

Science Curriculum Implementation in Educational Settings: A Case of Public Secondary Schools of Sukkur, Sindh



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Abstract: Many reforms have been taking place in the development and implementation of education curriculum across the globe to uplift the standard of education. In 2006, the Government of Pakistan had revised the science curriculum of secondary grades after few decades to meet the challenges of modern times. The current study has adopted a quantitative approach in the descriptive research design was used. The data was collected through a questionnaire. The reliability of the questionnaire was found to Cronbach alpha =0.723 which is reliable. The percentages, mean and standard deviation was calculated. The findings of the study revealed that the science curriculum could not be implemented properly due to the inclusion of extra topics in the science curriculum of secondary grade, time constraints and availability of laboratory equipment. This study recommends the syllabus should be condensed and extra topics from the syllabus must be removed.

Key Words: Curriculum Implementation, National Science Curriculum, Curriculum Upgradation, Pakistan

Introduction

In the past few years, many countries have initiated reforms in the development and implementation of education curricula. In 2006, the Ministry of Education, Government of Pakistan changed the curriculum of science at all stages of education. Specifically, the science curriculum of secondary education has been changed after many decades, and updated stuff was included in the curriculum to meet the challenges of the 21st century (Shah, Ahmad, & Khan, 2019). The science curriculum was designed and developed as per the needs of Pakistani society. Education has become a universal system around the world. The global science education system requires more than factual knowledge to be transferred to the students. Generally, science has been considered as the study of facts related to the material and natural world. However, a recent shift has been observed regarding the teaching of science education from fact and knowledge-based education to the experiential and practical constructivist approach. This shift not only caters to the needs of learners but also enhances the skills, dispositions, values and understanding of the world (Iqbal & Almani, 2018)

In 2006, Pakistan's National Science Curriculum was developed with overarching expectations to implement it across the country (Aslam & Ali, 2017). The main objectives of Pakistan's National Science Curriculum were to promote science education through developing philosophical and critical thinkers in science, instil scientific approach, and personal significance. Nevertheless, achieving such goals is a distant dream in Pakistan. It is very difficult to achieve such goals due to various reasons related to the implementation of science education in Pakistan. (Ullah, Ullah & Allender, 2020; Kausar, 2017).

In the modern times of technological advancement, which has converted the world into a Global Village, the development of a nation is measured by its advancement in science and technology (Awan et al., 2017). The proper knowledge of science and technology, along with its progressive utilization, makes the nations stand out economically among other nations. Pakistan, being a progressing country, cannot survive without proper development in the field of science and technology. In this regard, emphasis is needed in the implementation

process of the science curriculum in Pakistan ([Asad et al., 2020](#)).

In Pakistan, Physics, Chemistry and Biology are taught at lower secondary, secondary and higher secondary levels as core subjects to the learners of the science group ([Rind & Mughal, 2020](#)). Among these, Physics deals with the study of Matter and Energy as well as the relationship between them. It also deals with the motion and behaviour of matter through space and time, along with related concepts such as energy and force. The main target of Physics is explaining the behaviour of the universe. Chemistry explains the matter, its states and forms, as well as their impacts on both animate as well as inanimate things. Whereas biology teaches all the components of life along with its related things. It also describes behaviours, reactions and processes of living things. Classifications of living things and their interdependence are also focused on by Biology.

While keeping such in-depth importance of these branches of science, there is a dire need to intimate the learners with the trend of modern developments, which can be achieved through the effective curriculum implementation of these subjects.

A curriculum is a systematic organization of subject matter which is presented as pieces of information. Most of the researchers have given their definitions of curriculum. ([Penuel, Fishman et al. 2007](#)) consider curriculum as the part of school academic programme specifically designed to provide planned and guided teaching experiences. This definition divides the curriculum into four related components; (1) objectives or the end product of instruction, (2) content to be studied, (3) teaching methodology through which the study and teaching are done (4) process of evaluation through which the results of teaching are assessed. The usefulness of the aforementioned components of curriculum solely depends on the percentage of proper implementation of each component which is interrelated ([Alshammari, 2013](#)).

