Analysis of Alignment between Curriculum and Biology Textbook at Secondary Level in Punjab

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Abstract
A textbook plays a key role in achieving the learning outcomes specified in the curriculum if it is well aligned with the curriculum. This well aligned textbook also contributes towards effective instruction and valid assessment. The present study investigated if the Biology textbook at secondary level in Punjab was aligned with the curriculum. In the Curriculum students learning outcomes [SLO] were outlined in five categories viz. (a) Knowledge, (b) Comprehension, (c) Higher order, (e) Skills, and (f) STS connection. Textbook’s content was analyzed to find out if it was congruent with the curriculum with respect to these five categories of SLO. Two panelists evaluated the content of the textbook on the self-developed alignment protocol. The data were analyzed through simple percentages and comparisons were displayed through graphs. It was found that textbook provided more content about Knowledge category of cognitive level and less content for Comprehension and other Higher Order categories of cognitive level. It is recommended that more content for higher order categories of cognitive level may make the textbook more aligned with the curriculum.

Keywords: Alignment, curriculum, textbook, students learning outcomes

I. Introduction
Curriculum alignment has got considerable significance among the educationists (Porter, Smithson, Blank, & Zeidner, 2007, p.1) because curriculum alignment is among basic factors that contribute to high performance of schools in the public examinations (Murphy, 2007, p. 75). Moreover, curriculum alignment also enhances students’ learning (McFadden, 2009; EdSource, 2006, p. 2; Zavadsky, 2006; Kercheval, 2001). Therefore, classroom instruction as well as the educational resources must be aligned with curriculum (Kuhn & Rundle-Thiesle, 2009, p. 352).
The textbooks play a key role in bringing the alignment of written, taught, and assessed curricula. If the textbooks are aligned to the curriculum, the classroom instruction is more likely to be aligned to the curriculum. Similarly, the examinations would also be more aligned to the curriculum. Fan (2010, p.2) thinks that a well aligned textbook is basic requirement for the implementation of curriculum.

Alignment of textbooks with curriculum becomes more important as the external examinations are assumed to be based on the curriculum. The poor quality of textbooks is a major factor of students’ low achievement in external examinations (Oakes & Saunders, 2002, p.3). The students perform well in external examination if the textbooks are aligned with the curriculum. For example, Singapore students’ excellent performance in the international exams is thought to be due to the well aligned textbooks (Fan, 2010).

In Pakistan, textbooks are crucial material used in classroom instruction as the external examinations are based on these textbooks (Shah, 2012, p.37). He recommends that textbooks aligned with curriculum would ensure quality of instruction in Pakistan. However, the process of textbook development in Pakistan indicates that there may be gap between the textbooks and the curriculum. There are multiple layers of curriculum and textbook development in Pakistan as the curriculum has been developed by Federal Government in 2006 and the textbooks have been developed by the Provincial Governments. This assortment of curriculum development and interpretation, as Hume and Coll (2010, p. 43) suggest, affects curriculum alignment negatively.

While textbook publishers claim that they develop textbooks that are aligned with the curriculum (Sawchuk, 2012), the research does not support this claim (Schmidt et al., 2001). Moreover, the studies (e.g. American Association for the Advancement of Science, 2005; Edvantia, 2005) indicate that there may be gaps between the curriculum and the textbooks. Therefore, it is essential to know how much the textbooks taught in schools are aligned with curriculum. Some studies have been undertaken to analyze the textbooks taught in schools in Punjab. However, these studies have not analyzed textbooks in relation to curriculum up to students learning outcomes [SLO] level, which is being employed in most of the developed countries of the world. Therefore, the present study was undertaken to analyze the alignment level of Biology textbook with the curriculum at secondary level in Punjab.

II. Literature Review

Curriculum is the product of mutual consensus among all the stake holders such as curriculum specialists, educational managers, parents, students, and teachers. It specifies the learning outcomes to be achieved after classroom instruction. It guides the teacher, educational manger, textbook/instructional material developer, and examiner. However, instructions given in curriculum are mostly not followed (Goodson, 2010, p. 193). Therefore, the curriculum specialists stress on curriculum alignment. Roach, Niebling and Kurz (2028, p. 158) define curriculum alignment as the degree of coordination among curriculum, instruction, and assessment to facilitate students’ learning. Martone and Sireci (2009, p. 24) think that alignment occurs when various components of education system work harmoniously in order to achieve collective goal.

Curriculum alignment is a method of “educational quality control” where the “process of teaching and learning is predetermined, pre-paced, and pre-structured.”
(Rubin & Kazanjian, 2011, p. 94). It requires teachers to teach “a standards-based curriculum with depth and complexity”. The instruction that is aligned with the curriculum results in students' high performance in external examinations (Schuenemann, Jones, & Brown, 2011, p. 64). Studies conducted on underprivileged students (e.g. Blankstein, 2004; Evans, 2005; Lavin-Loucks, 2006) demonstrate that instruction aligned with the curriculum also results in significant academic improvement and increased intellectual abilities of even underprivileged students.

