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Elementary School Teachers' Perspectives on the Science Textbook

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Abstract: *Within the school context, the goal of developing scientific literacy in students can be achieved if certain provisions such as quality textbooks are made accessible to students. The purpose of this study was to evaluate the objectives and content of existing science textbooks through the perceptions of elementary science teachers. The assumption was that the teacher could better judge the objectives and content of the textbook. The study followed the quantitative approach to the research design. More specifically, survey research was used. Data were collected using convenient sampling techniques. The sample comprised science teachers (Seventy-one teachers from private schools and thirty teachers from public schools) of elementary level. A self-constructed five-point Likert scale questionnaire was used to collect data from elementary science teachers. The findings of the study show that the book, in its present form, does not fulfil the objectives of science. The weaknesses of the book are that it focuses only on covering the curriculum martial and ignores that content, which helps the students develop scientific literacy.*

Key Words: Elementary School Teachers, Education, Science, Textbook, Students

Introduction

Pakistan is experiencing fast-growing financial, societal, and civilization changes. The appearance of the competitive and incorporated global economy, rapid hi-tech modernism, and rising awareness are leaving a deep impact on the lifestyle of the people of Pakistan. All this is attributed to the applications of science and technology to society. Therefore, it is safe to assume that scientific and technological advancements play an important role in everyday life situations.

In this scenario, learning science for school students is essential. Science has been helping human beings to ask questions, test explanations through in-depth study, and to use their result to create significant improvements in society. Science has now become an essential part of daily life (Fives, Huebner, Birnbaum, & Nicolich, 2014). Since science learning is a key component in increasing scientific literacy, it is important to evaluate the teaching of science in schools. More specifically, it is pertinent to see what content is being taught in our schools to cultivate scientific literacy in our students.

The recent review of the existing school curricula and publication of revised curricula and textbooks made it pertinent to examine the content of science textbooks. Pakistan's Ministry of Education constituted the National Curriculum Review & Improvement

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Committees/Groups "to review the existing curricula of all core Science and Humanities Subjects (Grades I-XIII) as well as to provide the revised Curricula for these Subjects" (Jamil, 2009). A number of meetings were held to discuss different issues related to science education, that is, content, textbooks, teaching, assessment, etc. in order to improve science education in Pakistan. Consequently, the new curriculum documents were produced in 2006/2007.

In the new science curriculum document, the development of scientific literacy of school students was declared as the overall goal of science education. Following specific goals were also determined suitable for the science education of school students:

> Encourage students at all grade levels to develop a critical sense of wonder and curiosity about scientific and technological endeavours, enable students to use science and technology to acquire new knowledge and solve problems, so that they may improve the quality of their own lives and lives of others; prepare students to critically address social, economic, ethical, and environmental issues related to science and technology; provide students with a foundation in science that creates opportunities for them to pursue progressively higher levels of study, prepares them for science-related occupations, and engages them in science-related activities appropriate to their interests and abilities; and develop in students, of varying aptitudes and interests, and the knowledge of a wide variety of careers related to science, technology, and the environment. (MoE, 2006)

Indeed, the adoption of these goals shows the curriculum developers' intention to achieve scientific literacy for all students of science education.

The textbook approach to teaching is essential for science education because it provides an efficient way to teach scientific concepts in a well-defined structured way. Using the content of the textbooks, teachers may take part in helping students in accomplishing scientific literacy and in meeting the challenges of science education. Mahmood and Saeed (2011) asserted: "Textbooks are the primary vehicles for delivering content knowledge, for determining in large measure what goes on in a class, and for assessing what students do and do not learn. It has been identified that access to and availability of textbooks is a particularly significant factor in predicting academic achievement." (p. 503)

As Rogan and Grayson (2003) noted elsewhere that though the curriculum policy documents "themselves contain many visionary and educationally sound ideas, the implementation of these ideas is proving to be much slower and more difficult than anticipated" (p. 1172). It would be valuable to explore this phenomenon in the Pakistani context—where several contextual factors may hinder the process of implementation of a top-down created document in the writing of textbooks.

