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Difficult Foreign Words in Textbooks of Science Subjects Leading to Cacoepy and Negative Learning: An Asian Perspective

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A B S T R A C T

It is assumed that if the problem of mispronunciation is not taken care of at the secondary level in students, then it continues to exist at advanced levels and in later stages of their lives. In this research the problem of cacoepy faced by students at the secondary school in district Kohat was thoroughly investigated and the responses of teachers for overcoming it by bringing changes in the textbooks were analyzed. It was found that majority of the students liked science subjects but the long, difficult and foreign words repelled them. they found words containing more than 7 letters as complex and difficult to learn. science terms derived from Greek, Latin and other ancient languages, were found difficult to pronounce and understand. Abundance of such words was found in chemistry, physics and more particularly in Biology. The cause of cacoepy and the negligence to address it was traced to the teachers' heavy workload, their busy schedule and their focus to finish their courses in time. on the basis of the findings and conclusion it was recommended that the teachers should limit their use in each lecture to the minimum possible and should spare some time to teach their pronunciation when such words are faced instead of focusing more on the completion of the courses assigned to them. English movies of scientific nature may be used by a teacher to help students learn correct pronunciations of such words, some recommendations for bringing changes in the textbooks were also made like limiting the number of such words, replacement of such words with simple words and inclusion of aids from Urdu phonology to help students pronounce such complex foreign words correctly.

Keywords: pronunciation, scientific terms, cacoepy, wrong pronunciation, education, science, biology, chemistry, physics, secondary level.

INTRODUCTION

Background of The Study

This research investigates cacoepy of science terminology encountered by the secondary level school students of Kohat district. Oxford English Dictionary defines pronunciation as someone's competence in producing sound used to deliver meanings. The study to find out pronunciation problems becomes necessary since secondary science education is the basic and it is one of the problems in students of KPK districts. Someone with inaccurate pronunciations might jumble sounds. As known that sound or combination of sounds are causing different meanings (Dardjowidjojo, 2009), it will lead the hearers to misunderstand what is being tried to deliver. Then, the hearers will misunderstand the speech because the speaker is unintentionally misleading the speech by performing mispronunciation as research unfolds the fact that the British Mirpuris (when visiting back their relatives in Mirpur) introduce a new type of vocabulary which is neither English nor Mirpuri (Shaheen, 2017).

The problem of cacoepy needs investigation due to the assumption that mispronunciations if learned in secondary level are still frequently be performed by the advanced level students or may be throughout their lives.

Despite being at the advanced level of speaking courses, they are still identified to perform mispronunciations. This research then tried to find out the cacoepy of scientific terms and their effect on learning of secondary level science students so that such pronunciation problems could be taken into account. This study will help those who are teaching or and studying science subjects in English as a second language by raising awareness of certain complicated scientific terms. The research will assist science teachers in addressing these terms and encourage students to practice further in order to achieve proper pronunciation. The finding of this research would also facilitate the textbook board in replacing complex science terminology with simple alternative words.

Cacoepy

Cacoepy means the bad pronunciation or mispronunciation of words (Wordsense, 2020; Wiktionary, 2019). According to Dictionary.com, "cacoepy means incorrect or mistaken pronunciation". The word "cacoëpy or cacoepy" (kuh-koh-uh-pee) is derived from ancient Greek κακός (kakos) which means "bad" and ἔπος (epos) which means "word"). The first known use of cacoepy is 1840-45 or 1854 (Rasheed & Awan, 2021). Scientific terms, which plays a significant role in the teaching of research, is a part of the jargon that scientists use in their professional practises. The collection of science or technological words that typically originate from Greek and Latin roots and are used in different languages, sometimes with morphological alterations but with the same meaning can also be defined as scientific terms. Scientists often discover or generate new material or immaterial phenomena and ideas when observing nature and are forced to name them. Many of those titles are only known to clinicians. However, they are increasingly becoming part of modern languages and research courses due to the popularisation of science (Watson & Kimble, 2017).

Secondary education

Secondary education is informally regarded as the education children receive during their teenage years, although the average ages of entrance and exit vary considerably among various nations. The distinction between lower secondary education and higher secondary education is useful in a global context, because developing countries are sometimes able to provide some access to lower-secondary education, while higher secondary education is still beyond the national reach. Lower-secondary education is considered to generally target eleven- to fifteen-year-old children, and upper-secondary education to target fifteen- to nineteen-year-olds (Serrant and McClure, 2001). Secondary education is always taken as first step towards getting the opportunities and enjoying the benefits of economic and social development. If quality education at secondary level will be made sure, it will drive the students a path of acquiring more education either academic or technical and it will have great impact on the enrolment not only at the levels below secondary level but above this level as well. Nothing by only quality education can make young generation better dedicated citizens of the society and drive the country towards the path of prosperity. More focus on the provision of quality secondary education has also become the demand of the time due to the fact that market is in demand of a more sophisticated labor force and only quality education at secondary level can help achieving this goal (Kazmi, 2016).

