



## **An Assessment of Chemistry Teachers' Skills in Test Blueprint Development for Objective test items in Senior Secondary Schools in Enugu Education Zone**

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### **Abstract:**

This study examined the assessment of chemistry teachers' skills in test blueprint development of objective test items in senior secondary schools in Enugu education zone. The study adopted descriptive survey research design and was guided by four research questions and two null hypotheses. The population comprised of fifty seven chemistry teachers. No sampling was. A validated instrument titled Chemistry Teachers Skills in Test Blueprint Development for Objective Test Items Questionnaire with a reliability of 0.83. Mean and standard deviation were used to answer the research questions while ANOVA was used to test the formulated hypotheses at 0.05 level of significance. The study revealed that chemistry teachers' in Enugu Education Zone possessed all the skills listed on the content analysis and instructional objectives development but do not possess all the skills listed on test blueprint development for objective test items. However, teachers' qualification has an influence on their content analysis and instructional objectives development but has no influence on their test blueprint development. The researchers recommended that educational stakeholders, school owners and the ministry of education should organize workshops, trainings, seminars and conferences to train chemistry teachers' on the right skills for test blueprint development.

**Keywords:** Chemistry Teachers, Assessment, Competence, Test Blueprint, Qualification

### **Introduction**

Chemistry is a science subject that plays fundamental role in human advancement, nation building and sustainable national development. Advancement in chemistry is essential for advancement in other areas of science and technology. Thus, Chemistry enhances sustainable development through basic research skills, chemical innovations and technology. According to Riaz (2018) chemistry is a branch of science that is concerned with the properties and composition of different substances with their chemical reactions and properties. Equally, Helmenstine (2020) referred chemistry as the systematic study of the properties, and activities of organic and inorganic substances and various elementary forms of matter. These definitions imply that chemistry is concerned with human understanding of the constituent and composition of matter as well as its properties and characteristics. Since the study of Chemistry is concerned with matter, it could mean that chemistry plays numerous importance to mankind.

The importance of chemistry is overwhelming. Its importance to national development cannot be overemphasized. According to Igwe (2015) learning chemistry inculcates scientific knowledge and stimulate scientific attitudes which when applied in the world of works is capable of bringing about development of the individual, the society as well as improving the standard of living of members of the society. This means that understanding the skills of chemistry can facilitate economic and industrial development in countries of the world including Nigeria. As reported by Shamsuddin, Arome, Aminu, Isah and Adamu (2017) the importance of chemistry is noticeable in the areas of agriculture such as fertilizers and insecticides production; clothing, housing (cement, concrete and steel production); in the field of medicine (drugs) and transportation among others. Other areas where chemistry finds important applications include the production of basic component of computer such as



microchips made of silicon, soaps and detergents for daily cleaning (Riaz, 2018) and in cooking (Helmenstine, 2020).

The above importance of chemistry shows how essential chemistry is as a subject. Maybe, it is in the realization of this importance of chemistry that the government of Nigeria has facilitated its integration in the national curriculum. This is seen in the objectives of chemistry as stated in the Nigerian Educational Research and Development Council (NERDC). These objectives of chemistry according to NERDC (2015: IV) include:

To facilitate transition in the use of scientific concepts and techniques acquired integrated science (now basic science) with chemistry.

To provide basic knowledge in chemistry concepts and principles through efficient selection of contents and sequencing.

To show inter-relationships between chemistry and other science subjects

To show chemistry and its link with the industry, everyday life, hazards and benefits, and

To provide students not proceeding for higher education with adequate foundation for other future careers.

These objectives present chemistry as a practical subject through which scientific concepts, skills, principles and attitudes can be developed. The extent to which these stated objectives have been attained can be determined through quality assessment of students. In essence, for chemistry teachers to ascertain the extent of attainment of the above objectives of chemistry, assessment must be effectively done.

