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Challenges to Maintaining Alignment between Secondary Level Mathematics Curriculum and Assessments in Pakistan

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ABSTRACT

In Pakistan, the curriculum was revised in 2005-06 to establish a standard based setup and this curriculum was adopted for secondary classes from 2012. The alignment between standards and assessments is must feature of any standard-based educational program. A descriptive study was conducted to judge the alignment between secondary level National Curriculum of Mathematics standards and corresponding assessments made in the province of the Punjab, Pakistan. During this study, it was identified that there are some weaknesses in the National Curriculum of Mathematics and the corresponding assessments that challenge the process of alignment. The purpose of this paper is to give an account of those weaknesses to facilitate the process of standard-assessment alignment. It was identified that the National Curriculum of Mathematics for secondary classes lacks coherence as the same students learning outcomes (SLOs) were listed within and across different grades; for 21 SLOs no benchmark was designed. Majority of items in assessments was found assessing SLOs of lower grades instead of secondary classes.

Keywords: *curriculum-assessment alignment, educational alignment, mathematics curriculum*

Introduction

The alignment between educational standards and assessments is considered to be a key step to reform any educational system that adopts the standard-based education system (Nasser et al., 2014). Pakistani curriculum was revised in 2006, expected competencies in students were specified in the form of observable and measurable standards (Punjab Curriculum and Textbook Board, 2014) and that standard-based curriculum was adopted for secondary classes for the session 2012-13 onward. A study was conducted to gauge the degree of alignment between the standards for secondary classes and assessments made by Boards of Intermediate and Secondary Education (BISE), Punjab, Pakistan. This paper encompasses the areas, identified during the study, that challenge the maintaining of alignment between secondary level Pakistani curriculum and the assessments that are prepared by BISEs. There are both science and arts groups of subjects at secondary level in Pakistan and this study was delimited to the students of the science group of the province of Punjab. Out of the nine subjects being taught, the subject of mathematics was selected. There are nine Boards of Intermediate and Secondary Education in Punjab and for all the nine subjects including mathematics, the process of paper setting is same. For the annual examination, every BISE conducts the examination in two groups, called the first group and second group. This study was delimited to the assessment 2013 for grade IX and assessment 2014 for grade X. The research design used in this study was a descriptive and explanatory case study in which data was analyzed both in qualitative and quantitative methods. The second version of a standardized Webb Alignment Tool (WAT(v2)) was used to review the

degree of alignment between secondary level Mathematics curriculum and BISE 2013 assessment for grade IX and assessment 2014 for grade X. As recommended by Webb, five content experts were involved as reviewers having knowledge of educational standards and assessments. Following the guidelines given in the manual, the reviewers assigned Depth of knowledge (DOK) level to the prescribed students learning outcomes (SLOs) for the secondary mathematics of Pakistan. Afterwards, they assigned DOK level to the items of grade IX and grade X assessments and coded those items to the SLOs of secondary mathematics of Pakistan. In order to gauge the quality of assessment items, the reviewers' opinion was also obtained in the form of 'source of challenge' and 'notes' (where it was necessary). An item was considered by a reviewer to be containing a source of a challenge if he/she felt that for that particular item "a) a student who knows the appropriate material may still get the item wrong, or b) a student who does not know the appropriate material may answer the problem correctly…The Notes section was used to specify any additional comments about the item and how it matches up with objectives." (Webb, 2005, p. 42). While analyzing alignment level between standards and assessments it was identified that were certain issues in the National Curriculum of Mathematics and the corresponding assessments 2013 and 2014, interrupting the process of alignment. Illustrating those issues with causes would certainly facilitate the said process of alignment not only for mathematics but also for other subjects as procedures of developing assessments for the entire set of nine secondary level subjects is same.

