

# Skill Development Gap and Applications of Bloom Taxonomy-Related Assessment Techniques Among Teachers in Delta State of Nigeria

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## Abstract

Based on their classroom experiences, practicing teachers do realize important assessment-related skills which their teacher training programmes failed to develop in them. Failure to equip teacher trainees with such skills rids them of the opportunity of being effective in relevant classroom practices. The gap between the extent to which they perceive such skills as important and the extent to which such skills were covered during their training programmes constitute a determinant factor in their application of such skills in their classrooms. This study identified such gaps in 12 Bloom taxonomy-related 21<sup>st</sup> century-essential skills and determined the extent to which they influence the application of these desirable skills in the classroom. With data collected through a survey of 227 secondary school teachers in Delta State of Nigeria a gap analysis was done for each of 12 Bloom taxonomy-related skills and level of application of such skills were analysed using ANOVA to test twelve null hypotheses on the influence of level of these gap on classroom application of such skills. Classroom applications of ten of these skills were found to be significantly influenced by the related level of gap identified. These findings were discussed and recommendations that follow directly from these findings were made.

**Keywords:** Assessment skill gaps; 21<sup>st</sup> century skills; Bloom taxonomy; teacher training; Delta State of Nigeria.

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## Introduction and Background

Learning is the ultimate dependent variable in education (Nenty, 1992), everything done in the name of education impacts positively or negatively on learning. It is through assessment that learning and hence quality of education are defined, and any improvement in these depends ultimately on the

quality of and improvement in assessment. Just like the physicians cannot have effective practice without good assessment, teachers cannot have effective teaching without skills related to good assessment (Nenty, 2005). Hence assessment is at the heart or centre of all educational activities and every activity in education looks on to assessment to establish its validity and effectiveness. Educational processes and products of any system cannot be of a quality higher than that of the assessment processes in practice in the system. In other words, the quality of assessment bears on the quality of educational inputs, processes and products and hence on the quality of education enjoyed by the society.

Education should develop in our young ones global competencies that will situate them in an advantageous position among emerging global children. **According to** 21<sup>st</sup> Century Schools (2008), 21<sup>st</sup> century education is:

. . . bold. It breaks the mold. It is flexible, creative, challenging, and complex. It addresses a rapidly changing world filled with fantastic new problems as well as exciting new possibilities. Fortunately, there is a growing body of research supporting an increasing number of 21st century schools (p. 1).

In a review of Tony Wagner's book, *'The Global Achievement Gap'*, Conlon (2008) listed as seven survival skills of the 21<sup>st</sup> century:

1. Critical thinking and problem solving
2. Collaboration across networks and leading by influence
3. Agility and adaptability
4. Initiative and entrepreneurialism
5. Effective oral and written communication
6. Accessing and analyzing information
7. Curiosity and imagination

According to Conlon (2008), for survival in the 21<sup>st</sup> century, we:

. . . expect all teachers to teach all students how to think and communicate effectively, and they need to assess these skills and benchmark expectations to what the world will require of our high school graduates. And this needs to happen every day in every class and at all grade levels. If we do this in all of our schools, while also stimulating curiosity and imagination, then all students will have the skills they need to get and keep a good job and be a contributing citizen, while our country will have a workforce that can continually produce innovations. An economy based on innovation will be more competitive and successful than any other in the 21st century (p. 1).

## **Theoretical Foundations**

### **Teacher Preparation**

Effective in-service training is that designed to bridge the gap between what the teacher perceives as that necessary for effective classroom operation and the level of skill in related areas which he/she possesses. Such level of skill is mainly that acquired during teacher training. To Hughes (2011), "training is about bridging the gap between what is known (the present) and the level of skills required (the future)" (p. 1). With the fast changing skill demand for growth and development in a highly competitive global economy, teacher classroom practicing skills need to be frequently updated. According to Walter, Wilkinson and Yarrow (1996) "the quality of teaching depends on the quality of teachers which, in turn, depends to some extent on the quality of professional development" (p. 41) of skills necessary for preparing students for future growth opportunities.