The meaning of assessment has been put forward by many authors. Assessment is an important aspect of the teaching and learning process. Operationally, assessment could be defined as an important component of teachers' effort, whereby necessary feedback is required to maximize the outcome of learning. In essence, assessment involves

the use of a great variety of modes of evaluation for the purpose of guiding and improving learning and achievement of the students. Assessment must be systematic, comprehensive, cumulative and goal-oriented (Harbor-Peters, 2015). According to Nworgu (2015) assessment is concerned with the process of gathering information from a variety of sources on the activities of teaching and learning for the purpose of understanding and improving learning. Assessment used by teachers to evaluate students learning outcomes comprises of summative (assessment of learning) and formative (assessment for learning) (Harlen, 2012). Summative assessment evaluates students' learning at the end of an instructional program while formative assessment is geared towards enhancing both teaching and learning (Lile, 2014). In other words, at the end of formative assessment, there is expected to be an improvement of learning otherwise, the teacher has to re-teach the topic of the lesson to enable the students understand better. Thus, the researcher could say that assessment targets determining among other things, learners' weaknesses in learning and creates room for remediation such that teachers use the students' grades to improve learning through revision on students weaknesses while students use their grade to revisit their area of weaknesses. Nworgu (2015) stated that one of such ways in which assessment can be carried out is through the use of a test. A test has been considered as an essential assessment tool in the field of education.

Test provides one with the opportunity to ascertain whether or not learning has taken place and the extent to which learning has taken place. Operationally, test could be defined as an assessment tool which provides information regarding students' ability, knowledge, performance and achievement. According to Iketaku (2013) a test is a set of questions to which an individual is expected to respond to in order to obtain a measure that is a numerical attribute of such a person. More so, as viewed by Nworgu (2015) a test allows an instructor to assess students' achievement relative to specified classroom objectives or behaviour. Nworgu added that tests are designed to aid in determining the extent of attainment of objectives or to obtain information regarding level of pupil achievement in relation to the three domains of educational objectives (cognitive, affective and psychomotor). As reported by Davidson (2011) different tests formats exist based on the purpose of the tests. These formats are the various ways in which



questions on a test are structured and how they are to be responded to. These test formats include; objective test, subjective test and essay test. According to Davidson, the most prominent among these test formats is the objective test format.

The objective test type has been considered as one of the most widely used test formats. Lopes, Babo, Azevedo and Torres (2010) described objective test items as consisting of a question, a statement or a stem which could be an incomplete sentence or an interrogative statement with a correct response called the key and a list of options called alternatives or distractors which are the incorrect responses. These questions or items on a test are what makes up the test and are often referred to as test items. Nworgu (2015) referred to objective test items to consist of a stem and a set of response alternatives. As explained by the Center for Teaching Excellence, University of Waterloo (CTEUW: 2021), objective test format is structured to comprise of statements called a stem with an answer called a key and distractors or alternatives. Operationally, objective test is a test that has right or wrong answers. In other words, the items of the objective test are expected to measure learning outcomes. Anene and Ndubuisi (2015) posited that the items of a test enable one to determine how effective teaching and learning have taken place through appropriate and adequate testing.

Test items may be objectively, subjectively or theoretically constructed. Chemistry teachers make use of the objective test type in the assessment of chemistry owing to the fact that it is one of the most widely used test form (Davidson, 2011). One of the benefits of objective test items according to Little and Bjork (2012) is to improve retention of both tested and non-tested but related information. This is a great benefit because when learners are able to recall learnt information, teaching and learning could be considered effective. Greenan (2017) added that objective test is flexible, measurable and reliable in addition to saving students' the time of responding to the items. Weimer (2018) further stated that objective test type covers a wide range of higher-order thinking skills, as well as wider content areas. Zane Education (2021) added that the objective test format allows for effective measurement of both simple knowledge and complex concepts as well as assessing mastery of many topics since the test can be answered quickly and in a short period of time.