Importance of science education

The existing studies on South Asia mostly focus on macroeconomic variables such as Gross Domestic Product (GDP), domestic capital formation, interest rate, real effective exchange rate, labour and trade openness and overlook the crucial role that institutions and political factors might play in determining FDI in South Asia (Bimal, 2017). However, this is an era of science and technology but numerous studies documents, that students' attitude towards science decreases with increase in grade levels (Pell & Jarvis, 2001; Osborne et al., 2003), and this decline is more rapid in middle and high school years (Rani, 2000; Anwer, et al., 2012). Usage of scientific methods, concepts, and scientific tools have become a global phenomenon. Scientific information is shared across the regions. Every object is described by specific word which helps in building concepts. Single word or group of words are helpful in concept formation of things when they are out of context. Scientific research is going on all over the world providing knowledge in all fields of life. Scientific knowledge is increasing at a tremendous rate as science unfolds knowledge about surroundings and diversity of life. Out of physical and natural field of science, the researcher selected the biological fields of natural sciences, because it is an ever-expanding area and is directly related to the branch of science dealing with real life (Kauser & Shah, 2019). In order to prepare children to embrace diversity in society, education plays an important role, particularly in recognizing people with physical disabilities as equal

contributors to society's growth and development, and science education is an effective tool to achieve this goal (Kivirauma et al., 2014).

Science Textbooks: A source for the transfer of knowledge

The status of science education can be summarized in a single word-textbooks (Stinner, 2012). Science is the facts and concepts included in a textbook. Textbooks determine the order, the examples, the applications of science topics that students experience. The major curriculum decision that most teachers make is the choice of a textbook; after such selection, they often lament, "If only a better one could be found." The science curriculum is the content included in relatively few textbooks. Most all instruction in science is based on the information in a single textbook. Teachers seek safety in maintaining close alliance with a textbook. Teachers make textbooks the "answer place" for teacher questions-both those used in discussions and those used as examinations. The instructional sequence is dictated by a textbook; the typical sequence is assigned, recite, test, discuss test. The content of science is restricted to that between two covers of a textbook. The teacher's power seems to rest with the information in the textbook. Teachers' questions focus on information in the textbook. A. V. materials are supplements to information in textbooks; at times they merely prove to be a means to present the same information as that in a textbook. Teachers appear to be imprisoned by the textbook.

There are many objects (living/non-living) around us and each object is described by specific word. The need of information and understandable communication require specific designation to each item. This will lead to globalization and will help in global competition and global cooperation. Global communication is based on the vocabulary in all fields to convey the contents in meaningful ways. The vocabulary includes the words, concepts which ultimately in confined form, become specific terms. The designation of defined biological concept in a special language by a linguistic expression are known as biological terms. Textbook is a prime source of lessons for teachers and students. Through textbook the knowledge is transferred to next generations. So, it should be appraised according to new discoveries and needs of the nation. According to encyclopedia of education 2008 "textbook is a printed and bound artefact for each year or course of study and contain fact and ideas around certain subjects." Due to much dependence on textbooks, it is essential that textbook should be complete in itself. So textbook should be appraised on continual basis. Textbooks tend to focus on the disciplines of science; they emphasize words and specialized terminology.

Role of Scientific Terminology

Many things are present around us which we can observe and see. Our mind has ability to perceive the object and can create conceptual image. This conceptual image helps to recreate the object even when it is not in the reach of our senses. Students build their concepts about the world by studying science and use these concepts to interpret the world. According to Davis et al. (2013) biological concepts are built by sensation of things around the learner, perception of ideas and conception in mind. Kalina & Powell (2009) stated that concepts are built by actual experience of pupils. Chauhan (1987) described those concepts are built by following the principles of simple to complex, analysis to sync research, from induction to deduction and from particular to generalization. Concepts are mental perception and we use certain carriers to describe our concepts in languages. These carriers of language (word) have specific meanings and are in common use as they become technical terms.

Lynch has been concerned with the levels of meaning for various terminologies commonly included in science instruction (Lynch, 2010). There is strong evidence that one major fact of the current crisis in science education is the considerable emphasis upon words/terms/definitions as the primary ingredient of science-at least the science that a typical student encounters and that he/she is expected to master. A study on comprehension, scientific terminology/language, and textbook study do provide another dimension of issues related to the crisis in science education-that concerned with student study and learning (Hodson, 2003; Barnes, 2018). An exchange of opinions raised the issue of the appropriate use of scientific terminology in student conception studies and instruction from two different points of view (Duit & Treagust, 2003).

According to one view by Pushkin, there exists a precise scientific terminology and its appropriate use is necessary if one wants to avoid confusion or creation of pseudo conceptions (Mirzyńska et al., 2021). According to the other view by Lewis & Linn, in science textbooks, science writing, scientific discourse, and everyday experience, terminology is used in a broader, richer range of ways and there is little agreement concerning what

constitutes the appropriate usage of scientific terms (Matuk & Linn, 2018). In addition, as this second view suggests, terminological diversity, when contextualized in analogies and metaphors, contributes to an instructionally rich discussion (Levin & Wagner, 2006). A careful reader might find in science and physics textbooks is rather a diverse spectrum of different ways in which it is possible to talk about scientific concepts and processes. Even when a high level of agreement is reached regarding scientific accuracy, the cognitive adequacy of such terminology, or should we say, the cognitive inadequacy of the terminology, could still obscure its use in learning (Alexander & Jarman, 2018).