Given its importance teachers who are the prime movers of education processes need to be well trained in classroom assessment practices. Lack of a good level of such training handicaps the teacher in any attempt to fulfill his/her roles effectively in the classroom. Trained teachers realize these handicaps when they start teaching. They soon find out that without such skills their effectiveness is limited. In the context of the problem of the current study such classroom assessment skills include (Nenty, 2005):

Ability to detail or breakdown syllabus subject matter content into bits and pieces for ease of instructional coverage, as well as ease of valid assessment. This should reflect the depth and width of actual coverage of each subject matter content in the class.

Have detailed conceptual knowledge and application of levels and sub-levels of Bloom's taxonomy of human cognitive behaviour, and of their skill demands. They should be able to differentiate among and develop items (tasks, questions, statements, etc.) that call on each level or sub-level of these domains.

Be able to develop and provide a guide or plan for constructing valid classroom questions and test, by developing a test blueprint or table of specification to guide their effort. For the development of achievement test, for example, they should be able to break down and present for each level of human cognitive behaviour (memory, comprehension, application, analysis, synthesis, and evaluation), for example, the number of items that they will develop to assess each content area.

Be able to generate task, questions, statements, or items which when read or confronted by each learner will act as an appropriate cognitive stimuli to elicit exactly only the type of behaviour the assessment tool intended to measure. They should have conceptual knowledge of, and how to construct the several types of assessment items and a variety of other assessment tools for cognitive, affective, and psychomotor behaviour; and of their properties, advantages and disadvantages, and when to use each of them for maximum desirable results.

Ability to apply several modes of assessment in the classroom. Besides the usual paper and pencil tests in its different forms, these include: oral questioning and presentation, group work or projects, portfolio, creative writing, reviews, coursework and assignments, short writing exercises, case study, research projects, learning journals, seminar presentation, peer assessment, demonstration, problem-based learning, laboratory work, work-based learning, role playing and on-line assessment. Brainstorming exercise, if well planned, is a rich means of provoking and assessing higher order cognitive thinking especially creativity skills. An assessment mode in use is most effective if it matches the teaching learning style used in class.

## **Assessment Skill Gap Analysis**

Training of teachers from human resources development perspective implies identifying and developing relevant potentials inherent in the trainees to make them effective at teaching. The start of such a project is the identification of bit and pieces of skills necessary to perform well at teaching and the determination of the extent to which each of these is necessary. The end should be the finding out of how well each of these skills has been developed among the trainees. The difference between the two identifies a skill gap. The level to which there is a lack of congruence between skills deemed necessary for effective teaching and that possessed by the teacher, to that level is the teacher handicapped to teach effectively. One component of such skills is classroom assessment skills. As have been pointed out, fundamental to an effective teaching is the possession of basic classroom assessment skills by teacher trainees.

Assessment skill gap analysis is a systematic exploration of the differences in level of relevant assessment skills exhibited by teachers in relation to the level to which such skills should have been developed by their training programme. For this, the current situation or level of possession of a particular assessment skill is determined and the level to which the same skill is deemed by the teacher from experience to be necessary for effective teaching is also determined, the difference between the 'current' and the 'necessary' or the 'expected' is the 'gap'. The larger such gap, the more ineffective the teacher is likely to be in the exhibition of that skill in the classroom (Rouda & Kusy, 1996).

## **Research Questions**

To what level does the gap between teacher trainees' perception of the extent to which Bloom taxonomy-related classroom assessment practices ensures quality of education and the extent of coverage of such skills during teacher training determines their level of application of these skills in

the classroom? Related to the skills necessary for survival in the 21<sup>st</sup> century, the skills being assessed were:

1. application of theoretical concepts in solving practical problems in real-life situations;
2. ability to analyse ideas, communication and creations;
3. ability to think creatively;
4. ability to make inference;
5. ability to contribute solution to real-life problems;
6. ability to think divergently;
7. decision-making ability;
8. critical thinking ability;
9. affective behavior;
10. ability to access information;
11. problem solving ability;
12. higher-order cognitive skills.