The mental implication of the above to chemistry as a subject is that its teaching and learning

can be improved through the construction of appropriate test items such as the objective test items which has been considered to be very common among the various formats of test (Davidson 2011). Perhaps, the objective test items constructed by teachers in Enugu Education Zone measured learning at the lower cognitive level and this does not give room to wider coverage of content area and higher-order thinking. In essence, the objective test items, when appropriately constructed and used to examine students, it may also improve their academic achievement in Chemistry. This is in line with Agu, Onyekuba and Anyichie (2013) which states that the quality of a test given by a teacher is closely linked with its ability to provide the kind of information needed regarding students' achievement which may lead to poor academic achievement in chemistry. The poor academic achievement of students is caused by inadequate teaching method, lack of qualified teachers, insufficient resources, negative students' attitude towards their academics and poor test items developed by chemistry teachers.

Chemistry teachers despite being aware of the test development procedures do not apply them when constructing objective test items. According to Salihi (2019) teachers use teacher-made test in assessing students and these teacher-made test do not possess any psychometric properties of a test. Ngozi, Chika, and Aloysius (2013) added that these achievement tests made by teachers have been criticized over the years for lack of proper psychometric properties of a test. It could also be that the test items developed by chemistry teachers are complex and ambiguous thus, making it difficult for the students to comprehend. These views bother on teachers' possession or non possession of competencies in objective test items construction skills. Studies from Kinyua and Okunya (2014) on validity and reliability of teacher-made test in Nyaruru district of Kenya revealed that teachers training on test construction and analysis needs to be enhanced in order to raise test validity and reliability. David (2010) in a study on the relationship between chemistry teachers' knowledge of test construction and quality of their tests in private secondary schools in Maiduguri Metropolis, Borno State found out that there is a significant relationship between teachers characteristics, professionalism, qualification and their competency in test construction. This implies that there is need to assess senior secondary school chemistry teachers' objective test items construction skills in Enugu education zone with respect to their



qualification as this study intended to address these issues by putting into consideration all the steps required for developing a test blueprint for objective test.

Chemistry test items in internal examinations in Enugu education zone of Enugu state was poorly constructed by Chemistry teachers. This is because chemistry teachers do not possess the right skills in developing test blueprint. Poor construction of objective test items leads to inaccurate measurements of learning and provide false information regarding student achievement as well as instructional effectiveness (Ngozi, Chika, & Aloysius, 2013). When objective tests items are of good quality, it effectively measures learning outcomes and improves academic success (Davidson, 2011). It becomes imperative to assess senior secondary school Chemistry teachers' skills in developing test blueprint for objective test items in Enugu Education Zone.

In developing a test blueprint, the test developer is expected to check the contents to be covered in the curriculum, the significant sections of the content, the subdivisions of the sections and the content areas which were included in the test. According to Anene and Ndubuisi (2015) content analysis deals with outlining the subject matter, content or domain from which the test was developed which may be in form of major topics or sub-topics that have been covered during instructions. Operationally, content analysis facilitates the planning of teaching and learning whereby teachers identify the most important objectives, teaching strategies and communication strategies in the learning process so as to enhance effective teaching and learning. Kenneth (2021) stated that content analysis provides a summary of the intentions of the curriculum expressed in content terms. Anene and Ndubuisi added that the contents could be obtained from the syllabus, curriculum or officially recommended textbooks which give a clearer view of the stated instructional objectives.

The instructional objectives are derived from the content areas in the curriculum of a subject. Instructional objectives serve as checklists which are used to ascertain if the learning objectives were met during teaching and learning processes. Operationally, instructional objectives are the foundation upon which chemistry teachers can build lessons, assessments and instruction used to check if the overall course or lesson goals were met. According to Anene and Ndubuisi (2015) Instructional objectives are those behavioural

changes, which a teacher expects to notice in the students after they have been exposed to a particular topic. As defined by University of Western Kentucky (2018) instructional objectives are specific, measurable, short-term and observable student behaviour. This means that an instructional objective is the focal point of a lesson plan. In other words, the test developer has to ensure that the instructional objectives are clearly stated because these are the traits being measured in the testee. The behavioural objectives or cognitive levels according to Blooms taxonomy include knowledge, comprehension, application, analysis, synthesis and evaluation. These cognitive domains are best explained with a table of specification/test blueprint.