Literature Review

In large part, the concept of standards-based education evoked in response to the 1983 report of the U.S. Department of education, *A Nation at Risk.* In this report, the National Commission on Excellence in Education emphasized the need for shared education and formalized assessments and educational standards and assessments were developed (Liebtag, 2013). Standard-based education is a mechanism of narrating expected competencies as learning outcomes and assessment of the students' achievement level toward those learning outcomes (Laksitowening, Santoso & Hasibuan, 2017). Earlier, the term educational alignment referred to the congruence between different components of education system, that is, standards, curriculum, teaching and assessments but afterwards the alignment studies were meant to examine the degree of agreement between educational standards and assessments (Burkam, 2013; Nasser et al., 2014; Webb, 1997; Webb, 1999). According to Porter (2002), alignment is the degree of agreement between standards for a specific area or subject and the assessments used to measure the achievement of those standards whereas the assessment includes all type of tests, developed at school or state level (Kim, 2002), to assess the achievement level of those standards (Case & Zucker, 2005a). There are three commonly used methodologies to check the alignment status between the educational standards and the assessments: sequential development, expert review, and document analysis (Case & Zucker, 2005b).

In sequential development, educational standards and assessments are developed serially. The educators, experts and public representatives are involved to

develop the standards. In the light of those standards, the outline for assessment tool is prepared in to ensure availability of an adequate number of assessment items against every standard. Expert review method is used for pre-developed standards and assessments. This process could also be used as the second part of the Sequential Development methodology to assess the success of that methodology. Document analysis was a system of encoding for structure and content of standards and assessments. This system offered a framework to systematically compare standards and assessments by involving content experts in the process of encoding and analysis.

Initially the alignment process considered to be one-to-one matching of between content standards and assessment items but intervention of U.S. Department of Education through *No Child Left Behind Act 2001* made it more sophisticated by urging to investigate the depth and breadth of standards as well as certain other characteristics (Council of Chief State School Officers[CCSSO], 2006) . Out of the different models emerged, the three most frequently used ones are the Surveys of Enacted Curriculum (SEC) Model, the Achieve Model and the Webb Model (Case, Jorgensen, & Zucker, 2004). SEC Model compares standards across the states. The Achieve Model is used to compare standards within a state. The Webb Model is used to estimate the alignment between state standards and assessments (CCSSO, 2002) and so suits to the Pakistani education system where standards are developed at the state and the assessments are prepared at the provincial level. In Webb model, the standards vs assessments alignment are judged on the basis of four criteria: that are *categorical concurrence, depth of knowledge (DOK) consistency, range of knowledge*, and *balance of representation* (Webb, 1997). The quality of assessment items is also assessed by identifying items with sources of challenge and other issues (Webb, 2007).

Categorical concurrence is the assessment of the same or consistent categories of content to appear in both standards and assessments. *DOK Consistency* is the comparison between levels of the cognitive demands of the standards and assessments. *Range of knowledge* represents the span of knowledge needed to correctly respond to any assessment item. And *Balance of representation* is the indication of the degree of emphasis, given to one objective of any standard over other the objectives of that standard (Escobar, 2016). According to Shilling (2013), the alignment has been increasingly used in consideration of standard-based reforms but most of the studies on this issue are about teachers' perception about the usefulness of alignment. Research is rare on the process and activates conducted during the process of alignment. "Moreover, there is little discussion in the literature about the challenges and problems that educators encounter during the implementation process and how these challenges and problems are overcome" (p. 21).

In Pakistan, standard-based curriculum was revised in 2006 and adopted for secondary classes in 2012 (Gulzar & Mahmood, 2018). A few studies were conducted in Pakistan on curriculum alignment, though the focus of those studies was congruence among different components of the educational system, instead of curriculum-assessment alignment. For instance, Bhatti, Jumani and Bilal (2015) investigated the alignment

between the National curriculum of secondary Biology and corresponding textbooks. Nosheen, Jabbar, and Awan (2018) conducted a study to assess the alignment between the enacted curriculum, classroom teaching, assessment and supported curriculum at the elementary level. Saeed (2013, 2014, 2015) conducted a series of studies on the curriculum and textbook alignment for science subjects of secondary level. Gulzar and Mahmood (2019), however, conducted a study to investigate alignment between the National curriculum of secondary mathematics and assessment tool of BISE Lahore. Apart from this, published research on curriculum assessment alignment in Pakistan is rare. Bhatti (2015) and Zafar (2015) has though studied alignment between secondary level National Curricula of Biology and English, respectively, with the corresponding BISE assessments.

Methodology

A study was conducted to judge the alignment between Secondary level mathematics standards of Pakistan and BISE assessments 2013 and 2014 for grade IX and X respectively, using Webb Model of alignment. This paper is extracted from the outcomes of that study to illustrate those issues that seemed to challenge the process of alignment.