## **Research Hypotheses**

A significant number of participating teachers identified the presence of unfavourable gap between what they should know to be effective at classroom assessment and what they were exposed to during their training programmes.

For each of the 12 skills it was hypothesized that the gap between the extent to which they perceive of Bloom taxonomy-related classroom assessment skills as important and the extent to which they were covered during their training programme constitute a significant factor in their application of such skills in their classrooms.

## **Literature Review**

Gap analysis studies in education are hard to come by. In Canada, Fuchs, Wilcock and Aung (2004) designed a study to identify the skills and knowledge deemed important for food safety professionals and the degree to which a Food Safety and Quality programme helped students to develop these skills. Using interviews, related skill and knowledge items were identify and the content of the interviews was then used to develop a survey used to determine the extent to which these skills and knowledge were developed. Important skill gaps were also identified through survey results. Personal skills were considered more important than technical skills to food safety professionals (p.33).

Earlier, Davis, Misra and Auken (2002), in a university in western United States, used a gap analysis approach to contrast the relative importance of key skill and knowledge areas to one's current employment with the perception of their academic preparation in the relevant areas in marketing education. The study found that "marketing alumni perceive that they are under prepared in skills and over-prepared in designated knowledge areas." (p. 218). To address these shortcomings, a reassessment as to curriculum shortcomings was recommended.

## **Methods and Design**

The inferential survey based on the positivist paradigm was the design used in this quantitative study. The population of the study was made up of secondary school teachers in Delta State of Nigeria from which a sample of 227 teachers was randomly selected. A questionnaire titled "Advances in Assessment: A Consideration for Reforms in Teacher Education" was the instrument of data collection. It has 36 items that described aspects of global reforms in and assessment for 21<sup>st</sup> century skills or global competencies. Three scales were provided for such an item: The first was a 6-point scale that sought the extent teachers perceived the Bloom-taxonomy-related skill measured by the item is useful at ensuring development at the 21<sup>st</sup> century, hence quality of education. The second scale was also a 6-point scale that sought the opinion of teachers on the extent of coverage of such skill during their teacher training programme. The third scale was a 6-point scale that sought teachers' opinion on the extent to which they use such skill or knowledge in classroom practice. The reliability

of each of the three scales was determined and this ranged from a Cronbach value of .893 to .922 (see Table 1).

**Table 1:** Cronbach Alpha ( $\alpha$ ) Reliability Estimates for the Three Scales

#	Name of Scale	No. of Items	Cronbach alpha ( $\alpha$ )
1.	Extent to which Bloom Taxonomy-Related Classroom Assessment Practices Ensures Quality of Education.	12	.922
2.	Extent of Coverage of Bloom Taxonomy-Related Classroom Assessment Practices During Teacher Training.	12	.900
3.	Extent of Application of Bloom Taxonomy-Related Classroom Assessment Practices in the Classroom	12	.893

The data for the study were teachers' rating of the level to which the Bloom-taxonomy-related assessment skill is deemed necessary for development at the 21<sup>st</sup> century; rating of the extent to which skill was covered during their teacher training programme; as well as their rating of the extent to which they used the same skill in their everyday classroom assessment practices.

The difference between teachers' rating of the desirability of the skill and that of level of coverage during training provided the skill gap which was used as the independent variable in the study. For instance when a respondent ticks 6 as level of desirability and 2 as level of coverage for the same item the skill gap for that particular skill becomes 6 minus 2 which is 4.

On the basis of these gaps, three categories or classes of gap was identified among the teachers viz: positive gap (PG), No gap (NG) negative gap (NEG). The extent to which they applied each of these Bloom-taxonomy-related skills in their everyday classroom assessment practices served as the dependent variables in the study.

## Data Analysis and Interpretation of Results

A frequency analysis of the overall differences in the number of teachers across the three gap-levels in the 12 skills gave a chi-square ( $\chi^2$ ) value of 35.66 (df=2,  $p < .01$ ). Thus a significant number of participating teachers identified the presence of unfavourable gap between what they should know to be effective at classroom assessment and what they were exposed to during their training programmes.