Evaluation of a textbook is an essential component of the continuing health of the textbook. A well-conducted textbook evaluation provides the necessary knowledge and understanding to stakeholders about the strong elements of a textbook—as well as informs about the needed changes in the textbooks. This is particularly important when textbooks have a critical role in the teaching-learning processes happening in Pakistani schools. Siddiqui (2007) asserted that in Pakistan, "the textbooks are supposed to occupy a central position in the process of teaching and learning to the extent that assessment system and classroom teaching seem to revolve around the textbooks" (p. 103). Indeed, textbook evaluation improves not only textbooks but also the teaching-learning processes.

Statement of the Problem

The main goal of science education provided in elementary-level schools in Pakistan is to develop scientific literacy in students. Moreover, science education in Pakistan is seen to be in crisis by many researchers. Students' attitudes towards science education are noted to be progressively declining—more and more students are choosing not to study science at higher levels and are not adopting science as a

career. There is an urgent need to attract students to science. Within the school context at the elementary level, this goal can be achieved if certain provisions such as quality textbooks are made accessible to students.

Thus, this study was conducted to evaluate a science textbook at the elementary level as perceived by science teachers. Perceptions of teachers are given importance in the evaluation, following objectives guided this study: To evaluate the perceptions of elementary school science teachers regarding science textbook VIII objectives and to investigate the perceptions of elementary school science teachers regarding the content of the science textbook VIII.

Methods and Materials

The purpose of this study was to evaluate the objectives and content of the science textbook through the perception of elementary science teachers. The survey research method (Newby, 2014; Oppenheim, 1992; Wilkinson & Birmingham, 2003) was chosen to evaluate science textbooks at the elementary level through the perceptions of science teachers in Punjab province, Pakistan.

Population & Sampling

The study design followed the quantitative approach to the research design. More specifically, survey research was used (Fowler, 1995; Jackson, 2014). Creswell (2012) stated that "survey research designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the population" (p. 376). Survey research is helpful in describing trends in the data (Willem E Saris & Gallhofer, 2014). Self-reported verbal information was solicited from elementary school teachers about their perceptions of the science textbook (Andres, 2012; Willem E. Saris & Gallhofer, 2007). De Vaus (2002) suggested that survey research is "well suited to providing certain types of factual, descriptive information—the hard evidence" (p. 5). In addition, Creswell (2012) suggested that surveys can be administered in a short time. Data collection through surveys is economical, a geographically dispersed population can be easily accessed, and participants' responses can be elicited anonymously without biasing the individual responses (Weisberg, Bowen, & Krosnick, 1996).

The population of this study consisted of all the teachers of science at the elementary level in private and public schools in Lahore. This research dealt with the content evaluation of the textbook of science at the elementary level. The assumption was that the teacher could better judge the content of the textbook. Therefore, the researcher took the opinions of the teachers who were teaching at the elementary level. The participants were selected on the bases of a convenience sampling technique (Rea & Parker, 2014; Ross, 2005). Creswell (2012) suggested that in "inconvenience sampling, the researcher selects participants because they are willing and available to be studied. In this case, the researcher cannot say with confidence that the individuals are representative of the population" (p. 145).

Sample selection was made as follows: As a female researcher, it was very hard to visit the vast area for the collection of data, the researcher used convenient sampling. Twenty-five private schools were selected through a convenient sampling technique. Fifteen public schools were selected. Three teachers from each private school were selected who were willing to participate in the research study. (25 X 3=75). Two teachers from each public school were selected who were willing to participate in the research study (15 X 2=30).

The total sample, including public and private, was 105. It was very hard for the researcher to collect the data from science teachers because the numbers of teachers in each school were very less. Therefore, the researcher used a convenience sampling technique for the selection of both types of schools: 1) public and 2) private elementary science teachers. The teachers were selected to sample those who were teaching class 8th only. The General Science Book (Punjab Textbook

Board) was evaluated by taking the opinions of the selected teachers.

