An Investigation of The Impact of Teaching Quality of Science Subject on Students` Learning

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Abstract

This paper presents an investigation of teaching quality of science subject and its impact on students` learning. The reason behind selecting the problem was to investigate the impact of teaching quality of science subject on students` learning. It was also intended to describe the quality teaching of science subject and students` learning. It was thought that scientific literacy should be a top priority for all citizens since it would enable them to be curious about and aware of their surroundings, to value and critically evaluate claims made by others regarding scientific subjects, to recognize questions, to look into and draw conclusions based on evidence, and to make decisions regarding their own health and well-being as well as the environment. based on scholarly publications and information from both domestic and foreign sources. Teachers and students provided the data, and an idealized picture of the curriculum, teaching and learning techniques, career paths and teacher professionalism, facilities and resources, and the importance of science and science education to the community were painted. The investigation was conducted using a quantitative technique and a descriptive study design. To get the data, a random sampling procedure was applied. The Likert scale 5.0 questionnaire was the instrument utilized to conduct the study. The statistical program for social sciences, version 26, was used to analyze the data. It aided in obtaining improved outcomes based on information gathered from several responders. It was revealed that the teaching quality of science subject has a significant impact on students` learning. Better the teaching techniques better the students` learning outcomes can be availed.

Keywords: Teachers, Students, Teaching Quality, Science Subject, Students` Learning

Introduction:

It is evident that by the end of the 20th century, education was no longer able to equip people for stable, lifetime jobs in the local services or industry. As a result of the quickening speed of technical advancement and the globalization of business, people with a strong general education, effective communication skills, flexibility, and a dedication to lifelong learning are now more in demand. We believe that the science education we now provide to youth is outdated and essentially still serves as a training ground for the scientists of the future. It was thought that scientific literacy should be a top priority for all citizens since it would enable

them to be curious about and aware of their surroundings, to value and critically evaluate claims made by others regarding scientific subjects, to recognize questions, to look into and draw conclusions based on evidence, and to make decisions regarding their own health and well-being as well as the environment. based on scholarly publications and information from both domestic and foreign sources

A civilization with advanced technology will always need a supply of highly competent research scientists, but only a small portion of the population will be educated and trained to meet this need. However, due to the increasing significance of scientific issues in our daily lives, we need a public that is knowledgeable enough to follow scientific discussions and debates with interest and to participate in the issues that science and technology raise for our society as a whole as well as for each individual (Millar & Osborne, 1998).

The quality of science instruction and how it affects students' learning are examined in this paper. The problem was chosen with the intention of examining how scientific education quality affects students' learning. It was also meant to characterize the high caliber of science instruction and students' learning. It was once thought that scientific literacy should be a top priority for all citizens, as it would enable them to be curious about and knowledgeable about the world around them, to value and critically evaluate claims made by others regarding scientific matters, to recognize questions, conduct research and come to evidence-based conclusions, and to make decisions regarding their own health and well-being as well as the environment. based on scholarly publications and information from both domestic and foreign sources (Mayhill, & Brackley, 2022).

What we teach our young people risks becoming less and less relevant to both their needs and the requirements of society if we don't undertake a major assessment and reconsideration of the goals and substance of the science curriculum. Much more has been discovered over the past three decades regarding how students learn, the best practices for teaching and evaluating science subjects that could encourage students' learning, the kind of science education that could most effectively encourage scientific literacy, and the kinds of professional development and other resources required to support teachers in their quality teaching of science subjects. The research methodology used here was far more comprehensive than a straightforward curriculum evaluation that contrasted the planned and implemented curricula (Costa, & Araújo, 2018).

Virtuous science teaching and learning promotes students' active engagement with ideas and evidence through the use of a participatory approach that, with the assistance of the science teacher, connects students' prior understanding of the subject's concepts to the actual classroom presentation. This bridge will demonstrate how to teach science in a meaningful way in the classroom by fostering intellectual curiosity in science and encouraging active involvement that makes use of the "heart, head, and hands on" methods. It is obvious that engaging in practical activities is essential to meaningful science study. This hands-on exercise provides a platform for appropriately demonstrating the theoretical knowledge learned in scientific classes (Tahir, & Treagust, 2022).