Gigantic problems of secondary schools' science education in Pakistan

The rise and fall of the nation depend on the quality of human resources, which can be properly developed and deployed in the right direction only with right education. The overall position of a nation in the world community at large is generally idealized by determining the standards of its educational system. However, in Pakistan, the quality of secondary education has a declining trend. It is realized that science education in particular is reaching lowest ebb and needs to be improved urgently. At the time of independence and thereafter there remained acute shortage of teachers, laboratories were poor and ill equipped and curriculum had little relevance to present day needs (Memon, 2007; Parveen & Tran, 2020). The emergence of Pakistan has been the topic of many discussions (Habib 2018). Since its birth, the hottest issue in Pakistan has been standard of education; the educationalists of our country have been really worried about. The individuals of the society have their own view point regarding standard of education in Pakistan. The efforts of every government in Pakistan to raise the educational standards have been limited only to prepare educational policies in papers. No practical implementation of recommendations presented in any educational policy to rise educational standard has ever been found. Until now the role of secondary and college education in Pakistan has been simply preparation for tertiary education, which in the minds of most people means strictly a university education. Pakistan's educational documents are not acceptable abroad due to our poor educational standards. The claims of government of Pakistan regarding literacy rate of 47% is totally wrong. The actual figures of literacy rate are at about 20% at secondary level according to independent analysts and educational organizations (Kazmi, 2016).

There are dreary and uninteresting textbooks written for Pakistani textbook boards and schools, and they just overwhelm students with information. Teachers, and thus uninspiring, are either untrained or poorly educated. In teaching approaches that evoke logic and curiosity, teaching science requires extra care and special preparation by teachers. Pasha et al. (2020) emphasized a strong need for using technological resources to improve teaching and student learning because they were less interested in developing students' critical thinking and in teaching students how to learn. Unfortunately, in the vast majority of Pakistan's colleges, public or private, none of this is obvious, except in some costly elite schools. English is an international language and belongs to native speakers as much as it belongs to native English speakers of any language in any region. Pakistan is one of those countries where English is quickly expanding (Raza, 2008). The topic of the teaching medium of science education is a dynamic one (Asif et al., 2020). Concepts and their interpretations can be better expressed and received in a language that is readily understood. The overwhelming majority of high school students are barely able to understand English. Texts written in Urdu or mother tongues should be the strongest in this regard. But with vocabulary, the issue emerges because of reading some Urdu science textbooks that maintain transcribed English terminology in Urdu. The challenge faced by a class V student reading words like 'endangered animals' or names of complex organic molecules in Urdu is not impossible to picture. Only a small fraction of the overall number of secondary school students get to study science properly, while science terminology and principles behind them will be unknown to most secondary school students today. Yasmin (2015) puts forth the suggestion that the people of Pakistan have to work hand in hand with the government authorities to develop the current educational system.

Statement of the problem

Science and Technology subjects are taught in English in high schools, but Pakistan suffers from a lack of proficient teachers. English is not widely spoken in the classroom, except among graduates of prestigious universities, and there have been fewer educational resources for educators to study. Secondary school students face stress challenges due to the intrusion of difficult scientific words difficult to pronounce and understand. The difficulty might be due to the first-language or mother-tongue (Pashto in most cases)

interference. Many private schools that advertise themselves as offering English medium education often lack the capacity to live up to their promises, and this shortfall is not limited to only the government sector. Not enough is being achieved on the scientific terms of Pakistan's secondary school students' pronunciation. Textbooks are the center of all teaching and learning activities. The content of textbook provides interaction between the teacher and the students. If the content is overloaded with high profiled concepts and terms, it creates problem in understanding the text. The contents (text and informative box) and diagrams are included in textbook of science subjects for secondary schools. The difficulty in learning of science may be due to high profile terminology. This study has been designed to analyze the cacoepy of scientific terms included in Textbooks of Khyber Pakhtunkhwa Board for class IX and X.

Research Objectives

1. Identifying the cacoepy of common science terminology committed by secondary school students.
2. Analysis of the science teachers' and students' views on cacoepy and its avoidance by suggesting changes in the secondary level science textbooks produced by the Khyber Pakhtunkhwa Textbook board.

RESEARCH METHODOLOGY

Study design

This study was conducted to analyze the scientific terms used in science textbooks for secondary level students. It is a field study of exploratory and mixed approaches (using both quantitative and qualitative methods of data collection) in which cacoepy of scientific terminology was proposed. On the basis of observations, interviews and oral events, these words were compiled. Necessary words were transcribed and presented after selection. The research is exploratory in nature, because no substantial study on the same subject may be identified in the related literature.

Study population and sampling

This research study includes 112 male students from a Government Secondary School of district Kohat (table 1). Scientific terminologies from the subjects of biology, chemistry and physics were used.