Research Design

It was a descriptive and explanatory case study. Data were analyzed using both qualitative and quantitative methods.

Instrument

The second version of Webb alignment tool (WAT) was used that is a standardized tool used for gauging alignment level between educational standards and assessments (CCSSO, 2006; Shilling, 2016)

Procedure

WAT was used to identify four criteria of alignment between the standards and assessments: *categorical concurrence, depth of knowledge consistency, range of knowledge,* and *balance of representation.* As suggested by Webb (2005), five reviewers having knowledge of educational standards and secondary level mathematics teaching were selected using purposive sampling and trained on using WAT. The national curriculum for secondary level mathematics is organized in three layers: There are five standards which are subdivided into 35 benchmarks. Under those 35 benchmarks, 280 SLOs are designed (MoE, 2006). The said data was accordingly entered in WAT. Reviewers entered the DOK levels for every SLO and every assessment item. They also used WAT to point out the relevance of SLOs with assessment items. An item was considered containing a *source of a challenge* if, according to reviewers, for a particular item, "a) a student who knows the appropriate material may still get the item wrong, or b) a student who does not know the appropriate material may answer the problem correctly…The Notes section was used to specify any additional comments about the item and how it matches up with objectives." (Webb, 2005, p. 42). Results were generated using an automated mechanism of WAT. During the study, certain issues were noted both in the national curriculum for secondary level mathematics and in BISE assessments that were, in general, beyond the scope of an alignment study but appeared to have an impact on the process of alignment. This paper illustrates those issues.

Results and Discussion

National secondary level mathematics curriculum issues. While entering

standards in the WAT, It was identified that for one of the five standards, that is, *Reasoning and Logical Thinking*, no SLOs are designed. It was also found that for 21 SLOs out of the total 280, no corresponding benchmark was designed in the curriculum. WAT being a standardized tool demands all tiers of the curriculum to be intact. The matter discussed with the developer of WAT (Norman Webb, personal communications, January 20, 2015), and researcher designed some benchmarks as mentioned the Table 1 and Table 2 for grade IX and grade X respectively.

Table No 1

The researcher made Benchmarks for Class IX National Mathematics Curriculum

SLOs	Researcher made Benchmarks
• Define collinear points. Distinguish between collinear and non-collinear points • Use the distance formula to show that given three (or more) points are collinear • Use the distance formula to show that the given three non-collinear points form: • an equilateral triangle, • an isosceles triangle, • a right-angled triangle, • a scalene triangle. • Use the distance formula to show that given four noncollinear points form: • a square, • a rectangle, • a parallelogram • Recognize the formula to find the midpoint of the line joining two given points. • Use the distance formula to show that the given three non-collinear points form: • an equilateral triangle, • an isosceles triangle, • a right-angled triangle, • a scalene triangle.	Collinearity, Distant Formula and Mid-Point formula
• Any point on the right bisector of a line segment is equidistant from its endpoints • Any point equidistant from the points of a line segment is on the right bisector of it.	Apply properties of lines, angles and triangles to develop arguments about their geometric relationships (a benchmark for classes VI-VIII as per Ministry of Education[MoE], 2012, p. 6))
• Construct a triangle equal in area to a given quadrilateral. • Construct a rectangle equal in area to a given triangle • Construct a square equal in area to a given rectangle • Construct a triangle of the equivalent area on a base of a given length	Draw and subdivide a line segment and an angle. • Construct triangle (given SSS, SAS, ASA, RHS) (MoE, 2012, p.6) • Draw figures with equal areas.

Note: First column contains those SLOs against which no benchmark was designed in Grade IX National Curriculum. Second column contains benchmarks made by the researcher in the light of guidance of the developer of the WAT (Norman Webb, personal communications, January 20, 2015). SLOs = students learning outcomes

Table No 2

The researcher made Benchmarks for Class X National Mathematics Curriculum

SLOs	Researcher made Benchmarks
• Describe the method of synthetic division • Use synthetic division to find quotient and remainder when a given polynomial is divided by a linear polynomial • Use synthetic division to find the value(s) of unknown(s) if the zeros of a polynomial are given • Use synthetic division to find the value(s) of unknown(s) if the factors of a polynomial are given • Use synthetic division to solve a cubic equation if one root of the equation is given • Use synthetic division to solve a biquadratic (quartic) equation if two of the real roots of the equation are given	Perform synthetic Division