As teachers are considered to be the key factor in the curriculum implementation, so in National Education Policy, it was stated, “no educational system can rise above the quality of its teachers” (Ministry of Education, 2009). The worth and the quality of a curriculum cannot be judged from its planning, but the ability or inability of the teachers to execute a curriculum as originally stated by the planner decides its success or failure ([Akinsolu 2010](#)).

It has been observed that the effectiveness of the stated objectives and contents of the Physics/Chemistry/Biology curriculum is a function of the level of competence of the teachers of these subjects. One of the most important factors regarding the competence of the teachers is their academic as well as pedagogical qualifications. It includes both their level of education as well as professional attainment. It is the teachers’ exposure to learning which leads to the experience he or she is expected to be able to manipulate the teaching activities ([Sharp, Hopkin, & Lewthwaite, 2011](#); [VanTassel-Baska et al., 1998](#)). The desired change (intended learning outcomes) among the learners can only be achieved through a well-implemented curriculum. The research in the assessment of curriculum implementation has been carried out around the world ([Hunkins & Ornstein 2016](#); [Penuel, Fishman et al. 2007](#)). However, no research has been conducted in Pakistan, especially in the context of rural Sindh. Thus, there is a gap in the policy and implementations of Pakistan’s National Science Curriculum in the classroom settings. Therefore, this study aims at assessing the implementation of Pakistan’s National Science Curriculum in Public Sector Secondary Schools of Sukkur, Sindh, Pakistan.

Problem Statement

Science Education has been given much importance in the education curricula of a nation. Many countries have changed their science education curriculum to include advanced scientific concepts in the curriculum ([Asad et al., 2020](#)). Science plays a very significant role in the progress of a country. However, there is various issue pretending to the perceptions and practices that influence the student's viewpoint about science curriculum implementation in Pakistan. The issues include the nature of science textbooks, which promote rote learning and factual knowledge, overemphasized facts, no personal relevance, and less interest for students ([Rind & Mughal, 2020](#); [Memon, 2007](#)). Moreover, learning science has become a difficult and boring subject for students because of its abstract concepts and difficult scientific language used in science textbooks. Students do not find any connection of science with their personal and social life; therefore, they become disinterested and dejected from teaching this subject ([Allen & Peterman, 2019](#)). Another important issue of science education in Pakistan is that students have been taught through

teacher-centred classroom where the traditional way of teaching is promoted. In such classrooms, teachers are considered as knowledge transmitters and students as a passive receiver of the knowledge. Consequently, students have less autonomy in the science classroom (Awan et al., 2017; Anwer, Iqbal, & Harrison, 2012). Further, students are directly or indirectly influenced by the high stake examinations system that compels both teacher's practices and the students learning to cover the full-length syllabus in a specified time. Due to limited time, teachers are bound to cover courses, focus on task achievement, content delivery and fact-based knowledge transmission to students (Iqbal & Almani, 2018). However, the public board examinations restrict the teacher's autonomy and authority in both content selection and delivery. Teachers are under constant pressure to cover the course of study within a limited time by compromising the student's enjoyment and learning (Kausar, 2017; Memon, 2007). Moreover, students have not been taught science practically and experientially in the classroom, which is another dilemma of science education curriculum implementation in the science classroom context of Pakistan. The curriculum policies of Science education fails because they all have neglected the role of the teacher in the implementation of the science curriculum at the classroom level. Additionally, the role of the teacher in the implementation of the science curriculum has been neglected in Pakistan's National Science Curriculum (Rind & Mughal, 2020). Therefore, to fill this gap in the policy of science education and achieving the aims and objectives of science education, particularly in secondary science education, there is a dire need to ensure proper implementation of their aims, objectives, and content of the designed secondary school Science curriculum (Sharp, Hopkin & Lewthwaite, 2011). So, the current study seeks to investigate the perceptions of science teachers about the curriculum implementation at the secondary level in the rural context of Sukkur Sindh, Pakistan