A test blueprint/table of specification describes the key properties of a test. According to Anene and Ndubuisi (2015) test blueprint is a two-way grid table which specifies the level of objectives as they relate to the content of the subject. Therefore, test blueprint helps to ensure the content validity of objective test. Operationally, a test blueprint/table of specification measures the content skills/achievements of a test to ensure that a fair representative sample of questions appear on the test items. Raymond (2016) stated that a test blueprint describes properties such as amount of emphasis allocated to each content area, the cognitive demand of the assessment task, the assessment area, the format and other important features. This means that a test blueprint should specify the contents to be covered. The four major stages to development of an effective test blueprint according to Raymond (2016) include to; identify major knowledge and skill domains, delineate the assessment objectives, decide on the assessment format and specify the category weights. The test blueprint is usually drawn vertically and horizontally to determine the content areas and behavioural objectives.

The test blueprint/table of specification specifies the proportion of questions allotted to each of the behavioural objectives and topics of the content. The objectives are placed along the horizontal part of the table while the content or topics are placed along the vertical part of the table. According to Obilor (2019), the table of specification/test blueprint is a two-dimensional chart showing list of instructional objectives, content areas and types of items in its dimensions. Preparing the table of specification includes four main steps according to Obilor and these steps are as follows: (a) Determine which instructional

objectives to be included. (b) Determine which content areas to be included. (c) Determine the item types to be included. (d) Prepare the 2-way chart (Table of Specification). For instance, the table below shows a 40 items Achievement test. This means that three (3) content areas were covered, five (5) specific objectives for Topic A, five (5) for Topic B and six (6) for Topic C. The next step is to decide on how many of the 40 items will be assigned to each of the cells

that relate objective to content. This is done by assigning weights to the topics and objectives. The weightings are for topic 'A' 31.25% topic 'B' 31.25% topic 'C' 37.5% giving a total of 100%. For the cognitive, the weightings are for knowledge 31.25% comprehension 25% application 12.5%, analysis 31.25%, synthesis 0% and evaluation 0%. (See Appendice B, pg.106).

|         |                   | Cognitive Level     |                      |                      |                    |                 |                  |            |
|---------|-------------------|---------------------|----------------------|----------------------|--------------------|-----------------|------------------|------------|
|         |                   | Knowledge<br>31.25% | Comprehension<br>25% | Application<br>12.5% | Analysis<br>31.25% | Synthesis<br>0% | Evaluation<br>0% | Total<br>% |
| Content | Topic A<br>31.25% | 4                   | 3                    | 2                    | 4                  | 0               | 0                | 13         |
|         | Topic B<br>31.25% | 4                   | 3                    | 2                    | 4                  | 0               | 0                | 13         |
|         | Topic C<br>37.5%  | 4                   | 4                    | 2                    | 4                  | 0               | 0                | 14         |
|         | Topic<br>100%     | 12                  | 10                   | 6                    | 12                 | 0               | 0                | 40         |

These skills required by chemistry teachers for test blueprint development for objective test are to a large extent dependent on the qualification of the teachers (Camble&Hamman-Tukur, 2017). This is because; qualification could influence the test blueprint development for objective test items (Salihu, 2019).