• Locate the centre of a given circle • Draw a circle passing through three given non-collinear points • Complete the circle by finding/ without finding the centre, when a part of its circumference is given	Construct a circle
• Circumscribe a regular hexagon about a given circle. • Inscribe a regular hexagon in a given circle	Circumscribe/inscribe a regular hexagon in a given circle

Note: the First column contains those SLOs against which no benchmark was designed in Grade X National Curriculum. The second column contains benchmarks made by the researcher in the light of guidance of the developer of the WAT (Norman Webb, personal communications, January 20, 2015). SLOs = students learning outcomes

National Mathematics Curriculum for grade I to XII is designed in three tiers. Topmost tier comprised of standards. Under standards, there is a second-tier called benchmarks and the third tier called SLO comes under the benchmarks (MoE, 2006). These three tiers were expected to be phrased discretely but during the current study, some of mathematical concepts/task were found to be expressed both as benchmarks as well as the SLOs which are shown in Table 3. This issue pertains to vertical alignment as "vertical alignment requires explicit signposting of what has been learned and where that learning is leading" (Watermeyer, 2012) but it is notable from Table 3 that three concepts were identified to be challenging the explicitness of the secondary level National Mathematics Curriculum. Furthermore, it is important to note that this weakness was not identified by design as this study was not intended to investigate the vertical and/or horizontal alignment of the National Mathematics Curriculum.

Table No 3

Secondary Level National Mathematics Curriculum Concepts/Task Expressed both as Benchmarks and SLOs

Sr #	Grade	Tier	Reference from National Curriculum for Mathematics Document
1	XI-XII	Benchmark	"Show the concurrency of right bisectors/ medians/altitudes of a triangle" (MoE, 2006, p.6).
	IX	SLO	Prove that "the right bisectors of the sides of a triangle are concurrent"(MoE, p.88).
	XII	SLO	"Show that three right bisectors, three medians, three altitudes, of a triangle are concurrent" (MoE, p.125).
2	VI-VIII	Benchmark	"Find the measure of central tendency mean, median and mode"(MoE, p.7).
	IX-X	Benchmark	"Find measures of central tendency and dispersion to draw conclusions" (MoE, p. 7).
	VIII	SLO	"Calculate mean (average), weighted mean, median and mode for ungrouped data" (MoE, p. 68)
3	VI-VIII	Benchmark	"Find the measure of central tendency: mean, median and
	IX-X	Benchmark	mode" (p.7)
	VIII	SLO	"Find the measure of central tendency and dispersion to draw conclusions." (p.7)

Note: the First column shows a number of curriculum concepts/tasks, second column and third columns respectively show the grade names where that concept/task is included as benchmark or SLO and the fourth column contains the actual text copied from National curriculum of mathematics. SLOs = students learning outcomes.

Assessment 2013 and assessment of 2014 issues. Each of the assessments 2013 and 2104 comprised of 52 items. Out of these 52 items, 15 items are multiple-choice questions (MCQs), 27 items are short questions, and 10 items are long questions.

The total point value of both the assessments 2013 and 2014 is 117 as described in Table 4.

Table No 4

Point Value of Items in the Assessments 2013 and 2014

Point value/item marks	Point value in BISE question papers
1	15
2	27
4	8
8	2

Note. The first column is the list of point values used in assessments 2013 and 2014 and the second column shows different item types.

As recommended by Webb (2005), the reviewers were required to code the assessment items against the SLOs but there were several assessments items for which no suitable SLOs were available and the reviewers had to code those SLOs against the generic benchmarks or goals (Webb, p.146). Table 5 contains the list of those assessment items showing that almost one-fourth of the assessment items didn't match with any SLO of National Curriculum.