A comprehensive vision for high-quality scientific teaching and learning is outlined in the National Scientific Education Standards, and it includes the following: The way science is taught to pupils has a significant influence on how effectively they learn it. How successfully teachers were able to teach science was greatly influenced by their own perspectives on the

discipline and the subject matter that pupils were expected to acquire in school. Students' understanding of science subjects is a result of their active creation and social processing of knowledge, and teachers' perceptions of and interactions with their students have a big influence on their behavior. When it comes to how much students engage with and adhere to epistemology and self-understanding, the affective dimension of learning is crucial (Collier & Lerch, 2019).

Developing scientific literacy is the goal of teaching science subjects; narrowing the gap between reality and ideals is the main area of focus for change; instructors hold the key to this transformation; effective science education requires time, resources, and collaboration. Teaching science is a prerequisite that must be met. Teachers who have undergone preparation are better able to impart scientific knowledge to their pupils and demonstrate their professionalism. They can also accomplish higher learning outcomes for their students. By combining comments from the method mentioned, the noteworthy aspects related to awareness, teachers, resources, assessment, and national collaboration can be produced. Each of these aspects includes a variety of recommended activities for implementation (Tahir & Treagust, 2022). By focusing on the tangible aspects of what is needed to advance, the breach between the real and perceived realities of science teaching and learning can be substantially reduced. This creates an environment that improves the quality of science education and influences students' learning. Hence, this research study intended to have an investigation of the impact of teaching quality of science subject on students` learning.

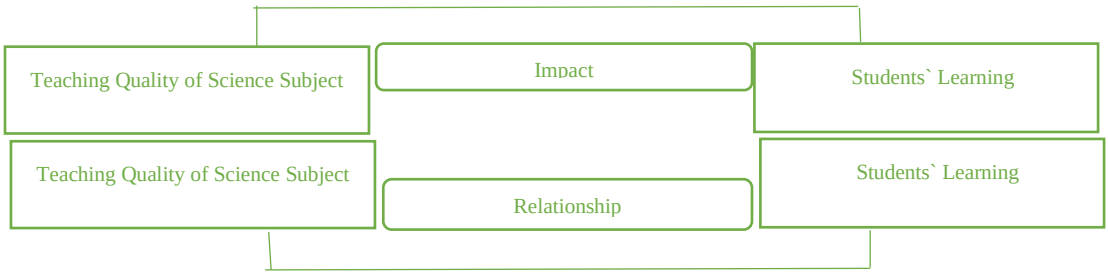
Objectives

1. To investigate the impact of the teaching quality of science subject on students` learning.
2. To describe the relationship between the teaching quality of science subject and students` learning
3. To inline the suggestion to improve the teaching quality of science subject for better students` learning.

Hypothesis

1. There is no significant impact of the teaching quality of science subject on students` learning.
2. There is no significant relationship between the teaching quality of science subject and students` learning

Conceptual Framework



(Self-Developed 2024)

The study envisioned to investigate the teaching quality of the science subject which will be helpful for the teachers to teach the science subject with quality of teaching techniques that can result in better institutional outcomes. This research is study will also be valuable for the students to understand the better learning of science subject. This research is study will also be beneficial for the policy maker to consider the main inputs for better teaching of quality of science subject that helps to develop a quality teaching and learning environment. This research study was delimited to all the Government Colleges (science) of Hyderabad District. Science Subject Teachers and Students of Hyderabad District. Science Subjects in this study refers to Chemistry Subject only.

The motivation for participating in the study was to raise the standard of science instruction. It is generally accepted that science should be taught to all students as a fundamental subject and that encouraging scientific literacy should be the main goal of science education. However, this goal has rarely been met by science instruction in our classrooms (Nakhleh, 2021). According to Millar and Osborne (1998), science education in the future will focus on developing scientific literacy and assisting students in reaching the specified outcomes. This statement highlights how the actual state of curriculum implementation in most schools differs from the intended curriculum (Taber, 2017).