Data collection methods and instruments

Mixed method research approach was used for data collection. Primary data was collected on basis of observation, interviews and oral activities. Secondary data was obtained by transcribing and arrangement of primary data. The data was collected through the following procedures.

- The interview and discussion with the secondary school science teachers.
- The researchers asked the students to read the text having important terminologies and definitions.
- One by one of the students read the text, while the researchers recorded their voices and observed the difficulties made by them.
- The researchers assigned the tasks of learning and understanding the concept of some terminologies from each chapter.
- Each of the students, one by one, presented their views about the assigned terminologies and the researchers noted the remarks on a piece of paper.
- Then, the researchers analyzed the data collected.

Table 1. The distribution of the participants

Grade/Class	Number of students
9th A	25
9th B	26
10th A	33
10th B	28
Total strength	112

Data analysis methods

Data processing was performed with the help of the percentage frequency method using Microsoft Excel. The researchers used certain criterion based on Best's (1981) criterion in order to know how well the students pronounce the scientific terminologies and how well they understood its concepts (table 2).

Table 2. Best's criteria for data analysis.

Categories	Number of mistake in percentage
Excellent	0-25 %
Good	26-50 %
Fair	51-75 %
Poor	76-100 %

Position of the Researchers

The researchers acted as planner, performer, and collector of data and also as reporters of the research results. The planner is the researcher who processed, to find out and set the result of data. The performer was supposed to analyze and explain the results of the

collections of data by making conclusion. The collector is the researcher who determined the subject of research and provided the instruments of data collection. So, the researchers' presence was very important and needed.

Ethical considerations

Research approval was obtained from the principal of the institutions before the commencement of data collection.

RESULTS

This research used the observations, interviews and oral events like presentation. The observations, interviews and oral events were used to find out the cacoepistic scientific terms that were found by the secondary school students difficult to be pronounced learnt or understood. These methods also helped in finding out the factors associated with the difficulty of students.

Table 3. List of cacoepistic scientific terms from secondary schools/class IX and X Biology, Chemistry and Physics books.

Biology 9th	Biology 10th	Chemistry 9th	Chemistry 10th	Physics 9th	Physics 10th
Algae	Abdominal cavity	Absolute zero	Anthropogenic	Analogue	Altitude
Alveoli	Acquired immunodeficiency syndrome	Acetylene	Baeyer's test	Archeology	Amplitude
Amino acid	Adenosine Triphosphate	Actinides	Bessemerization	Archimedes	Aperture
Anthophyta	Adhesion	Aliphatic hydrocarbons	Carboxylation	Artificial	Architectural
Aorta	Adolescence	Amphiprotic	Characteristics	Australopithecus	Assignment
Apoptosis	Allele	Arrhenius	Dehydrohalogenation	Cartesian	Characteristics
Binomial Nomenclature	Amoeba	Aufbau principle	Denaturing	Celestial	Chirping
Brassica compestris	Anabolism	Avogadro's number	Dissociation	Centrifuge	Cochlea
Bronchioles	Anaerobic	Burette	Elimination reaction	Coefficient	Curvature
Carbohydrates	Androecium	Carboxylic	Gaseous state	Conventionally	Eclipse
Carolus Linnaeus	Angiosperm	Chlorofluorocarbon	Granulation	Doubtful	Edges
Chlamydomonas	Apical meristem	Coefficient	Inflammability	Fahrenheit	Features
Chyme	Atherosclerosis	Colligative property	Manufacture	Gradually	Gradually
Collenchyma	Bronchioles	Compressibility	Metallurgical	Inertia	Incandescent
Cutaneous	Calvin cycle	Electromagnetic spectrum	Oligosaccharides	Initially	Longitudinal
Cytokinesis	Cervical	Electronegativity	Potassium permanganate	Knob	Machined
Diaphragm	Chemoautotroph	Instantaneous	Precipitate	Knowledge	Magnitude
Diphtheria	Chloroplast	Lanthanides	Quantitative	Maneuvered	Mechanical
Duodenum	Commensalism	Locant	Sedimentation	Measurement	Molluscs
Endoplasmic reticulum	Deciduous	Molybdenum	Stomach	Mechanisms	Negligible
Fungi	Dendrite	Neutralization	Structural formula	Meniscus	Neighboring
Heterogeneous	Deoxyribonucleic acid	Polymerization		Metallurgical	Nuisance
Interstitial	Diastole	Precipitation		Negligible	Pitch
Lymphatic	Electrophoresis	Pungent		Peculiar	Schematic