Table No 5

List of Items Not Coded against SLO by more than One Reviewer

Assessment	Item No.	The total point value of items	Percentage within the assessment tool
2013	1, 4, 5,6, 9, 10, 11, 13, 18, 32, 34, 36, 37, 38, 40, 47, 50	30	24
2014	1, 3, 4, 7, 8, 9, 10, 13, 15, 24, 25, 31, 33, 37, 38, 39, 40, 41, 42	29	23

Note: Second column shows the corresponding serial number of items if 52 items of assessments 2013 and 2014 are serially arranged. The third column shows a total of point value in each assessment and column four shows the percentage of point value carried by these assessment items. SLO = students learning the outcome

Reviewers also pointed out that, out of total 52, 15 items of assessment 2013 and 13 assessment items of assessment 2104 were not inappropriate for grade IX and X, respectively, as according to MoE (2006) these items targeted the SLOs of some lower classes. This is described in Tables 6 and 7 with reference to the National Mathematics Curriculum document. It was further explored that the items were predominantly chosen from the textbooks for grade IX and X. As manifested in Tables 8 and 9, instead of constructing the items, 86.5% of the assessment 2013 (45 out of 52 items) of assessment 2013 88.5% items of assessment 2014 (46 out of 52) were either chosen from the exercise questions or solved examples given in the textbooks.

Table No 6

Assessment 2013 Items Targeting SLOs/Benchmarks of Grades below Secondary Level

Sr #	Item statement	Reference from National Curriculum for Mathematics Document	Grade
1.	A triangle having all sides equal is called:	"Define triangles with respect to their sides (i.e. equilateral, isosceles and scalene triangle" (MoE, 2006, p.36).	V
2.	The sum of internal angles of a triangle is	"Define triangles with respect to their angles" (p.36).	V
3.	Equality of ------ ratio is defined as the the proportion	"[Students should] know that equality of two ratios constitutes a proportion" (p.44).	VI

4.	What will be added to complete the square of $9a^2$- 12 ab?	"Recall the formulas: $(a + b)^2 = a^2 + 2ab + b^2$,$(a - b)^2 = a^2 - 2ab + b^2$,$a^2 - b^2 = (a - b)(a + b)$" (p.62).	VIII
5.	The symbol -------- is used for line AB:	"Differentiate between a straight line and a curved line" (p.17).	II
6.	What is meant by the congruency of the triangle?	"Apply the following properties for congruency between two triangles. *SSS* ≅ *SSS* , *SAS* ≅ *SAS* ,*ASA* ≅ *ASA*, *RHS* ≅ *RHS"* (p. 55).	VII
7.	How many congruent triangles can be formed by each diagonal of a parallelogram? Draw figure	"Construct a parallelogram when • two adjacent sides and their included angle are given, two adjacent sides and a diagonal are given" (p. 56).	VII
8.	The given triangle ABC is an equilateral triangle and AD is bisector of angle A. Then find the values of unknown x◦, y◦, z◦	"Define triangles with respect to their sides (i.e. equilateral, isosceles and scalene triangle)" (p.36). "Bisect a given angle" (p.47).	V VI
9.	3 cm, 4 cm and 5 cm are not the lengths of a triangle? Give reason	"Construct a triangle when three sides (SSS) are given" (p.47).	VI
10.	Define similar triangles.	"Identify congruent and similar figures" (p.55)	VII
11.	Define area of figure	"Recognize region of a closed figure" (p. 37).	V
12.	Find area of square when sides are 4 cm	"Apply formulas to find perimeter and area of a square and rectangular region" (p. 37).	V
13.	Construct triangle ABC when AC = 5.2 cm; BC = 4.2 cm, AB = 3.2 cm	Construct triangle (given SSS, SAS, ASA, RHS)" (p. 6) "Construct a triangle when three sides (SSS) are given." (	VI
14.	Construct a right angled triangle whose hypotenuse is 6.2 cm	"Apply properties of lines, angles and triangles to develop arguments about their geometric relationships" (p. 6).	Benchmarks VI-VIII
15.	Construct a triangle and draw its bisectors in which angle B = 45◦, angle A = 75◦ AB= 3.6 cm	"Construct triangle (given SSS, SAS, ASA, RHS)," (p. 6) "Construct a triangle when two angles and the included side (ASA) are given" (p.47)	VI

Note: Second column contains items of assessment 2013, third column shows SLO or benchmark with reference of National Mathematics Curriculum document and forth column shows the corresponding grade for which that SLO or benchmark is designed. SLOs = students learning outcomes

Table No 7

Items of Class X Assessment Tool 2014 of Mathematics Targeting SLOs of Grades below Secondary Level