Since science is typically student-centered and activity-based, many high school students are disappointed to find that the science they are taught is neither interesting nor relevant, and it does not relate to their interests or experiences, which is indicative of poor science instruction. Students' disenchantment with science is evident in the decrease in the number of intermediate-level scientific courses they take. A large number of scientific instructors feel overworked, underappreciated, and lacking in resources. Several essential presumptions supported the need to raise the standing and calibre of science education (Othman, Treagust, & Chandrasegaran, 2018).

Meyers & Jones (1993) distinguished between two general categories of science learning: learning by reading, writing, talking, and listening, and learning by doing, or the hands-on aspect of education. Othman, Treagust, and Chandrasegaran (2018) pointed out that up until now, there has been less of an emphasis on the practical component. This is due to a few factors. First off, the cost of the practical exams is more than that of the written exams. Second, there is a strong association between the written test result and the practical component. As a result, written assessments can take the role of actual assessments. In order for their students to receive high exam scores, science teachers also place more emphasis on written assessments. Though, Leach and Paulsen (1999) determined that the practical component is still necessary to complement science learning.

It was discovered that people enjoy and remember the experiences they gained via doing, such as participating in a group project or attending a lecture. In this sense, a science teacher is essential (Driver & Wood-Robinson, 2019). A teacher can effectively encourage his pupils to engage in experiential learning if he shows them more respect, care, and attention to their needs. If a teacher lacks the ability to pique students' interest in his lessons, exhibits poor

classroom management skills, and has an unpleasant disposition, the students' interest in science subjects will decline. It was also discovered that conducting experiments gives students the opportunity to think critically about a variety of occurrences and, as a result, formulate questions. This helps to make science knowledge seem practical and genuine. Ultimately, it might help the students understand how scientists pose problems and look for solutions (Foley & McPhee, 2018).

The sciences are special in that they derive their knowledge from natural phenomena and experimentation. The classroom learning and the experimental learning are mutually dependent with these goals in mind. An essential component of the entire learning process is the experiment. According to Leach (2012), "it is a fact that effective learning of science subjects cannot be accomplished without practical or laboratory work." Students always remember the experiences they had through group projects, presentations, and "learning by doing." The function of the science teacher is crucial in this regard. Furthermore, it is a proven fact that the only instructor who can inspire pupils to engage in experimental learning is one who is sincere, committed, and aware of their unique learning requirements. Therefore, a teacher is considered incapable of teaching any science topic well if they are unable to inspire students' interest in and enthusiasm for practical or experimental work (Osborne, Simon, & Collins, 2021).

These teachers demonize science education and promote indifference in it. There are several benefits to doing experiments, including the ability for students to investigate and pose numerous questions, making science more physical and real, and allowing them to consider various occurrences and formulate inquiries about them. Students get an understanding of how science poses questions and how to find answers by engaging in experimental activity. Ultimately, the work done in the lab and the knowledge gained in the classroom are connected and play a crucial role in the secondary school teaching and learning process." Games, Simulations, and Role Playing

The academic performance of the students was examined in a study of the relationship between the teaching strategies and approaches used by secondary school science teachers and Ijaz Ahmad. The purpose of this study was to look into the relationship between students' academic performance in science classes and the teaching strategies and pedagogies used by secondary school science teachers. It has been discovered that the vast majority of science instructors teach science topics through the lecture format. There were variances in the questioning strategies, use of the whiteboard, presentation and explanation of the students' participation in instructional activities, and dictation of notes in the form of exam questions inside this general teaching methodology (Gee, & Wong, 2012).

Chemistry is the study of matter, including its characteristics, interactions with energy, and how and why chemicals mix or separate to form other substances. We are all chemists, despite the common misconception that they are white-coated professionals who mix weird liquids in a lab. It is essential for practically every career to comprehend the fundamentals of chemistry. Every aspect of our life involves chemistry. Matter makes up everything in the universe, including our own bodies. Everything we do involves chemistry, including raising and preparing food, cleaning our bodies and houses, and launching space shuttles. One of the physical sciences that aids in explaining and characterizing our environment is chemistry (Bagley, 2017).