Objectives of the Study

1. To assess the current conditions of secondary science curriculum implementation in secondary schools of Sukkur
2. To explore the perceptions of science teachers about the curriculum implementation in secondary schools of Sukkur

3. To investigate the influence of curriculum implementation on the learner's academic performance

Research Questions

- RQ 1:** What are the perceptions of teachers regarding Physics/Chemistry/Biology curriculum content?
- RQ 2:** What is the process of implementation of the Physics/Chemistry/Biology curriculum?
- RQ 3:** How proper or improper implementation of the Physics/Chemistry/Biology curriculum affects the learners?

Literature Review

This section discusses the review of literature in the context of curriculum implementation in science, issues and challenges in the implementation of science subjects at the classroom level,

Concept of Curriculum Implementation

The way of transferring the planned or officially designed course of study by the related teachers into a syllabus, scheme of work, and lessons to be delivered to students is known as curriculum implementation (Snyder, Bolin et al. 1992). In other words, it is the process of putting all that has been planned as curriculum document into practice in the classroom through the combined efforts of the teacher, learner, school administration, parents, as well as interaction with physical facilities, instructional materials and learning environment (Mobolaji, Motunrayo et al. 2017).

Issues in Implementation of Curriculum

Improper planning leads to many issues in the implementation of the science curriculum. Likewise, there are many challenges in the proper implementation of the Physics/Chemistry/Biology curriculum. Lack of teachers' participation in decision making and curriculum planning is one of the most important problems of implementation of the curriculum. Teachers are either not involved or involved at a minor level, just for reviewing the curriculum. According to Manolaji (2017), while making teachers responsible for interpreting and putting the sole responsibility of curriculum implementation on them, it assures that teachers'

efficiency makes or mars the curriculum implementation.

Another issue with the curriculum of said subjects in Pakistan is that these cover too much information, and it is suggested to remove unnecessary and irrelevant facts. The teachers' unpreparedness to cope with growing curricula (Barbour, Siko et al., 2013) worsen the implementation process. Because of this, instruction becomes ineffective, inappropriate and often inaccurate. This leads to confusion among learners. Buckley et al. (2004) state that the public sector of education at lower secondary and secondary levels has witnessed stagnation and decay because the provision of basic facilities in most of the schools in Pakistan is dilapidated buildings, leaking roofs, lack of chairs and tables for students teachers use. What could be expected regarding appropriate scientific instruments, chemicals and condition of the laboratories?

As scientific development mainly results in economic, industrial and technological prosperity, so, proper implementation of the curriculum of science subjects generally and Physics/Chemistry/ Biology curriculum particularly counts the future development of the nation. Science occupies the central locus in contemporary society, so it underpins every aspect of modern life.

Among the subjects of the discussed curriculum, Physics is such a branch of natural science that leads to the study of both matter and energy, as well as the relationship between both of these. It is the branch of science that makes the majority of the industry. One of the branches of Physics, Mechanics, covers all kinds of machinery and their use in contemporary society. From the wheel to the pressure cooker, every piece of machinery is because of this. All forms of energy, from solar to electrical, exist and are utilized by the human race because of Physics. From every vehicle running on the road to a needle, every plane flying in the air to a simple button, every larger ship sailing in the sea to paper pin, there is Physics behind every machine's creation and its use (Millar, 2011).