Teachers' qualification has been explained by many researchers. A qualification is awarded for achievement of a narrow body of knowledge with very specific learning objectives. As defined by Kola and Sunday (2015) teachers' qualification is a particular skill or knowledge teachers possesses to make them suitable to teach. Equally, Kola and Sunday stated that teachers' qualification includes academic qualifications such as O'level, National Certificate in Education (NCE), Bachelor of Science (B.SC), Post Graduate Diploma in Education (PGDE), Master of Science (M.SC), among others. Egum (2016) referred to teachers' qualification as the academic qualifications as well as professional development. Operationally, teachers' qualification can be defined as the certificates and professional development of a teacher that qualifies the teacher for a particular task or activities. The categories of qualifications to be considered in this study include; Ph.D (Doctorate Degree), M.Sc (Master of Science), M.Ed (Master of

Education), HND (Higher National Diploma), B.Sc (Bachelor of Science), B.Ed (Bachelor of Education), OND (Ordinary National Diploma), NCE (National Certificate in Education).

Despite the academic qualification of these teachers and the fact that in their schooling they are exposed to a course in research measurement and evaluation, teaching them how to develop test items both objective and essay, the problem of poor objective test development remains. This is evident in the teachers' internal exam questions in objective test items construction. Because the questions are poorly constructed, it affects students' academic achievement.

Previous researchers have shown that teachers' qualification has no influence on the test blueprint development for objective test items (Adodo, 2014; Ogbeide & Idusogie, 2019). Thus, it is necessary to examine chemistry teachers' skills in test blueprint development using chemistry teachers qualification as a moderating variable to assess senior secondary school chemistry teachers' competences in objective test items construction which teachers use to access students in Enugu education zone.

The main purpose of this study is to assess senior secondary school chemistry teachers' skills in test blueprint development of objective test items in

Enugu Education Zone. Specifically, the researchers sought to determine the:

1. content analysis and instructional objectives development skill possessed by senior secondary school chemistry teachers in test blueprint development
2. test blueprint development skill possessed by senior secondary school chemistry teachers
3. influence of teachers' qualification on their content analysis and instructional objectives development skill of senior secondary school chemistry in test blueprint development
4. influence of teachers' qualification on their test blueprint development skill of senior secondary school chemistry

In line with the purposes of the study, the following are the research questions that guided the study:

1. What is the content analysis and instructional objectives development skill possessed by senior secondary school chemistry teachers in test blueprint development
2. What is the test blueprint development skill possessed by senior secondary school chemistry teachers
3. What is the influence of teachers' qualification on their content analysis and instructional objectives development skills of senior secondary school chemistry in test blueprint development
4. What is the influence of teachers' qualification on their test blueprint development skill of senior secondary school chemistry

In line with the research questions, the following null hypotheses at 0.05 level of significance were put forward to guide the study:

HO1. There is no significant influence of chemistry teachers' qualification on their content analysis and instructional objectives development skill in the development of test blueprint

HO2. There is no significant influence of chemistry teachers' qualification on their test blueprint development skill

## Methods

This study adopted a descriptive research design. According to Nworgu (2015), a descriptive research design is a type of research design that seeks

to describe the characteristics, attributes, or features of a given population, an observation, event or a phenomenon. The population of this study comprised of fifty seven (57) senior secondary school chemistry teachers in Enugu education zone in the thirty two (32) public secondary schools in the area. This is as captured by Post Primary School Management Board. The study was carried out in Enugu Education Zone of Enugu State ( Enugu East, Enugu North, Isi Uzo) because the area represents a diverse mix of urban and rural schools, thereby enhancing a suitable context for examining differences in teachers skills in test blueprint development and teachers qualification. No sampling was done because the entire population was exhaustible. The instrument for data collection was a question titled Chemistry Teachers Skills in Test Blueprint Development for Objective Test Items Questionnaire (CTSTBDOTIQ). CTSTBDOTIQ was made up of two sections, A and B. Section A elicited information from Chemistry teachers about their bio data such as academic qualification (Ph.D, M.Sc./M.Ed, HND/B.Sc, OND / NCE) and instruction. Section B contained fourteen (14) item statements and it has two clusters. Cluster A has seven (7) items which is assessing chemistry teachers' content analysis and instructional objectives skills. Cluster B has 7 items which is assessing chemistry teachers' test blueprint or table of specification skills. The instrument was responded to using the response options of strongly agree (SA=4), agree (A=3), disagree (D=2), and strongly disagree (SD=1). The instrument was validated by three experts, one from Chemistry unit and two from Measurement and Evaluation unit, all from the Department of Science Education, Faculty of Education, University of Nigeria, Nsukka. The reliability of the instrument was determined using Cronbach Alpha and the reliability coefficient of 0.83 was used because the CTSTBDOTIQ involved a polytomously scored items. Mean and standard deviation were used to answer all the research questions while Analysis of Variance (ANOVA) was used to test the null hypotheses because teachers' qualification has more than two levels. The decision rule is that mean values of 2.50 and above was considered high and accepted while mean values below 2.50 was considered low. If the associated exact probability value obtained is less than 0.05 level set as benchmark, the null hypothesis will be rejected, otherwise, not rejected.

