of the Government secondary schools in District Ziarat do not have science laboratories. A large number of the Private secondary schools that take an adequate amount of monthly fees from the students also do not have science labs. The condition of science laboratories in the secondary schools located in the rural area of District Ziarat is worse than that of the science labs located in the urban areas of the Ziarat. Many secondary schools of both the Government and Private sectors in District Ziarat do not have sufficient science equipments and materials. Most of the secondary schools of District Ziarat do not advanced and modern science equipments. The quality of science textbooks taught in the secondary schools of District Ziarat is so poor that they fail to fulfill the needs of the modern time. A large number of the secondary schools of District Ziarat do not have enough library sources about science subjects for the use of the students. Many secondary schools do not have suitable classrooms for learning science in District Ziarat. It was also revealed that the science teachers in a large number of secondary schools of District Ziarat avoid using interactive teaching methods while teaching science subjects. The science teachers depend on the rote learning system while teaching science subjects in District Ziarat. Some science teachers use visual aids for enabling the students to understand science subjects but some teachers do not use them. The teachers who use visual aids mostly rely on charts. They avoid using video for this purpose. The science teachers in most of the secondary schools do not conduct practical experiments on regular basis. Majority of the teachers do not connect science lessons to real life situations in the secondary schools of District Ziarat. Technology is not incorporated for teaching science subjects to the students in the secondary schools of District Ziarat.

Most of the students find the teaching methodologies of their science teachers ineffective and outdated. The ineffective teaching methodologies used in the secondary schools of District Ziarat make it difficult for the students to comprehend concepts of science subjects. The ineffective teaching methodologies used in the secondary schools of District Ziarat do not motivate the students to study science in future. The absence of adequate facilities in the secondary schools of District Ziarat hinders the ability of many students to learn effectively. Language barriers also make it difficult for many students to understand science subject in the secondary schools of District Ziarat. Lower allocation of time for practical work also acts as a challenge for most of the students of the secondary schools of District Ziarat. Absence of qualified science teachers is a serious challenge for the secondary school science students of District Ziarat.

5.2. Findings of the Study

- 66.4 percent students do not have science laboratory in their respective secondary schools of District Ziarat.
- 69.7 percent students in the secondary schools of District Ziarat do not have access to sufficient science equipments and materials.
- 65.8 percent students think that the science textbooks, which they are taught in the secondary schools, are of poor quality in content, language and ideas.
- 69.7 percent students do not have access to ample science resources in the school library of the secondary schools of District Ziarat.
- 64.8 percent students do not consider their classroom suitable for learning science subjects at the secondary school level.
- 66.4 percent students think that the teaching methods in the science subjects at the

secondary school level in District Ziarat are not interactive.

- 65.7 percent students have never experienced the visual aids in science subjects at the secondary school level in District Ziarat.
- 65.8 percent students think that practical experiments are not performed in the schools in District Ziarat.
- 65.7 percent students consider that their teachers do not connect science lessons with the real life examples.
- 70 percent students find the lack of incorporation of technology in the science subjects at the secondary school level in District Ziarat.
- 69.7 percent students are not motivated by the current teaching methodologies of their teachers for studying science in future.
- 74.6 percent students think that the ability to learn science is affected by the inadequate facilities in the secondary schools of District Ziarat.
- 75.4 percent students consider language barriers as a challenge in learning science subjects in the secondary schools of District Ziarat.
- 75.8 percent students think that their respective secondary schools in District Ziarat face shortage of qualified science teachers.
- 57.14 percent teachers say that their respective secondary schools in District Ziarat do not have science laboratory.
- 78.58 percent teachers think that sufficient science equipments and materials are not available in their schools in District Ziarat.
- 75 percent teachers opine that the quality of science textbooks in the secondary schools of District Ziarat is very poor.
- 82.14 percent teachers think that ample resources on science subjects are not available in the school library in the secondary schools of Ziarat.
- 50 percent teachers do not use visual aids either in the shape of charts or videos in the science classes at the secondary schools of District Ziarat.
- 64.5 percent teachers do not connect science lessons to the real life examples in the secondary schools of District Ziarat.
- 89.3 percent teachers think that information technology is not incorporated in the science subjects at the secondary school level in District Ziarat.
- 75 percent teachers opine that the lack of sufficient facilities hinder the abilities of their students to learn science at the secondary schools of Ziarat.
- 64.29 percent teachers find language barriers as a serious challenge for their students in the secondary schools of District Ziarat.
- 89.3 percent teachers think that the inadequate allocation of time for practical work is a challenge for their students in the secondary schools of District Ziarat.

5.3. Discussion

The quality of science education is very poor in the secondary schools of Districts Ziarat. Gujjar (2022) rightly observed the role of absence of science facilities in the educational institutes in the deterioration of the quality of science education. The absence of basic science facilities like well-equipped science labs and shortage of science equipments worsen the quality of science education in the secondary schools of District Ziarat. Javed (2023) also identified several cause of the poor quality of science education in the secondary school. Similar causes contribute to the poor quality of science education in the secondary schools of District Ziarat. The causes of lack of improvement of the quality of science education in the secondary schools of District Ziarat were similar to the causes identified by Hussain (2023) in his study about the causes of poor quality of education at secondary level in Pakistan.