Development of Research Tools

On the basis of the literature review, a questionnaire comprising 28 items was constructed for elementary school teachers. The face validity and content validity of the tool were established through the opinion of educational experts. In survey research, content validity is a "type of measurement validity that requires that a measure represent all aspects of the conceptual definition of a construct" (Neuman, 2006, p. 216). Content validity was ensured through expert opinions. Creswell (2012) asserted that "this form of validity is useful when the possibilities of questions…are well known and easily identifiable" (p. 162). In survey research, "reliability is a matter of whether a particular technique, applied repeatedly to the same object, yields the same result each time" (Babbie, 2013, p. 157). In other words, a tool is considered "reliable if it yields consistent results" (Patten & Newhart, 2017, p. 141). The reliability of the tool was calculated through SPSS. The reliability of the questionnaire was tested by applying Cronbach's Alpha. The reliability index was 0.91.

Since "questionnaires do not emerge fully-fledged" and since "every aspect of a survey has to be tried out beforehand to make sure that it works as intended" (Oppenheim, 1992, p. 47), the questionnaire tool was pilot-tested through 12 elementary science teachers who had the same characteristics as those of the participants (Lavrakas, 2008; Rossi, Wright, & Anderson, 2013). Creswell (2012) argued that: "A pilot test of a questionnaire…is a procedure in which a researcher makes changes in an instrument based on feedback from a small number of individuals who complete and evaluate the instrument. The participants in the pilot test provide written comments directly on the survey, and the researcher modifies or changes the survey to reflect those concerns." (p. 390).

Implementing the above suggestions helped in identifying various issues in the questionnaire and subsequently resolved them. For example, presentation, the difficulty level of items, a language like the length of the time taken for item response, etc. were identified by the participants and resolved by incorporating the suggestions in the final version of the questionnaire. After successfully resolving issues in the pilot-tested questionnaire, one self-made questionnaire was finalized and later used as a research tool for measuring the perceptions of elementary science teachers.

Data Collection

The finalized questionnaire was distributed among selected 105 selected samples of elementary science teachers. The feedback from the surveys was collected from the period between 16 August 2015 and 25 September 2015. The researcher collected the data with the help of teachers. The researcher visited each school 2-4 times and took appointments from heads of departments of each school and distributed a questionnaire to school teachers. The target schools were 40, of which 25 were private schools and 15 were public—the target population of the present study comprised elementary school teachers of both private and public sectors. Out of 105 selected samples of elementary science teachers, 101 participants responded. Seventy-five teachers were selected from private schools, whereas 71 teachers gave their responses. Thirty teachers were selected from public schools, and all gave their responses.

Data Analysis

Having collected data and created a data file based on the responses of the elementary school teachers, the next step was to analyze the data so that statistical estimates could be made, and conclusions could be drawn. Descriptive statistics were used to analyze data (Patten & Newhart, 2017). The data were analyzed using percentages to determine the perceptions of elementary science teachers. The results of the analysis have been organized in the form of percentages (Coolican, 2014) and are given in the next chapter.

Ethical Considerations

Research studies that involve human subjects need to be attentive to the ethical manner in which the research is carried out (Gray, 2009). Moreover, the questionnaire should " be technically correct, practically efficient and ethically sound" (De Vaus, 2002, p. 71). Since this survey research involved human beings, all guidelines regarding the ethical conduct of the researcher were strictly followed (Bryman, 2012). This researcher made sure that no participant in this study suffered any adverse consequences as a result of participating in the study (Bell & Waters, 2014). Furthermore, attempts were made to maximize the positive outcomes of the research process of this study. The voluntary cooperation of the participants was ensured. Moreover, the participants were fully "informed about what it is that they are volunteering" (Fowler, 2013). Confidentiality regarding their names and institutions was ensured by not disclosing their information to anyone and by keeping their responses anonymous (Loue, 2000; Newby, 2014).