The conclusion is that science is a methodical process that involves universal truths, is commutative in nature, and encompasses the world's natural facts. Our lives are greatly influenced by chemistry. It offers the fundamentals of contemporary technology—instruments, materials, methods, and energy sources that facilitate our daily lives and jobs (Mursaleen, 2012). The phrase was used the term "chemistry" is occasionally used to describe the application of chemical knowledge that focuses on technological advancement. Our perceptions of who we are and where we fit in the cosmos are likewise shaped by scientific discoveries. An effective scientific education program contributes to a nation's social and economic advancement. It gives pupils the scientific knowledge they need, which may enable them to solve the majority of environmental and socioeconomic issues. Science education equips students with the scientific abilities they need for the workplace as well as a solid and adequate knowledge basis in the areas of agriculture, environmental concerns and problems, nutrition, and food. Mohanty, on the other hand, confuses science education with the findings of scientific study and has an overly positive perspective of science. Too many of the present issues facing the globe have long since been solved. Neither science nor science education are the issue. Politics is the issue! Additionally, he misinterprets the supply of science education as a way to foster socially evolved attitudes towards science. The public's social knowledge of their rights and political will are necessary to address the problems facing the modern world. When Jacques and Poisson (2001) elaborated on the breadth of education, they pointed out that different countries had different standards for science education. Additionally, the emphasis alternates between scientific information, scientific instruments, educational approaches, and values (Praviolo, 2021).

It has been proposed that critical thinking entails questioning newly presented information about what, how, and why it exists, as well as about its source and relationship to previously recognized concepts. Until the meaning of the phrase is clarified, it is impossible to make statements about the effectiveness of science education to foster critical thinking. It is quite foolish to believe that science gives students the ability to start changes that will improve different sorts of needs. While studying the sciences may impart information, putting that knowledge to use is another story. This entails concerns about political will, dedication, and resources, among other things. Here, science is not very helpful. According to Barber (2006), science education in Pakistan is currently in the following state: "At the high school level, various teachers teach mathematics, physics, chemistry, and biology. Although all four of these disciplines are typically taught by two teachers, good schools assign at least three teachers to each of these subjects. Curricula are prescribed by the Ministry of Education via its curriculum division. There is no one organization that can provide this comprehensive process in the field of science education in terms of related instructional materials, such as teacher guides, student workbooks, learning modules for students, charts, transparencies, film slides, filmstrips, demonstration models, and inexpensive and cost-effective devices to execute inquiry-oriented practical. Poor science instruction in middle and high schools contributes to a high failure rate and fewer students being accepted into universities. Treagust & Tahir, 2022). This is the outcome of an all-around subpar teaching-learning process carried out by inexperienced and unmotivated science teachers, inadequate science equipment and labs, out-of-date curricula, subpar practical work, subpar testing procedures, and insufficient educational research. (Nakhleh, 2021).

Methodology:

This provides an explanation of the research methodology and process used to finish the study and produce fresh results that will improve understanding of the science teaching profession and improve student learning outcomes. As a result, a quantitative strategy was used in concurrence with a descriptive survey style of study. The Likert Scale 5.0 questionnaire was used to gather the data. The study's main goal was to determine how science teachers' teaching quality affects students' learning in order to recommend appropriate changes to the way science is currently taught in accordance with the students` learning.

The population was consisting of number of science colleges, Principals, Number of Teachers and students studying in science colleges of Hyderabad district

S. No	Name of District	No of Science Colleges and Principals	No of Science Teachers (Chemistry)	No of Science Students
1	Hyderabad	15	97	9944

Source: Office of the Director Colleges Hyderabad Region Hyderabad (2021)

The sample size of the research study was calculated by using Krejcie and Morgan, (1970) table through simple random sampling technique. In this table calculation was based on p=0.05.