Marasmus	Epididymis	Quantization	Phenomena	Seismic
Meiosis	Exocytosis	Stoichiometry	Precautions	Sinusoidal
Meristematic	Gametogenesis	Substituent	Precisely	Stretched
Mitochondria	Glycogenesis		Proxima centurial	Tangential
Mitoses	Gynoecium		Psychological	Trough
Morphology	Homeostasis		Sketch	Wiggle
Necrosis	Human immunodeficiency syndrome		Sledge hammer	
Paleontology	Interstitial fluid		Substituting	
Paramecium	Krebs cycle		Tangentially	
Peristalsis	Neurotransmitter		Torricellian	
Phagocytosis	Nicotinamide Adenine Dinucleotide		Unfortunately,	
Physiology	Osteoporosis		Unfortunately	
Pinocytosis	Parasympathetic		Unnoticeably	
Prokaryotes	Parenchyma		Visualization	
Pyloric sphincter	Pasteurization		Whirled	
Respiration	Pituitary		Whistles	
Salientia	Pneumonia			
Saprotrophic	Pseudo coelomate			
Sclerenchyma	Pyrimidine			
Sinuses	Pyruvate			
Taxonomy	Rhesus			
Taxonomy	Sebaceous			
Theophrastus	Segregation			
Turgor	Seminiferous			
Vasodilation	Testosterone			
Visalius	Thoracic			
Xylem	Urinogenital			

A total of 259 cacoepistic scientific words/terms which were difficult for the secondary school students to be pronounced, learnt or understood. were listed according to the classes and subjects mentioned in table 3. Results revealed that majority of the difficult terms were found in Biology followed by Physics and then Chemistry. Moreover, the results also showed that the students of class IX reported more difficult terminologies as compared to those of class X. Findings of the current research are the following:

Table 4. Analysis of Biology cacoepistic terms on the basis of students' interpretation regarding difficulty in pronunciation, spellings and concept.

Biology 9th	Category	Biology 10th	Category
Algae	Good	Abdominal cavity	Excellent
Alveoli	Good	Acquired immunodeficiency syndrome	Poor
Amino acid	Excellent	Adenosine Triphosphate	Poor
Anthophyta	Poor	Adhesion	Fair
Aorta	Excellent	Adolescence	Fair

Apoptosis	Good	Allele	Good
Binomial Nomenclature	Fair	Amoeba	Good
Brassica compestris	Poor	Anabolism	Good
Bronchioles	Good	Anaerobic	Good
Carbohydrates	Good	Androecium	Fair
Carolus Linnaeus	Poor	Angiosperm	Fair
Chlamydomonas	Poor	Apical meristem	Fair
Chyme	Fair	Atherosclerosis	Poor
Collenchyma	Poor	Bronchioles	Good
Cutaneous	Good	Calvin cycle	Fair
Cytokinesis	Good	Cervical	Poor
Diaphragm	Good	Chemoautotroph	Fair
Diphtheria	Fair	Chloroplast	Excellent
Duodenum	Poor	Commensalism	Fair
Endoplasmic reticulum	Good	Deciduous	Fair
Fungi	Good	Dendrite	Good
Heterogeneous	Good	Deoxyribonucleic acid	Poor
Interstitial	Fair	Diastole	Fair
Lymphatic	Excellent	Electrophoresis	Poor
Marasmus	Good	Epididymis	Poor
Meiosis	Good	Exocytosis	Fair
Meristematic	Poor	Gametogenesis	Poor
Mitochondria	Fair	Glycogenesis	Fair
Mitoses	Excellent	Gynoecium	Fair
Morphology	Excellent	Homeostasis	Good
Necrosis	Good	Human immunodeficiency syndrome	Poor
Paleontology	Poor	Interstitial fluid	Poor
Paramecium	Fair	Krebs cycle	Fair
Peristalsis	Good	Neurotransmitter	Good
Phagocytosis	Good	Nicotinamide Adenine Dinucleotide	Poor
Physiology	Fair	Osteoporosis	Good
Pinocytosis	Fair	Parasympathetic	Poor
Prokaryotes	Good	Parenchyma	Fair
Pyloric sphincter	Poor	Pasteurization	Fair
Respiration	Fair	Pituitary	Poor
Salient	Good	Pneumonia	Fair
Saprotrophic	Good	Pseudo coelomate	Poor
Sclerenchyma	Poor	Pyrimidine	Fair
Sinuses	Fair	Pyruvate	Good
Taxonomy	Fair	Rhesus	Fair
Theophrastus	Poor	Sebaceous	Good
Turgor	Fair	Segregation	Good
Vasodilation	Fair	Seminiferous	Poor
Visalius	Poor	Testosterone	Poor
Xylem	Good	Thoracic	Good
		Urinogenital	Fair

Table 4 shows analysis of biological scientific terms. The researchers found that only a few terms were placed in the excellent category as they were correctly pronounced and easily learnt by more than 75% students. Terminologies occurring in the poor and fair categories should be replaced by easy equivalent words or should be accompanied by their Urdu equivalent terms; that will help in easy learning of biology for students of secondary schools. The terminologies listed in table 4 also reflect those biological terms were belonging to two major domains, botany related to plants and zoology related to animals. The Text was not equally divided and majority of biological terms were from zoology. Authors should give equality in building concept of Biology by giving equal information related to plants and animals.

Table 5. Analysis of Chemistry cacoepistic terms on the basis of students' interpretation regarding difficulty in pronunciation, spellings and concept.