The second most important branch of science, of which curriculum implementation is discussed here, is Chemistry. It deals with matter, its states and kinds, molecules and their form, as well as the arrangement of molecules in every state of matter. Every medicine, its uses and abuses, quantities to be used are also told by chemistry. From simple plastic toys to large-sized polymers, everything made up of plastic comes under

the umbrella of Chemistry. Availability of different hormones in the human body, including vitamins, proteins, fats, lipids, carbohydrates and their balance, is measured and guided by Bio-chemistry. Causes of all diseases, their precautionary measures and treatments are guided by one of the branches of chemistry, pharmacy. Most importantly, Chemistry adds to the knowledge of learners regarding composition, structure, properties and changes of matter while under varied conditions. The matter is defined as anything which occupies space and has mass. Most commonly, matter exists in three states, solid, liquid and gas (Ituma 2012). According to Ituma (2012), Chemistry enables the masses in the provision of services and production of quality goods.

The third branch of natural science, of which curriculum implementation is under discussion in this study, is Biology. Being a study of life deals with all the matters of life, from a sperm to a dead body. Even after death, the decomposition of living things, formation of different things from decomposition as well as their impacts on the environment are also matters of study for biology. The branch of biology, Ecology, describes the relationship among living things as well as their interdependence on other physical surroundings. The basic unit of every living organism, cell and all changes occurring in it is the main focus of Cytology. After cell, tissues and their formation, as well as becoming different organs, are studied under the shadow of Histology. Living organisms of water, aquatic, are studied in Freshwater biology and marine biology (Penuel, Phillips & Harris, 2014).

The knowledge of these three subjects, Physics, Chemistry and Biology, is also a prerequisite for enrollment into scientifically inclined careers, such as engineering, medical, biotechnology, pharmacy etc. Despite the apparent significance of these subjects and the corresponding need for proper implementation of their curriculum, effective education of all of these three branches of science is yet to be attained globally.

In spite of teacher-centred teaching approaches in these major fields of science in Pakistan, both the students and teachers agree that the relevance of these subjects needs improvement by aligning their contents to daily life and placing more importance on laboratory work (Halai 2002).

Effective implementation of science education is threatened by factors such as the transition between levels of education, science background of students, diversity of the student body, the problem of scientific

language and cognitive level of students. Additionally, scientific misconceptions among learners, the impact of information technology (IT) on instruction and ignorance of science education research among most lecturers also affect the implementation of the curriculum of these subjects (Anwer, Iqbal et al. 2012; Halai, 2003).

Methodology of the Study

Research Design

The quantitative approach was used, and the descriptive survey design was adopted to carry out this study on the assessment of the implementation of the Physics/Biology/Chemistry Curriculum in public secondary schools of Sukkur city (Gronmo, 2019).

Population and Sample of the Study

The population of the study was secondary school, science teachers. All science teachers teaching any of the three subjects of the science, Physics, Chemistry or Biology, working in any public secondary or higher secondary school are the sample of this research study. Overall, 175 teachers participated in this research. A simple random sampling technique was adopted in the selection of 175 science teachers of Physics or Chemistry, or Biology.

Instrumentation

The current study has adopted the questionnaire and modified it to fit the context of Pakistan to know perceptions of science teachers' regarding implementation of the curriculum of the science curriculum in Pakistan at the secondary level. The questionnaire's reliability was also tested in this study. The questionnaire is reliable in the context of Pakistan because the reliability statistics showed that Cronbach alpha = 0.726, which is reliable. This questionnaire contains twenty statements. Each statement followed five Likert scales, in which 1 represents strongly disagree, 2 for disagree, 3 for being neutral, 4 for agree and 5 for strongly agree

Data Collection

The data was collected through an adapted questionnaire. It was done through random sampling of 175 public sector science school teachers of secondary and higher secondary schools of Sukkur.