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Determined sample size

S. No	Name of District	No of Science Colleges and Principals	No of Science Teachers (Chemistry)	No of Science Students
1	Hyderabad	14	76	370

The measures for the validity of the research tool and reliability were also undertaken to get the instrument fit for the collection of the data whereas, the reliability was found higher than

0.7 which is considered suitable. The analysis of the data was gone through the help of SPSS 26.
As the data was found normal hence, the parametric test was applied to get the better statistical results of the study.

Objective:
To investigate the impact of the teaching quality of science subject on students` learning.

Hypothesis:
There is no significant impact of the teaching quality of science subject on students` learning.
To achieve the objectives the Regression analysis (Parametric Test) as per the need of the problem was applied for prediction of the impact.
Regression Analysis Table

Hypothesis	Regression Weight	Beta Coefficient	R Square	F-value	P-value	Hypothesis Supported
Ho	TQSS-SL	1.297	.132	85.332	.000	Not Supported

The table of the statistical analysis represents the p-value+.000, which reveals that there is a significant impact of the teaching quality of science subject on students` learning hence, statistical evaluation advocates the alternative hypothesis is accepted whereas, the null hypothesis is rejected

Objective:
To describe the relationship between the teaching quality of science subject and students` learning.

Hypothesis:
There is no significant relationship between the teaching quality of science subject and students` learning.
Correlation Analysis Table

Correlations			
SL		SL	TQSS
	Pearson Correlation	1	.811
	Sig.(2-tailed)		.000
	n	76	76
TQSS	Pearson Correlation	.811	1
	Sig.(2-tailed)	.000	
	n	370	370

The table of the correlation analysis represents the p-value+.000, which reveals that there is a significant relationship between the teaching quality of science subject and students` learning hence, statistical evaluation advocates the alternative hypothesis is accepted whereas, the null hypothesis is rejected.

Findings:
The study reveals that there is a significant impact of the teaching quality of science subject on students` learning which shows that the teaching quality of science subject can bring a positive change in students learning. The teaching quality of science subject undergoes through different techniques of teaching so that the level of students learning could be improved. The practical involvement of the students in science subject teaching makes them well aware about different things when they do things by their own. The practical involvement of students develops their critical thinking and the nature of exploring things is also advanced. Innovative ideas can better be generated through the students by doings things on the ground level. The study also revealed that there is a strong correlation between the variables which reveals that if the teaching quality of science subject is better than the students` learning also increases the same can be expected in inverse action as well low teaching quality of science subject can decrease the students` learning outcomes. The students` learning depends upon the teaching quality of the teachers teaching different subject specially the science subject which has a core value in throughout the course of science students. It has a prominent dependence of practical involvement of the students in different topics of the study which enhances the students` level of understanding effectively. The findings of this research study are also aligned with the study of Costa, & Araújo, (2018) in Quality of Teaching and Learning in Science which reveals that the teachers` teaching quality can better shape the students` process of learning. A better learning outcome can be availed through productive input. Hence, the teachers` quality of teaching science subject leads to better students` learning outcomes.

Conclusion:
The findings of the study advocate that the teaching quality of science subject has a positive impact on students` learning. Whereas, a strong correlation between the teaching quality of science subject and students` learning is also originated through the findings of the study. It is concluded that the teachers` teaching quality is an essential factor that develops students` better learning. The better students` learning outcomes can be availed by quality teaching which can enhance an environment at the institutional level that can compete the challenges at the global level.

Recommendations:
The suggestions and recommendations under this research study advocate that, the teachers should focus on their teaching skills. Different teaching techniques should be applied to generate innovative ideas and critical thinking among the students. The administration should take initiatives to develop teachers` teaching quality specially, in science subject through different training sessions throughout the academic year. Continuous professional development is direly needed specially in teaching science subject as, the course of science subject is commonly updated whereas, different techniques are used in teaching multiple topics. Hence, it is a key responsibility of the administration to develop the teaching skills of the teachers as per the advancement of the course of the study (Curriculum).

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