Chemistry 9th	Category	Chemistry 10th	Category
Absolute zero	Fair	Anthropogenic	Poor
Acetylene	Good	Baeyer's test	Fair
Actinides	Fair	Bessemerization	Poor
Aliphatic hydrocarbons	Poor	Carboxylation	Fair
Amphiprotic	Poor	Characteristics	Good
Arrhenius	Poor	Dehydrohalogenation	Poor
Aufbau principle	Poor	Denaturing	Excellent
Avogadro's number	Poor	Dissociation	Fair
Burette	Fair	Elimination reaction	Good
Carboxylic	Excellent	Gaseous state	Excellent
Chlorofluorocarbon	Good	Granulation	Fair
coefficient	Fair	Inflammability	Fair
Colligative property	Fair	Manufacture	Good
Compressibility	Poor	Metallurgical	Fair
Electromagnetic spectrum	Poor	Oligosaccharides	Poor
Electronegativity	Fair	Potassium permanganate	Poor
Instantaneous	Fair	Precipitate	Good
Lanthanides	Good	Quantitative	Fair
Locant	Good	Sedimentation	Fair
Molybdenum	Fair	Stomach	Fair
Neutralization	Excellent	Structural formula	Good
Polymerization	Good		
Precipitation	Fair		
Pungent	Poor		
Quantization	Fair		
Stoichiometry	Poor		
Substituent	Fair		

Table 6. Analysis of Physics cacoepistic terms on the basis of students' interpretation regarding difficulty in pronunciation, spellings and concept.

Physics 9th	Category	Physics 10th	Category
Analogue	Good	Altitude	Fair
Archeology	Good	Amplitude	Fair
Archimedes	Poor	Aperture	Poor
Artificial	Fair	Architectural	Poor
Australopithecus	Poor	Assignment	Good
Cartesian	Poor	Characteristics	Good
Celestial	Fair	Chirping	Fair
Centrifuge	Fair	Cochlea	Poor

Coefficient	Fair	Curvature	Fair
Conventionally	Poor	Eclipse	Fair
Doubtful	Good	Edges	Good
Fahrenheit	Fair	Features	Good
Gradually	Fair	Gradually	Good
Inertia	Good	Incandescent	Poor
Initially	Good	Longitudinal	Good
Knob	Good	Machined	Good
Knowledge	Excellent	Magnitude	Good
Maneuvered	Poor	Mechanical	Good
Measurement	Good	Molluscs	Fair
Mechanisms	Good	Negligible	Fair
Meniscus	Fair	Neighboring	Fair
Metallurgical	Fair	Nuisance	Poor
Negligible	Fair	Pitch	Good
Peculiar	Fair	Schematic	Good
Phenomena	Good	Seismic	Poor
Precautions	Good	Sinusoidal	Poor
Precisely	Fair	Stretched	Fair
Proxima centurial	Poor	Tangential	Poor
Psychological	Good	Trough	Fair
Sketch	Excellent	Wiggle	Fair
Sledge hammer	Poor		
Substituting	Poor		
Tangentially	Poor		
Torricellian	Poor		
Unfortunately	Fair		
Visualization	Good		
Whirled	Fair		
Whistles	Fair		

Analysis of table 5 and 6 revealed that most of the terms were found difficult hence, fall in the category of fair and poor. The reason is that scientific terminologies, listed in table 4, 5 and 6, were derived from many languages such as Greek, Latin, Arabic origin. These languages are ancient and are not native to Pakistani secondary school students. So these terms should be replaced by alternative and easy native language terms or their meaning and origins must be clearly described in textbooks of Khyber Pakhtunkhwa textbook board. If authors attempt to described their meaning and origin, it will enhance learning of biology, chemistry and physics, and will make it easy for secondary level students to avoid cacoepy, to understand and building better concepts.

Interview and discussion with students

It is pertinent to ask what the role of attitudinal research might be in a country with a weak infrastructure like Pakistan, which has a national goal of achieving an effective State science education system (GOP, 2001). Bloom (1976) has attributed as much as 25% of the variation in achievement in school to attitude. As it can be argued that attitudes have a fundamental impact on later behavior (Ajzen, 1988), it follows that success in school science and hence achieving the national goals requires classroom actions from the teacher that inculcate positive attitudes (Iqbal et al., 2008).

Randomly selected 10 students from each class (n=40) were interviewed by the researcher regarding their science textbooks. To make the children more comfortable, they were interviewed in their as a whole, although it is acknowledged that with these young children the responses of one more articulate child might lead the others. They were excited at being given the chance to participate. Questions were put and answered in 'Pashto', the local language of Kohat.

Table 7. Responses of 40 students chosen at random to the interview questions/statements.