Twelve one-way analysis of variance (ANOVA) were done to test the 12 statistical null hypotheses involving the level to which the identified skill gap influenced the level of application of the related assessment skills in their everyday assessment practices in their classroom (see Tables 2 & 3).

For the first Bloom-taxonomy-related assessment skill, the null hypothesis that the identified skill gap has no significant influence on the level to which teachers apply the skill to assess the ability of students to apply theoretical concepts in solving practical problems in real-life situations was rejected ( $F_{(2, 210)} = 3.53$ ,  $p < .05$ ). In other words, the related inadequacy of their training programme constitutes a significant factor in their application of such skills in their classrooms. Hence the gap between the extent to which they perceived Bloom taxonomy-related classroom assessment skills as important and the extent to which they were covered during their training programme constitute a significant factor in their application of such skills in their classrooms.

A post hoc analysis using least significant difference (LSD) statistical test (see Table 3) showed that teachers who saw their training programmes as performing beyond their expectation in terms of imparting the skill to enable them assess the ability of students to apply theoretical concepts in solving

practical problems in real-life situations apply such skill in their classroom practices significantly more than those who perceived their training programme to have performed below their expectation in this regards.

**Table 2:** Analysis of the Influence of Related Skill Development Gap in Bloom Taxonomy-Related Assessment Techniques on the Extent to which Teachers Assess the Ability of Students to Apply Theoretical Concepts in Solving Practical Problems in Real-life Situations

Related Skill Development Gap in Bloom Taxonomy-Related Assessment Techniques	n	Extent to which Teachers Assess the Ability of Students to Apply Theoretical Concepts in Solving Practical Problems in Real-life Situations		
		Mean	Std. Deviation	Std. Error
Negative gap	48	4.4375	1.30313	.18809
No Gap	59	4.2373	1.39382	.18146
Positive Gap	106	3.8585	1.33409	.12958
Total	213	4.0939	1.36001	.09319

  

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.754	2	6.377	3.530	.031
Within Groups	379.368	210	1.807		
Total	392.122	212			

  

(I) Level of Gap	(J) Level of Gap	Mean Difference (I-J)	Std. Error	Sig.
Negative gap	No Gap	.20021	.26126	.444
	Positive Gap	.57901*	.23383	.014
No Gap	Negative gap	-.20021	.26126	.444
	Positive Gap	.37880	.21832	.084
Positive Gap	Negative gap	-.57901*	.23383	.014
	No Gap	-.37880	.21832	.084

Except for problem solving as well as critical thinking ability for which the null hypotheses were retained (see Table 3), similar trend in findings were observed for all the other skills. These are:

1. ability to analyse ideas, communication and creations;
2. ability to think creatively;
3. ability to make inference;
4. ability to contribute solution to real-life problems;

**Table 3:** Summary of the Analysis of the Influence of Skill Development Gap in Bloom Taxonomy-Related Assessment Techniques on Related Assessment Practices in the Classroom

Skill Development Gap in Bloom Taxonomy- Related Assessment Techniques	F	p<	Post-hoc
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Bloom-related Assessment Skill Exhibited During Classroom Assessment						(df)		analysis (LSD)
		(1) Negative gap	(2) No gap	(3) Positive gap	Total			
Assessing the Ability to Apply Theoretical Concepts in Solving Practical Real-life Problem	n	48	59	106	213			
	Mean	4.438	4.237	3.859	4.094	3.53	.031	1 vs. 3
	SD	1.303	1.394	1.334	1.360	(2, 210)		
Assessing Students' Ability to Analyse Ideas	n	46	61	108	215			
	Mean	4.249	4.197	3.722	3.967	3.32	.038	1 vs. 3 2 vs. 3
	SD	1.268	1.436	1.439	1.419	(2, 212)		
Assessing Creative Thinking	n	43	58	114	215			
	Mean	3.700	4.448	3.816	3.963	4.51	.012	1 vs. 2 2 vs. 3
	SD	1.567	1.535	1.373	1.482	(2, 212)		
Assessing Ability to Make Inferences	n	37	56	113	206			
	Mean	3.945	4.482	3.832	4.03	3.80	.024	2 vs. 3
	SD	1.413	1.440	1.481	1.478	(2, 203)		
Assessing Ability to Contribute Solutions to Real Life Problems	n	39	68	106	213			
	Mean	3.487	4.647	3.793	4.009	11.12	.000	1 vs. 2 2 vs. 3
	SD	1.571	1.169	1.459	1.460	(2, 210)		
Assessing Ability to Think Divergently	n	59	49	112	220			
	Mean	4.322	4.490	3.616	4.000	8.22	.000	2 vs. 3 1 vs. 3
	SD	1.467	1.340	1.478	1.493	(2, 212)		
Assessing Decision -Making Skills	n	45	49	124	218			
	Mean	3.956	4.327	3.653	3.867	4.05	.015	2 vs. 3
	SD	1.397	1.297	1.476	1.442	(2, 215)		
Assessing Critical Thinking Skills	n	40	60	112	212			
	Mean	4.325	4.383	4.018	4.179	1.37	.256	-
						(2, 209)		