Hofstein and Lunetta (2024) identified the significance of presence of science labs in the educational institutes. Similar significance of the presence of well-equipped science laboratory in the secondary schools of District Ziarat was felt. It is impossible to impart quality science education to the students of the secondary schools without the presence of science laboratory. The presence of science equipments and materials is of equal significance for the provision of the quality science education to the students of secondary school students.

Faize (2021) observed that the outdated teaching methods used by the science teachers in the secondary schools had negative impacts on the students. The outdated methods reduce

promotion of analytical abilities among the students of secondary schools of District Ziarat. They also diminish the critical thinking among the students. They promote rote learning culture which is harmful for the students of the secondary schools of Ziarat.

Kaptan and Timurlenk (2022) were right when they discovered several challenges faced by the students during the attainment of science education in the developing nations of the world. McFarlane (2023) also observed the several challenges faced by the science students in the twenty-first century. Akram (2021) also identified challenges faced by science students in Pakistan. The challenges identified in these three studies were also faced by the science students and teachers in the secondary schools of District Ziarat. Language barriers, low allocation of time for practical work, large class size, and presence of qualified science teachers are among these challenges in the secondary schools of District Ziarat.

Teixido (2021) named several measures for the amelioration of the quality of education according to the needs of the twenty-first century. Wolk (2022) rightly termed the incorporation of technology as a solution for the improvement of the quality of science education. Similar measures are solution to the poor quality of science education in the secondary schools of District Ziarat.

5.4. Conclusion

The significance of science education is undeniable in the twenty-first century. Many nations of the world achieved development and prosperity due to science education. It is science education that results in the social as well as the economic mobility of an individual within a society. The quality of science education in the developing nations of the world is poor. Unfortunately, Pakistan is also among those nations of the world where the quality of science education is very poor. There are various factors that contribute to the poor quality of science education in Pakistan.

District Ziarat as an under-developed district of the backward Balochistan also faces several issues at the secondary school level in the provision of science education. Many schools in Ziarat lack well-established and well-equipped science labs. As a result, the students of the secondary school level are deprived of practical work in various science subjects. Moreover, majority of Government schools face financial problems. They do not have enough funds for the provision of the science equipments and materials to the students. These schools are also unable to ensure the provision of library resources to the students about science subjects due to budget constraints.

The quality of the science textbooks taught in the secondary schools of District Ziarat is poor. These books do not contain modern concepts of science subjects. Their language is very poor. Their contents are irrelevant in the twenty-first century. They are boring for the students. Resultantly, the students do not take interest in these books. Consequently, the quality of science education in Ziarat becomes poor.

The teaching methods used by the science teachers in the secondary schools of District Ziartat are outdated. These methods fail to promote analytical skills among the students of Ziarat. They also do not generate critical ability among the secondary school students of District Ziarta. Rather, they promote rote learning culture. They students are compelled to memorize science contents instead of understanding them.

The lack of incorporation of technology in the science subjects is another key factor responsible for the poor quality of science subject in the secondary schools of District Ziarat. These schools do not have sufficient financial resources for the incorporation of technology. The poor internet connectivity and the higher prices of the digital devices are obstructions in the path of the incorporation of the technology for the provision of science education in the secondary schools of District Ziarat.

There are multiple challenges faced by both the science students and teachers in the secondary schools of District Ziarat. The absence of adequate resources, language barriers, and the shortage of the qualified teachers are common challenges faced by the students. On the other hand, large class size and the poor educational background of the students are the challenges for the science teachers in the secondary schools of District Ziarat. There are some measures that

can improve the quality of science education in District Ziarat.

5.5. Recommendations

- The Government of Balochistan should establish science laboratory in every Goverrnment Secondary School of District Ziarat.
- The Education Department of the Government of Balochistan should seek the help of the International Organizations and philanthropic organizations in the provision of science education to the students of the secondary schools in District Ziarat.
- The regulatory bodies of the Government of Balochistan should ensure the establishment of well-equipped science labs in the Private secondary schools of District Ziarat.
- The Education Department of the Government of Balochistan should provide sufficient science equipment and materials to the secondary schools of District Ziarat.
- The Government of Balochistan and other stakeholders should provide proper training to science teachers of the secondary schools of District Ziarat so as to enable them to adopt modern teaching methods.
- All stakeholders should take serious measures for the incorporation of the technology for the better provision of science education to the secondary school students of District Ziarat.
- The Science teachers must conduct practical work of the science subjects in order to enhance the interest of the students in studying science subjects.
- The Government of Balochistan, the policymakers and the teaching staff of the schools should address the issue of language barriers.
- The Education Department of the Government of Balochistan should solve the shortage of qualified science teachers in the secondary schools of District Ziarat.
- The regulatory bodies and the civil society should compel the Private secondary schools of District Ziarat to resolve the issue of shortage of the qualified science teachers in District Ziarat.

5.6. Future Research Area

- The future researchers may investigate the negative impacts of poor quality of science education on the students of the secondary schools of District Ziarat.
- The future studies may be about the exploration of the adaptation of the recommendations of this study by different stakeholders.
- The future researchers may study major causes of lack of adaptation of the recommendations of this study.

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