Questions/Statements	Responses (n=40)	
	Yes	No
Do you like science subjects?	35	5
I should like to be a scientist	11	29
Science makes me think	32	8
Is it easier for you to understand science?	11	29
Science is good for everybody	37	3
Science is just too difficult	22	18
Science terminology in your textbook is difficult	29	11
Is it difficult for you to understand science because of terminologies?	16	24
Insert the meaning and pronunciation of specific/important terms in Urdu at the start page of each chapter.	40	0

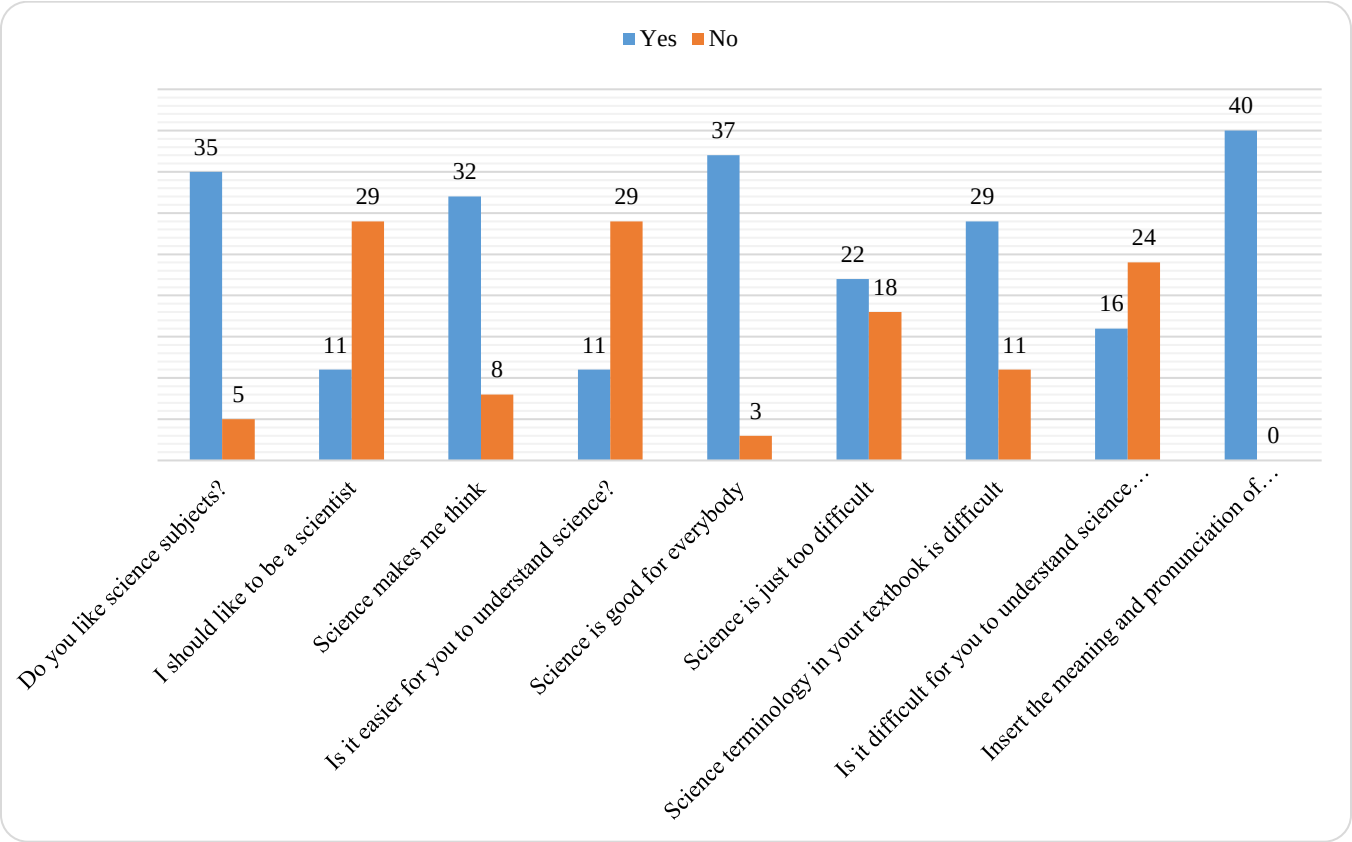

Figure 1. Responses of 40 students chosen at random to the interview questions/statements

Table 7 and figure 1 shows that almost all students like science subjects (n=35/40) which shows their motivation to science despite limited resource provision in the schools. Majority of students mentioned the difficulty of textbook contents and terms. The students also discussed that through removal of unnecessary area and inserting real life examples and activity, it is easier to learn and understand science topics. All the students agree with the insertion of meaning and pronunciation style of specific/important terms in Urdu at the start page of each chapter will facilitate them more as an initiative is taken by the Provincial Institute of Teacher Education, Peshawar (KPK) for Continuing Professional Development (CPD) Programme for Primary School Teachers (figure 2).