Data Analysis Procedure

For quantitative data analysis, Statistical Package for Social Sciences (SPSS) 22.0 was used. All the descriptive statistics such as percentage of agreement and disagreement, mean and standard deviation were found during this analysis. The collected data were analyzed using frequency count, percentage mean and standard deviation

Table 1. Shows the Overall Degree of Agreement and Disagreement of Respondents, mean Score and Standard Deviation of Data Analysis

S. No	Items	D %	A %	M	S. D
1	The curriculum contains extra topics which were not taught while I was in school.	13.4	70.4	3.76	1.01
2	I cannot teach all Physics/Chemistry/Biology topics very well.	26.7	49.4	3.37	1.24
3	All the topics of my subject can be applied to everyday living.	16	66.6	3.69	1.03
4	There are facilities to put into practice all Physics/Chemistry/Biology topics taught in class.	20.3	54	3.40	1.16
5	I can improvise all materials for the Physics/Biology/Chemistry practical's.	24	45.3	3.30	1.13
6	The number of periods assigned for Physics/ Chemistry/Biology in a week is enough to teach the syllabus.	25.3	48	3.29	1.04
7	I have obtained a certificate in the Physics/Chemistry/Biology teaching profession.	16.5	69.9	3.79	1.05
8	I have taught Physics/Chemistry,/Biology for more than six years.	40.5	59.5	3.63	1.09
9	I am enthusiastic about teaching Physics/Chemistry/Biology.	16	65.4	3.76	1.13
10	The government frequently involve teachers to revise curriculum contents.	29.8	50	3.33	1.41
11	All my students understand the topics taught before proceeding to another topic.	24	48	3.26	1.10
12	There should be textbooks that will be more explanatory to the average students.	33.3	66.7	3.37	.90

S. No	Items	D %	A %	M	S. D
13	Physics/Chemistry/Biology topics are easy to understand.	49.3	50	3.49	.93
14	We always go to the Physics/Chemistry/Biology laboratory for practicals.	17.8	64.4	3.72	1.19
15	My school is helpful enough for learning.	8.2	70.2	3.87	.93
16	I admire how my Physics/Chemistry/Biology teacher taught us.	17.3	61.4	3.65	1.15
17	My school has a lot of Physics/Chemistry/Biology laboratory equipment.	19	63.5	3.62	1.17
18	There are enough Physics/Chemistry/Biology textbooks in the library of my school that can serve all Physics/Chemistry/Biology students.	34.7	42.6	3.09	1.24
19	I oftentimes run away from Physics/Chemistry/Biology class because of difficulty.	22.7	45.3	3.36	1.20
20	I enjoy reading, and working calculations on Physics/Chemistry/Biology topics taught.	14.6	70.7	3.77	1.21

D=Disagree A=Agree M=Median S. D=Standard Deviation

The findings of the study revealed that the teachers were of the opinion that the science curriculum containing extra topics not covered in the classes, a huge majority, 70.4%, agreed, whereas only 13.4% participants of this study disagreed with this item. Regarding the inability to teach all the topics of the subject concerned about a majority of teachers, 49.4% agreed. While showing their concern related to the application of their subjects to daily life and availability of facilities for practising all the concerned topics, a huge majority of the participants, 66.6% and 54% respectively, agreed with the statements. Whereas, for bringing improvement, teachers were observed hesitant, as only 45.3% showed agreement and 24% rendered their disagreement.

Moreover, many teachers shared that their curriculum contains extra topics not to be taught in the class. Even about half of the participants gave their consent that they are unable to teach all the topics of their subject. Meanwhile, teachers of Physics, chemistry and biology showed unwillingness to bring change and improvement in their practice.

Regarding proper allocation of the time period to their subjects, about a majority of the research participants, 48%, agreed, and only 25% disagreed. In response to the questions having a certificate in the subject they are teaching, more than six-year experience and being enthusiastic about teaching their subject concerned a majority, 69.9%, 59.5% and 65.4% respectively agreed with the statements and a minority 40.5%, 16% and 29.8% respectively showed their disagreement. Regarding the most important item, involvement of the teachers to revise curriculum contents, around 50% agreed, and only 29.8% disagreed.