On the other hand, complete alignment of instruction with curriculum is not so simple. According to Karvonen, Wakeman and Flowers (2006) one of the major obstacles in achieving alignment is employing different parties for carrying out different educational tasks (e.g. developing curriculum, teachers training, evaluation, etc.). So, Penuel, Fishman, Gallagher, Korbak and Lopez-Prado (2009) recommend harmonizing the curriculum, professional development of teachers and assessment. Similarly, misaligned examinations also put teachers in conflicting situation of following the curriculum or examination (Fuhrman, 1993). Moreover, sufficient level of alignment among curriculum, instruction and assessment is not possible without availability of proper educational resources.

The educationists all over the world admit that textbooks are vital educational resources (Oakes & Saunders, 2002, pp.3-5). The significance of textbooks is evident from the fact that the organizations like Organization of Economic Cooperation and Development (OECD), United Nations Educational, Scientific, and Cultural Organization (UNESCO), and World Bank consider availability of textbooks for students as an indicator of quality education.

Quality of textbooks and other instructional material is an important factor of curriculum alignment (Hill, 2001; Spillane, 2004). Classroom instruction is deeply associated with textbooks as it involves the interaction of teacher and students with the textbooks (Brown, 2009). Textbooks influence content delivered by teacher and the content learnt by the students (Schmidt, Houang, & Cogan, 2002). Stein, Remillard, and Smith (2007) contend that content which is not included in textbooks is usually not taught. English (1986, p. 50), on the basis of several surveys, concludes that teachers use textbooks and their own ideas as basis for selecting content of instruction.

Quality of textbooks has direct bearing upon students’ learning (Allington, 2002). Textbooks make students aware of the knowledge and skills to be achieved stipulated in curriculum. Carney (2011, p. 11) rightly asserts that many students cannot master the content which is not included in the textbooks as students are not taught that particular content.

But, mostly the exams in the developing countries are content centered as the test items cover the content in the textbook (Çepni & Karab, 2011, p. 3226). In spite of widespread use of and dependence on the textbooks, the textbooks are not satisfactorily aligned with the standards (American Association for the Advancement of Science, 2005; Edvantia, 2005). Shah and Tariq (1986-87) analyzed the relationship between the biology textbook and examination for secondary level and found that questions are set from the specific (only 20%) part of textbook. They also found that paper setters had not given proper representation of content from every chapter (p.45).
So, for alignment of instruction and assessment with the curriculum it is essential that textbook should be aligned with the curriculum. Glatthorn (2000, pp. 86-87) contends that analysis of the textbooks is a key step in the process of curriculum alignment. It is essential because the textbooks may treat topics too deeply to attract teacher and learners.

III. Statement of Problem

Studies (e.g. Shah, 2012; Shah and Tariq, 1986-87) have shown that in Pakistan textbooks are extensively used by the teachers in their classroom instruction and by examiners for developing question papers of the external examinations. Similarly, research (e.g. Naeem-Ullah, 2007; Rehman, 2004) also indicates that external examinations in Pakistan encourage cramming and rote memorization. Moreover, the textbook developers claim to develop the textbook according to curriculum. Therefore, it is essential to know if the textbooks’ content is congruent with the curriculum. Present study analyzed if the Biology (IX) textbook’s content was aligned with the curriculum at secondary level in Punjab.

IV. Research Question

The study was undertaken to investigate if the content of Biology (IX) textbook was aligned with curriculum with respect to (a) Knowledge (b) Comprehension (c) Higher order (e) Skills (f) STS connection categories.

V. Method

The present study employed quantitative research method which is suitable for relationship studies (Creswell, 2009, p. 4). Biology–IX textbook developed by Punjab Textbook Board Lahore was analyzed. The surveys of enacted curriculum [SEC] protocol is “a practical research tool for collecting consistent, reliable data on math and science” as it provides data which are objective, dependable and comparable for evaluation (Blank, 2002, p. 87). Moreover, it employs a uniform language for analysis of content and it is being used for alignment studies in several states of United States (Porter, 2002, pp. 3-4). Therefore, an alignment protocol was developed on the pattern of SEC protocol and it was used as tool of study.

There were total 270 students learning outcomes [SLO] in curriculum. In the curriculum, students learning outcomes have been divided into three levels:

- Understanding (173 SLO)
- Skills (72 SLO)
- STS connections (25 SLO) (GOP, 2006, p. 6)

The learning outcomes in Understanding belonged to cognitive domain of Bloom’s classification of objectives. The 173 SLO of Understanding level were further related to Knowledge (109), Comprehension (52) and higher order (12) categories of cognitive level of Bloom’s taxonomy.