Findings

This section deals with data analysis and interpretations, including item analysis and interpretation. This study was conducted to evaluate a science textbook at the elementary level through the perceptions of science teachers. A sample of 101 participants (elementary science teachers) provided their responses: 71 teachers were from private schools, whereas 31 teachers were from public schools. They filled out a questionnaire consisting of 28 items on a five-point Likert-type scale. Table 4.1 provides an item-wise analysis of the first ten items.

Table 1. Item-wise Analysis 1-10

S. No	Statements	SD	D	N	A	SA
1	The length of the content is sufficient.	2. (.2)	14. (.14)	17. (.17)	49. (.49)	18. (.18)
2	The required knowledge and skills given at this level are appropriate.	20. (.20)	10. (.10)	60. (.60)	10. (.10)	0 (.0)
3	This content makes students lifelong learners.	4. (.4)	16. (.16)	19. (.19)	45. (.45)	16. (.16)
4	This content helps students understand the basic aspect of scientific inquiry.	2. (.2)	19. (.19)	4. (.4)	49. (.49)	26. (.26)
5	This content provides the relationship between science, technology, and society.	0 (.0)	32. (.32)	24. (.24)	28. (.28)	16. (.16)
6	The time allocation for the content is adequate.	6. (.6)	37. (.37)	14. (.14)	39. (.39)	4. (.4)
7	All necessary competencies/learning objectives are included within the course content.	6. (.6)	36. (.36)	18. (.18)	33. (.33)	7. (.7)
8	Learning objectives are particularly relevant to the content.	0 (.0)	21. (.21)	16. (.16)	54. (.54)	9. (.9)
9	The content needs to be revised.	36 (.36)	23. (.23)	16. (.16)	26. (.26)	16. (.16)
10	There is a proper balance between theory and practice.	25. (.25)	15. (.15)	23, (.23)	18. (.18)	19. (.19)

67% of teachers agreed, and 16% disagreed with the first statement that the length of content was sufficient. 10% of teachers agreed with this, and 30% disagreed with the second statement that the required knowledge and skills given at this level are appropriate. 61% of teachers agreed with it, and 20% disagreed with the third statement. This content makes the students lifelong learners. 75% of teachers agreed with it, and 21% disagreed with the fourth statement. This content helps students understand the basic aspect of scientific

inquiry. 44% of teachers agreed with it, and 32% disagreed with the fifth statement. This content provides the relationship between science, technology, and society. Here 43% of teachers agreed with it, and 44% disagreed with the sixth statement. The time allocation for the content is adequate. 40% of teachers agreed with it, and 42% disagreed with the seventh statement. All necessary competencies/learning objectives are included within the course content. 63% of teachers agreed with it, and 21% disagreed with the eighth statement that learning objectives are particularly relevant to the content. Here 52% of teachers agreed with it, and 58% disagreed with the ninth statement that content needs to be revised. 37% of teachers agreed with it, and 40% disagreed with the tenth statement. There is a proper balance between theory and practice.

Table 2. Item-wise Analysis 11-20

S. No	Statement	SD	D	N	A	SA
11	The objectives of this course are clearly defined.	5. (.5)	16. (.16)	22. (.22)	43. (.43)	14. (.14)
12	The content of the subject meets the expectations.	5. (.5)	10.0 (.10)	21.0 (.21)	46.0 (.46)	18.0 (.18)
13	The content is organized coherently.	0. (.0)	10. (.10)	27. (.27)	46. (.47)	17. (.17)
14	The content is arranged in a logical manner.	0. (.0)	33. (.33)	17. (.17)	39. (.39)	11. (.11)
15	The content offered sufficient opportunities to meet specific objectives.	0. (.0)	9. (.9)	24. (.24)	41. (.41)	26. (.26)
16	The content offers sufficient challenges for ambitious students.	4. (.4)	31. (.31)	7. (.7)	34. (.34)	24. (.24)
17	The content is based on scientific facts.	33. (.33)	22. (.22)	22. (.22)	22. (.22)	23. (.23)
18	The content is formed coherently.	3. (.3)	20. (.20)	40. (.40)	19. (.19)	18. (.18)
19	The content has cohesion.	3. (.3)	22. (.22)	34. (.34)	23. (.23)	16. (.16)
20	The content is arranged in a logical manner.	40. (.40)	15. (.15)	24. (.24)	2. (.2)	17. (.17)