Sr #	Item statement	Relevant content in Mathematics Curriculum 2006 (I-XII)	Expected LO for Class
1.	The length of the diameter of a circle is how many times the radius of the circle	"Identify circle, its radius and diameter" (MoE, 2006, 23).	III
2.	If tan θ = √3 then θ is equal to:	"Define trigonometric ratios of an acute angle. Find trigonometric ratios of acute angles (30^o, 60^o and 45^o)"(p. 68).	VIII
3.	Point (1, -3) lies in the quadrant	"Locate an ordered pair (a, b) as a point in the rectangular plane"(p .83)	IX
4.	The number of elements in the power set of {1, 2, 3} is	"Find power set P (*A*) of a set *A*" (p. 58).	VIII
5.	Find the cost of 1.5 kg of sugar, if 7 kg of sugar cost 560 rupees	"Solve real-life problems involving direct and inverse proportion" (p.44).	
6.	Show A U (BUC) by Venn Diagram	"Use Venn diagram to represent union and intersection of sets and complement of a set" (p. 81).	X VIII

		"Demonstrate union and intersection of three overlapping sets through Venn diagram."(p.58).	
7.	If A = {1, 3, 5, 7, 9}, B = {1, 4, 7, 10}, and C = {1, 5, 8, 10} then find the value of A U (B∩C)	" Perform operations on sets union, intersection, difference, complement"(p.81) " Find union of two or more sets, intersection of two or more sets, difference of two sets"(p.49)	X VII
8.	Define mode and range	"Describe measures of central tendency. Calculate mean (average), weighted mean, median and mode for ungrouped data"(p.68)	VIII
9.	Define measurement of central tendency and write two measures of it	"Find measure of central tendency: mean, median and mode" (p.7) "Find measure of central tendency and dispersion to draw conclusions." (p.7) Describe measures of central tendency (p. 68)	Benchmark VI-VIII Benchmark IX-X VIII
10.	Define a circle	"Describe a circle and its centre, radius, diameter chord, arc, major and minor arcs, semicircle and segment of the circle."(p. 56)	VII
11.	Define the sector of circle	"Describe the terms; sector, secant and chord of a circle"(p.66)	VIII
12.	Define tangent to a circle	"Describe the terms; sector, secant and chord of a circle, concyclic points, tangent to a circle and concentric circles"(p.66)	VIII
13.	For any two sets A and B, prove that A U B = B U A	"Verify commutative and associative laws with respect to union and intersection"(p.58)	VIII

Note: Second column contains items of assessment 2013, third column shows SLO or benchmark with reference of National Mathematics Curriculum document and forth column shows the corresponding grade for which that SLO or benchmark is designed. SLOs = students learning outcomes

Table No 8

BISE Assessment Tool 2013 Items' Selection/Making Content Traced in Grade IX Textbook

Item number	Taken from	Textbook Page #	Item number	Taken from	Textbook Page #
1.	Review Ex.4	95	27.	Ex. 7.2	138
2.	Review Ex.7	142	28.	Ex. 8.1	156
3.	Review Ex.1	29	29.	Textbook contents	146
4.	Review Ex.9	184	30.	Exercise 9.1	170
5.	Not form Textbook	-	31.	Review Ex. 9	184
6.	Textbook contents	228	32.	Textbook contents	186
7.	Review Ex.11	208	33.	Review Ex. 11	208
8.	Review Ex.12	216	34.	Review Ex. 12	216
9.	Review Ex.5	111	35.	Review Ex. 13	228
10.	Textbook contents	292	36.	Review Ex. 14	236
11.	Review Ex.17	266	37.	Review Ex. 14	236
12.	Review Ex.8	166	38.	Review Ex. 16	250
13.	Review Ex.3	73	39.	EX. 15	241
14.	Review Ex.6	128	40.	Review Ex. 16	251
15.	Review Ex.2	53	41.	Ex. 17.1	255
16.	Textbook contents	7	42.	Ex. 17.1	256
17.	Review Ex.1	30	43.	Ex. 1.6	28
18.	Ex. 2.1	39	44.	Ex. 2.4	46
19.	Ex. 2.4	47	45.	Ex. 3.4	72
20.	Review Ex.3.3	70	46.	Ex. 4.2	88
21.	Ex. 3.1	59	47.	Ex. 5.3	109
22.	Ex. 4.3	90	48.	Ex.6.3	126
23.	Solved example	92	49.	Ex. 7.1	135
24.	Solved example	99	50.	Ex.17.2	260
25.	Ex. 6.1	120	51.	Solved Theorem	215
26.	Ex. 7.1	135	52.	Solved Theorem	247