The alignment protocol consisted of 19 rows (for topics) and five columns for categories of SLO which were:
(a) Knowledge
(b) Comprehension
(c) Higher order
(e) Skills
(f) STS connection

Two subject matter experts (panelists) were employed to analyze the content of the textbook. These panelists had good knowledge of content and curriculum. The validity and reliability of the instrument were ensured by (i) seeking experts’ opinion, (ii) pilot-testing, (iii) applying Davis-Becker and Buckendahl’s model for evaluating the curriculum-alignment studies, and (iv) ensuring high inter-raters correlation.

The data were analyzed, simple percentages were calculated and comparison was displayed through graphs.

VI. Findings

Figure 1 shows the chapter wise class period comparison between textbook and curriculum. It shows that there is complete mismatch (except chapter 2) in percentage of class periods between textbook and curriculum. Curriculum requires more time for different chapters but textbook demands less time for its content. The range of difference is from 2.5% to 12.5%.

Figure 1: Chapter-wise Class Period (in percentage)

Figure 2 compares textbook and curriculum with respect to category Knowledge. It shows that except that of topic 7b, content of all the topics in textbook is misaligned with the curriculum. Moreover, Textbook gives more (difference of SLO percentage ranges from 5% to 67%) emphasis to remember category as compared to curriculum (except topic 8b where it is 11% less). This gap is relatively more evident in the topics 2a, 3a, 4a, and 6b (differences of SLO percentage are 67%, 40%, 47%, and 40% respectively).
Figure 2: Alignment between Textbook and Curriculum: Category Knowledge

Figure 3 compares textbook and curriculum with respect to category Comprehension. It shows that, except that of topic 7b, content of all topics in textbook is misaligned with curriculum with respect to Comprehension category (the difference of SLO percentage ranges from 2% to 40%). Moreover, SLO percentage of most of the topics in textbook is much less than that of given in curriculum. This gap is more evident in topics 4b, 6b, and 9a where the differences of curriculum and textbook are 31%, 40%, and 27% respectively.

Figure 4: Alignment between Curriculum and Textbook: Category Comprehension

Figure 4 compares textbook and curriculum with respect to category Higher Order. It shows that textbook is completely misaligned with curriculum with respect to category Higher Order. Misalignment is because textbook provides no content with respect to the category Higher Order contrary to that of curriculum that has 0% to 28% SLOs for various topics.
Figure 4: Alignment between Curriculum and Textbook: Category Higher Order

Figure 5 compares textbook and curriculum with respect to category skills. It indicates that textbook and curriculum are comparatively more aligned with respect to category skills. Topics 1a, 3b, 4b, 4d, 5a, 7b, 9a, and 9b of textbook are significantly aligned (difference of SLO percentage ranges from 0% to 3%) with those of curriculum. However, topics 2a and 7b are significantly misaligned (difference of SLO percentage is 17% and 67% respectively).

Figure 5: Alignment between Curriculum and Textbook: Category Skills

Figure 6 compares textbook and curriculum with respect to category STS Connection. It shows that textbook is completely misaligned with curriculum with respect to STS Connection. Misalignment is because textbook provides no content with respect to the STS connection contrary to that of curriculum that has 0% to 30% SLOs for various topics.
VII. Discussion

Curriculum alignment demands a teacher to facilitate the learners in achieving the learning outcomes mentioned in the curriculum. Textbook aligned with the curriculum helps the teacher in this Endeavour. Alignment requires that the content of textbook matches the expectations of curriculum. It is not enough that textbook provides content about the topics mentioned in the curriculum. Besides, it must provide the content in accordance with the cognitive level as specified in the curriculum.

The mismatch between textbook and curriculum begins with number of allotted class periods for topics. The textbook has provided content for less class periods as compared to the requirements of curriculum. The reason for less time allocation for the topics by the textbook may be due to more content in the textbook on Knowledge category of cognitive demand. The textbook’s content for nearly all topics is related to learning outcomes belonging to Knowledge category of cognitive demand is greater than that of demanded in curriculum. On the other hand, textbook provides less content with respect to Comprehension category of cognitive demand.

Moreover, textbook is completely misaligned with curriculum with respect to SLO of Higher order categories of cognitive domain and STS Connection. Misalignment is because textbook provides no content with respect to SLO of Higher order categories of cognitive domain and the STS connection contrary to that of curriculum. It shows that textbook does not treat topics deeply contrary to demands of curriculum. Curriculum suggests achieving higher order learning outcomes for a topic, but textbook’s content is limited to lower order learning outcomes of Knowledge category and to some extent Comprehension category. However, textbook and curriculum are comparatively more aligned, with a few exceptions, with respect to category skills.

This misalignment between the content of textbook and curriculum may have serious consequences upon instruction and assessment. Considering the facts that in Pakistan (a) teachers and the examiners depend much on textbook, (b) teaching and assessment encourage rote memorization and cramming, and (c) external assessment lacks validity (Hina, 2008; Shah, 1998; Rehman, 2004), it may be inferred that textbooks with insufficient content for SLO related to comprehension and higher order categories of
cognitive are important factor of ineffective instruction and poor assessment. However, an experimental study is needed to prove this inference.

References