	SD	1.474	1.606	1.470	1.513			
Assessing Affective Behaviour	n	43	52	118	213			
	Mean	4.023	4.519	3.678	3.953	5.79 (2, 210)	.004	2 vs. 3
	SD	1.566	1.365	1.518	1.526			
Assessing Ability to Access Information to Guide Decision-making	n	44	59	110	213			
	Mean	4.273	4.288	3.746	4.005	3.60 (2, 210)	.029	2 vs. 3
	SD	1.336	1.463	1.499	1.475			
Assessing Problem Solving Skills	n	43	54	115	212			
	Mean	3.744	4.352	3.870	3.967	2.92 (2, 209)	.056	-
	SD	1.498	1.507	1.281	1.397			
Assessing higher-order Cognitive Skills	n	44	66	100	210			
	Mean	4.182	4.606	3.830	4.148	5.45 (2, 207)	.005	2 vs. 3
	SD	1.244	1.456	1.596	1.516			

5. ability to think divergently;
6. decision-making ability;
7. affective behavior;
8. ability to access information;
9. higher-order cognitive skills.

## Summary of Findings

A large and significant number of participating teachers indicated the presence of unfavourable gap between what they should know to be effective at classroom assessment and what they were exposed to during their training programmes. Except for problem solving and critical thinking abilities, among secondary school teachers in Delta State of Nigeria, the skill gap accruing from poor teacher training in classroom assessment skills were found to have significant influences on teacher ability to apply Bloom-related assessment skills in everyday classroom practices. Such skills are: ability to analyse ideas, communication and creations; ability to think creatively; ability to make inference; ability to contribute solution to real-life problems; ability to think divergently; decision-making ability; affective behavior; ability to access information; higher-order cognitive skills.

## Conclusion and the Discussions of Findings

### Conclusion

Great and successful economies are built upon the development of needed and relevant skills and competencies in the youths. The possession of vast amount of material resources does not make a nation, but the development of human potentials with which available natural potential can be expediently exploited and appropriately channeled for the development of the society is that which



makes a nation great. Development in the 21<sup>st</sup> century with a highly competitive global economy discriminates among skills and competencies, and education must identify and develop among our learners skills deemed useful for development under the current conditions. This requires special training for teachers who are the prime movers of the skill development process. The gaps produced by the level to which such skills are necessary and the extent to which they are developed in the teachers have been found by this study to have a significant influence on the teaching effectiveness of teachers.

## Discussions

During their teacher training programmes in Delta State of Nigeria, the teachers were generally under trained on the strategy with which to assess each of the twelve Bloom taxonomy-related skills deemed essential for development in the 21<sup>st</sup> century. These are higher-order skills and require adequate training in the internalization and application of Bloom taxonomy for valid assessment. The poor training poses a big problem as regards the quality of students our teachers are graduating, based on their assessment, to run Nigeria given a highly competitive global economy. As these are essential competencies needed for development in the 21<sup>st</sup> century global and competitive economy, we are entering the race already handicapped and with the wrong foot. The “21<sup>st</sup> century ... require(s) knowledge generation, not just information delivery, and schools ... need to create a ‘culture of inquiry’” (21<sup>st</sup> Century Education, 2008, p.5). The role of a teacher as an assessor of learners’ skills is no more that of assessing dispensed information but that of assessing how well the learner has been able to create information and turn it into knowledge, and such knowledge into wisdom (21<sup>st</sup> Century Education, 2008).