Vertebrates	Invertebrates	Characteristics	Mammals
فقاریہ (ریڑھ کی ہڈی رکھنے والے جانور)	غیر فقاریہ (بغیر ریڑھ کی ہڈی رکھنے والے جانور)	خواص	ممالیہ
Reptile	**Fish**	**Birds**	**Amphibians**
رینگنے والے جانور	مچھلی	پرندے	ایسے جانور جو خشکی اور پانی میں رہ سکیں
Monocotyledonous	**Dicotyledonous**	**Seeds**	**Veins**
یک دالہ پودے	دو دالہ پودے	بیج	پتوں میں موجود رگوں کا جال

Figure 2. Keyword to inform participants about the following vocabulary/ concepts/ terms during the session, so that, they will understand meaning with correct pronunciation.
Source: Continuing Professional Development (CDP) Programme for Primary School Teachers, Academic Year 2020-21).
Interview and discussion with science teachers

Table 8. Summary of teachers' interview/discussion

S. No	Statement	Agree	Disagree
1.	Lack of students interest	2	2
2.	Mother tongue interference	2	2
3.	Academic background of student matters	4	0
4.	Some students are able to acquire a reasonable knowledge of Science in few months while the others are not able to reach the same level within some few years.	4	0
5.	Science terminology in textbook is difficult	3	1
6.	Is it difficult to understand science because of terminologies?	2	2
7.	There is a mismatch between the science curriculum found in schools and that which 90% of the students want and need	4	0
8.	It depends on teacher's teaching skills and abilities how successful students are in terms of their science learning	4	0
9.	Continuous support and motivation by families or teachers could results in a greater success	4	0

Four secondary school science teachers were selected for an interview regarding secondary school textbooks evaluation in the context of students' perception and their point of view was observed and highlighted in the table 8. Firstly, 50% teachers agree regarding the lack of students' interest and mother influence. Secondly, all teachers were agreeing that academic background of student matters because some students are able to acquire a reasonable knowledge of science in few months while the others are not able to reach the same level within some few years. Majority of the teachers (n=3) agreed upon the difficulty of science terminologies in the secondary school science textbooks while half of them acclaimed that understanding science is difficult due to difficult terminologies. All teachers were of the view that difference exists between students' needs and curriculum in the school. Likewise, it was declared that teaching skills had a greatest role in terms of science learning. According to all the teachers understanding, continuous support and motivation by families or teachers plays overriding role in students' performance and success.

Furthermore, the teachers explored that current students' failure in terms of scientific understanding shrouds in many aspects. Terminologies, for example, used in secondary text books need be explained in a simple way for the sake of better understanding for even lower-ranked student. In the same manner, it was emphasized that Science related topics, such as respiratory system, alveoli, gravitational force, projectile motion, electricity and magnetism, acid and base reactions, etc. ought to be learnt with real time activities in School. As per the exigence of the situation, most part of the academic calendar has wasted due to intermittent disruption of educational institutions and Existing smart syllabus for COVID-19 pandemic in this context is

favorable for students to prepare for exam in a limited time, but in long term, the said syllabus is futile on account that it misses major topics, like some important diseases, that are useful for students in foreseeable future.

CONCLUSIONS

From the above-mentioned major findings, it was concluded that majority of the students like science subjects and find the terminologies difficult in which most of the terms contain more than 7 alphabets and were considered as complex terms. Due to this complexity, students feel difficulty in learning of scientific terms. Most of science terms were derived from Greek, Latin and other ancient languages, so students cannot understand their meanings. Almost every chapter of secondary school biology, chemistry and physics is overloaded with difficult terms and students felt difficulty in preparation of these chapters in which mostly difficult terms were found in biology. Mostly science teachers emphasize goals for school science that are directed only toward preparing students for the next academic level (for further formal study of science) and finishing his course within session ignoring the students` pronunciation of scientific terminologies.

RECOMMENDATIONS

- Terms should be made simple, and authors should try their level best to avoid terms that have more than 7 alphabets in them. Besides wherever possible such difficult terms should be replaced by easier alternative terms.
- Effort may be made to include terms hailing from the indigenous languages that are spoken, used and understood widely in Pakistan. Besides, in case of complex scientific terms, details about their origin and their explanation should be provide in the national Urdu language or easy English language.
- Real life activities or examples should be associated with important topics.
- Textbooks should be altered for language of explanation to match the level of students in secondary schools in Khyber Pakhtunkhwa, and some outdated themes should be replaced with new themes to meet the needs of the twenty-first century.
- It is important to expose the students of secondary level to such a workload which is appropriate for their studying needs instead of annual books' revision and insertion of high workload.
- Teachers should insert few terms into science lessons for practicing daily. It is enough to devote a minute or two to some pronunciation issue so that fluency of the lesson is not interrupted a lot. Pointing out a pronunciation problem when it has just arisen in the course is a good way of introducing pronunciation into the class.
- English plays an important part in the development of students because of its present and future as an international language. The textbook board in Khyber Pakhtunkhwa should include the Urdu phonology and meaning of the complex terminology at the start of each chapter.

CONFLICT OF INTEREST

There is no conflict of interest.

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AUTHORS' CONTRIBUTIONS

SA designed the work; AR collected the data and drafted the manuscript; TK analyzed the data and co-wrote the article; MH helped in the analysis of the data and the translation of findings into recommendations; MMS proofread and critically revised the manuscript for incorporation of necessary changes. SA and AR helped in the language correction and academic writing of the research. All the authors have read and approved the final version of this article for publication in the *Journal of South Asian Studies*.

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