57% of teachers agreed with it, and 21% disagreed with the eleventh statement that the objectives of this course are clearly defined. 64% of teachers agreed with it, and 15% disagreed with the twelfth statement that the content of the subject meets the expectations. 63% of teachers agreed with it, and 10% disagreed with the thirteen statements the content is organized coherently. 33% of teachers agreed with it, and 51% disagreed with the fourteenth statement that the content is arranged in a logical manner. 67% of teachers agreed with it, and 9% disagreed with the fifteenth statement that the content offered sufficient opportunities to meet the specific objectives. 58% of teachers agreed with it, and 35% disagreed with the sixteenth statement that the content offers a sufficient challenge for ambitious students. 45% of teachers agreed with it, and 55% disagreed with the seventeen statements the content is based on scientific facts. 37% of teachers agreed with the statement, and 23% disagreed with the eighteenth statement that the content is formed

coherently. 39% of teachers agreed with it, and 25% disagreed with nineteen the statement that the content has cohesion. 19% of teachers agreed with it, and 55% disagreed with the twentieth statement was the content is arranged in a logical manner.

Table 3. Item-wise Analysis 21-28

S. No	Statement	Disagree		N	Agree	
21	The number of study hours met my expectations, which were based on the study load indicated.	49. (.49)		8. (.8)	43. (.43)	
22	Time allocation for this content is appropriate.	17. (.17)	27. .(27)	14. (.14)	34. (.34)	8. (.8)
23	Content is flexible for learning.	0. (.0)	31. (.31)	25. (.25)	33. (.33)	11. (.11)
24	The content develops capacities for understanding topics of science.	2. (.2)	19. (.19)	20. (.20)	40. (.40)	19. (.19)
25	The content difficulty level is appropriate	7. (.7)	15. (.15)	12. (.12)	45. (.45)	21. (.21)
26	This content correlates with the national standard curriculum.	2. (.2)	15. (.15)	34. (.34)	29. (.29)	20. (.20)
27	This content promotes active, collaborative, inquiry-based learning.	11. (.11)	20. (.20)	19. (.19)	36. (.36)	14. (.14)
28	This content provides objectivity and fairness.	25 (.25)	33 (.33)	6 (.6)	20 (.20)	16 (.16)

42% of teachers agreed with it, and 49% disagreed with the twenty-first statement that "the number of study hours met my expectations, which based on the study load indicated." 42% of teachers agreed with it, and 44% disagreed with the twenty-second statement that time allocation for the content is appropriate. 44% of teachers agreed with it, and 31% disagreed with the twenty-third statement that content is flexible for learning. 59% of teachers agreed with it, and 21% disagreed with the twenty-fourth statement that the content develops capacities for understanding topics of science. 66% of teachers agreed with it, and 22% disagreed with the twenty-fifth statement that content difficulty level is appropriate. 49% of teachers agreed with it, and 17% disagreed with the twenty-sixth statement that this content correlates with the national standard curriculum. 50% of teachers agreed with the statement, and 31% disagreed with twenty-seventh the statements; this content promotes active, collaborative, inquiry-based learning. 58% of teachers agreed with it, and 36% disagreed with the twenty-eighth statement that this content provides objectivity and fairness.