Classroom applications of ten of these skills were found to be significantly influenced by the related level of gap identified. The positive skill gap found to exist had negative impact on their classroom assessment behavior in the areas that call for the application of the skills in question. This was the case for all but two of the twelve skills under study. These skills are Bloom’s higher-order cognitive skills which cannot be measured through poorly prepared multiple choice or essay items. It takes professional training and commitment to develop a items appropriate for the measurement of these skills and competencies.

Except for problem solving and critical thinking abilities, among secondary school teachers in Delta State of Nigeria, the skill gap accruing from poor teacher training in classroom assessment skills were found to have significant influences on teacher ability to apply Bloom-related assessment skills in everyday classroom practices. Such skills are: ability to analyse ideas, communications and creations; ability to think creatively; ability to make inference; ability to contribute solution to real-life problems; ability to think divergently; decision-making ability; affective behavior; ability to access information; higher-order cognitive skills.

The first guide to measuring higher-order Bloom-taxonomy related skills is the development of curriculum goals and objectives that call on the exhibition of skills at higher cognitive levels. Unfortunately, about 66% of our curriculum objectives require cognitive behavior exhibited at the resuscitation or recall level only (Evans, 2008). Bloom-taxonomy provides an excellent road map for stating valid curriculum objectives, for teaching and for developing valid assessment items. Lack of good understanding and application of this theory result in curriculum objectives, teaching and assessment that are invalid. Even with the very few objectives that might be stated to measure higher-order skills, teachers lack the skill to translate them into valid test items.

Classroom applications of 10 of the 12 skills under study were found to be significantly influenced by the related level of gap identified. Here lies the main source of ineffectiveness of our teachers in classroom assessment. Teachers, especially beginning teachers, lack the ability to use classroom assessment as a partner in teaching. This is compounded by their lack of skill to teach relevant skills and at a level necessary for development in a highly competitive global economy. Our curriculum objectives are invalid because they neither reflect the desirable skills and competencies needed for development in a dynamic, global and competitive economy nor do they provide for the development of these skills and competencies at a cognitive level required for such development. Furthermore, teaching and assessment in our classrooms are invalid because inadequacies in teacher training and

teacher commitment limit how much and how well they teach and assess to develop learners' essential potentials to the maximum. Hence the curriculum narrows the societal changing developmental needs to what it thinks education can take care of, teaching further narrows this to what it could take care of given lack of adequate training and commitment by teachers, and finally assessment further narrows this to what again because of lack of training and commitment they could assess. Hence what is assessed, in quantity and quality, is a very small percentage of what the society actually needs for meaningful development. There is a big and widening gap between these two. The bigger this gap, the less competitive we are in a fast changing world of the 21<sup>st</sup> century and the more backward we tend to be in meaningful development. What is taught and assessed in the classrooms is not exactly what is in the curriculum but as narrowed by what external examinations has been able to assess across the years.

## Recommendations

Efforts must be made by teacher training programmes in Delta State of Nigeria to address the areas where under-training has been identified. Training for the development of 21<sup>st</sup> century skills and competencies among our children or hence we will only be sharing the recall knowledge of the name "education" with other nations but not the meaning, practices and hence the benefits of it.

The Delta State Ministry of Education as well as other state ministries in Nigeria should regularly mount in-service training to update or develop among practicing teachers, specific skills and competencies for teaching and assessing learners 21<sup>st</sup> century skills necessary for a fast changing competitive global economy. In other words, teachers should be trained on assessment skills related to 21<sup>st</sup> century education by providing frequent workshops, on the job seminars, and on-going mentoring by up-to-date experts. These could provide good solution to the problem of gross lack of adequate skills related to assessment by teachers.

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