Note. Ex. = Exercise; Textbook = Mathematics Textbook for grade IX by Dar and Haq (2012)

Table No 9

BISE Assessment Tool 2014 Items' Selection/Making Content Traced in Grade X Textbook

Item #	Taken from	Textbook Page number	Item #	Taken from	Textbook Page number
1.	Review Ex. 4	83	27.	Review Ex. 5	105
2.	Review Ex. 5	104	28.	Solved example	96
3.	Review Ex. 9	187	29.	solved example	99
4.	Review Ex. 13	237	30.	Textbook contents	91
5.	Review Ex. 10	200	31.	Review Ex. 6	144
6.	Review Ex. 1	15	32.	solved example	29
7.	Review Ex. 2	45	33.	Review Ex. 6	144
8.	Review Ex. 3	70	34.	Solved example	152
9.	Review Ex. 6	142	35.	Ex. 7.4	165
10.	Review Ex. 11	209	36.	Ex. 7.4	165
11.	Review Ex. 7	169	37.	Review Ex.9	188
12	Ex. 7.4	165	38.	Review Ex.9	188
13.	Review Ex. 5	105	39.	Textbook contents	200
14.	Review of Ex. 3	70	40.	Textbook contents	220
15.	Review Ex.5	104	41.	Textbook contents	220
16.	Ex. 1.1	5	42.	Not from textbook	-
17.	Review Ex. 1	16	43.	Ex.1.1	5
18.	Solved example	19	44.	Ex.2.4	31
19.	Ex.2.2	25	45.	Ex.3.6	67
20.	Solved Example	23	46.	Ex.4.4	82
21.	Ex. 2.5	35	47.	Ex. 5.2	91
22.	Review of Ex. 3	71	48.	Ex.6.3	141
23.	Ex. 3.3	58	49.	Ex. 7.5	167
24.	solved example	52	50.	Ex.13.3	237
25.	Review Ex. 4	83	51.	solved theorem	182
26.	Unsolved example	76	52.	solved theorem	215

Note Ex. = Exercise; Textbook = Mathematics Textbook for class X by Habib et al. (2013)

Pakistan claims adoption of standard-based education especially in science even for higher education (Manzoor, Aziz, Jahanzaib, Wasim & Hussain, 2017) so the foremost measure is removed inconsistencies in the curriculum document as it challenges the process of alignment between standards and assessments. Moreover, the process of development of an assessment tool too is not in line with the requirements of a standard-based assessment system. For instance, the item at serial number 1 in Table 6 demands a student to recall the name of an equilateral triangle, and as per MoE (p. 36), this SLO was designed for grade V (not for grade IX). This is a fair indication of the fact that item construction of both the assessments 2013 and 2014 was not based on SLOs of grade IX and X as at least 25% of both the assessments 2013 and 2014 do not target the relevant grades' SLOs. Items targeting lower grades' SLOs not only affects the alignment between curriculum and assessments but also makes the entire examination, questionable. Grading of a student of grade X on the basis of an SLO of grade III (see Table 7) makes the grading system doubtful for the stakeholder. Besides, the standards-based system requires constructing items in the light of SLOs. Choosing the items, instead of constructing items, is itself unprecedented in a standard-based examination system but this becomes a more serious concern when the items are chosen from the textbooks used by the students to practice the

concepts/skills about those SLOs (Mahmood, 2010).

Recommendations

1. Benchmarks should be designed for the 21 SLOs of the secondary level national mathematics curriculum.
2. The three tiers of the national mathematics curriculum should be exclusively designed and delineated. The identified anomalies of expressing the same concepts as benchmarks as well as the SLOs should be removed. An exclusive study needs to be designed to investigate the vertical and horizontal alignment of National Mathematics Curriculum for grade I to XII.
3. It should be ensured that assessments items are made to assess the achievement level of SLO of the same grade for which the assessment is designed.
4. Assessment items should not be chosen from the textbook exercises used by

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