Discussions

Most of the teachers agreed with the statement that the length of the content is sufficient. Most of the teachers agreed with the statement this content makes the students lifelong learners. The majority of the teacher agreed with the statement that this content helps students understand the basic aspect of scientific inquiry. Most of the teachers agreed with the statement that this content provides the relationship between science, technology, and society. Most of the teachers agreed with the statement that learning objectives are particularly relevant to the content. Most of the teachers agreed with the statement that the objectives of this course are clearly defined. Most of the teachers agreed with the statement that the content of the subject meets the expectations. Most of the teachers agreed with the statement that the content is organized

coherently. Most of the teachers agreed with the statement that the content is arranged in a logical manner. Most of the teachers agreed with the statement that the content offered sufficient opportunities to meet the specific objectives. Most of the teachers agreed with the statement that the content offers sufficient challenges for ambitious students. Most of the teachers agreed with the statement that the content was formed coherently. Most of the teachers agreed with the statement that the content formed cohesively. Most of the teachers agreed with the statement that the content was arranged in a logical manner. Most of the teachers disagreed with the statement that the number of study hours met my expectations, which were based on the study load indicated. Most of the teachers agreed with the statement that content is flexible for learning. Most of the teachers agreed with the statement that the content develops capacities for understanding topics of science. Most of the teachers agreed with the statement that the content difficulty level is appropriate. Most of the teachers agreed with the statement that this content correlates with the national standard curriculum. Most of the teachers agreed with the statement that this content promotes active, collaborative, inquiry-based learning. Most of the teachers agreed with the statement that this content provides objectivity and fairness.

Most of the teachers disagreed with the statement that the required knowledge and skills given at this level are appropriate. Most of the teachers disagreed with the statement that time allocation for this content is appropriate. Most of the teachers disagreed with the statement that the content is based on scientific facts. Most of the teachers disagreed with the statement that the content needs to be revised. Most of the teachers disagreed with the statement that there is a proper balance between theory and practice. Most of the teachers disagreed with the statement that all necessary competencies/learning objectives are included within the course content. Most of the teachers disagreed with the statement that the time allocation to the content is adequate

Conclusion

The purpose of this study was to evaluate the content of the science textbook of grade VIII of Punjab. For this book evaluation, the researcher analyzed teachers' perceptions of the textbook science grade VIII of Punjab. The researcher used the questionnaire for science teachers of VIII of Punjab. The responses of the teachers reflect that the knowledge and skills of this level in books are not age-appropriate. The time allocated for the material is not adequate. The objectives described in the National Curriculum do not completely meet the content given in books. The content of the books needs to be revised to make them in accordance with the National Curriculum. Theory and practice do not fall in a balanced approach. In addition, research has found that scientific facts are being ignored as well though the content helps students to clear their basic concepts of science.

Recommendations for Improving the Textbook

On the basis of the finding, the researcher provides the following recommendations: The textbook should be revised, so that time allocation to the content is adequate. The textbook may be revised to incorporate all necessary learning objectives that are included with the course content. Since most of the teachers disagreed with the student that the required knowledge and skills given at this level are appropriate, the textbook should be rewritten to include content related to knowledge and skills. In the textbook, content and activities should be included in a way so that a balance between theory and practice is insured. Since the way a textbook is adopted in any jurisdiction has an impact on the quality of the material selected, it is suggested that Punjab Textbook Board should adopt science textbooks for elementary students using some rigorous method of selection.

Suggestions for Future Research

This small-scale study was designed to investigate the perceptions of the teachers about the content of the science textbook VIII. Several research studies can be designed to explore and analyze the issues related to this

study. A future study can be designed to investigate the perceptions of teachers regarding the content of science textbooks being taught at a different level in order to evaluate the books' content' helpfulness in developing scientific literacy. Another study can be designed using qualitative content analysis to understand the knowledge, skills, and activities incorporated in the science textbook being taught at different levels. Yet another study can be designed to evaluate the alignment between documents produced by curriculum policymakers and the textbooks produced by private writers and publishers

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