In response to the statements related to students understanding, availability of detailed explanatory

textbooks and easiness of topics to be understood, a huge majority, 48%, 66.7% and 50% respectively agreed, whereas 24%, 33.3% and 49.3% respectively disagreed. This percentage shows that there is a demand for detailed books for these science subjects; as per participants, the topics concerned to their subjects are easy to understand, so a majority understands prior topics before proceeding to new ones. While answering the items regarding frequent use of the laboratory for the practical and helping environment of schools, a good majority, 64.4% and 70.2% respectively, agreed with the statements, and only 17.8% and 8.2% respectively participants disagreed. This proves that most laboratories are used for practical and almost all schools help and support in teaching and learning of science.

Furthermore, the process of implementation of curriculum, the demand for detailed textbooks, frequent use of laboratory and full support of schools are the essentials. While responding to the statements, teachers shared that effects of proper or improper implementation of curriculum on the learners, participants showed that proper implementation of the curriculum subject concerned creates interest among the learners and majority of the learners gets all the topics cleared before moving to new topics.

While admiring the teaching methodologies of their teachers and availability of more than enough laboratory equipment's, a huge majority of the research participants, 61.4% and 63.5%, respectively, showed their agreement with the items. While only 17.3% and 19% respectively showed their disagreement regarding these statements. Responses to the items related to the availability of enough concerning textbooks in the libraries of their schools and leaving the class while facing difficulty in teaching and learning, mixed responses of 42.6% and 45.3%

respectably agreement and 34.7% and 22.7% respectively disagreement were shown. This shows that neither a majority of schools has enough textbooks nor most teachers remain in the class even after facing difficulty. In response to the last statement, regarding teachers' enjoying calculations of their subjects concerned, a huge majority, 70.7%, showed agreement, which proves their love and commitment to their profession as well as the subject and the learners they teach. In response to the same item, a minority, only 14.6 %, showed their disagreement while giving a message that they do not enjoy calculations.

In this study, science teachers were of the opinion, for proper implementation and its impact on learners, participants themselves admired their teachers' ways and methodologies. Regarding the improper implementation of curriculum and its impact on learners, even teachers showed a tendency towards leaving the class without completing their task of the day.

Conclusively, secondary science teachers shared that they were unable to cover extra topics in the science subjects due to time constraints.

Conclusion

This study can be summarized by noting that though the curriculum of Physics, Chemistry and Biology is compiled and distributed properly. But there are some lacking, such as few extra topics present in every textbook not to be covered in the class, lots of theory not to be implemented in practical life. There are few topics, which are even not clear to the teachers, which show their inability to teach all the topics of the subject. Moreover, it has been found that there exists contradiction in the ideas of the teachers as well. The

majority of the participants, in their responses, on the one hand, showed that their school is helping hand to them but, while responding to another statement, remained hesitant in bringing changes or improvement in their subject as per need.

Few questions even showed weaknesses of the institutes and improper management. As in response, participants mentioned that their subjects do not properly time allocated. Though most of the participants agreed that they have a professional certificate of teaching in their subject concerned as well as have enough teaching experience, yet they have mentioned that they run away while feeling difficulty in teaching particular topics. Though it is a well-known fact that teachers are rarely involved in curriculum improvement, yet, in response to a statement majority showed their agreement that they are involved in curriculum improvement. Amazingly a majority also agreed that their students learn all the previous topics before going to a new topic. A majority of the participants also showed their consensus on the point that the methodologies and teaching strategies of their teachers were highly admirable.

Generally, it is a perception in a Pakistani society that the teachers of public sector institutes are rarely involved in any kind of research, yet this research proved that the teachers of public sector institutes are not only properly involved in researches but, their responses proved that they are aware enough of curriculum and their perceptions regarding the implementation of the curriculum are also clear. There is a need to facilitate all the teachers with awareness regarding curriculum implementation. They must be trained enough to learn and divide the curriculum into their own behavioral terms to be transferred to all the learners without any exception.

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