## Results

**Research Question One:** What is the content analysis and instructional objectives development skill possessed by senior secondary school chemistry teachers in test blueprint development?

**Table 1: Mean and Standard Deviation of content analysis and instructional objectives development skill possessed by senior secondary school chemistry teachers in test blueprint development**

| S/N | Content Analysis and Instructional Objectives Skills                                                            | N  | $\bar{X}$ | S.D  | Decision |
|-----|-----------------------------------------------------------------------------------------------------------------|----|-----------|------|----------|
| 1   | I always take note of my contents in my subject area whenever I am preparing a test blueprint                   | 14 | 2.86      | 1.41 | Agreed   |
| 2   | I always consult Chemistry textbooks/notebooks when I am developing a test blueprint                            | 14 | 2.93      | 1.44 | Agreed   |
| 3   | I employ scheme of work whenever I am about to develop a test blueprint                                         | 14 | 3.14      | 1.36 | Agreed   |
| 4   | I usually list out the topics covered before developing a test blueprint                                        | 14 | 3.26      | 0.84 | Agreed   |
| 5   | I consult my lesson plan/note for the list of instructional objectives when I am preparing a test blueprint     | 14 | 3.49      | 1.05 | Agreed   |
| 6   | I use the chemistry curriculum to obtain the instructional objectives whenever I am preparing a test blueprint  | 14 | 3.51      | 0.68 | Agreed   |
| 7   | I ensure I do not deviate from the laid down instructional objectives whenever I am developing a test blueprint | 14 | 3.18      | 0.87 | Agreed   |

In table 1 above, in order to answer research question one, the scores from the responses of the respondents on the content analysis and instructional objectives development skill possessed by senior secondary school chemistry teachers in the development of test blueprint were analyzed. The benchmark for the decision is 2.5, whereby if the mean is  $> 2.5$ , it is agreed that the teachers possessed the skill, and if the

mean is  $< 2.5$ , then it is disagreed that the teachers does not possess the skill. The result showed that all the items had a mean above 2.5 set as bench mark, it showed that senior secondary Chemistry teachers possessed all the skills listed on the content analysis and instructional objectives development for developing a test blueprint of objective test items.

**Research Question Two:** What is the test blueprint development skill possessed by senior secondary school chemistry teachers?

**Table 2: Mean and Standard Deviation of test blueprint development skill possessed by senior secondary school chemistry teachers**

| S/N | Test blueprint development Skills                                                                                                                                                                                  | N  | $\bar{X}$ | S.D  | Decision  |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------|------|-----------|
| 1   | I always identify my cognitive levels such as remembering, understanding, analyzing etc. whenever I want to set objective test                                                                                     | 14 | 2.16      | 1.47 | Disagreed |
| 2   | I always construct a two-way grid indicating my topics and cognitive dimensions before I start constructing objective test items                                                                                   | 14 | 1.40      | 1.02 | Disagreed |
| 3   | I ensure I assign appropriate weight/percentage to each of my cognitive dimension                                                                                                                                  | 14 | 1.63      | 1.19 | Disagreed |
| 4   | I ensured that the topic/subtopics is assigned a weight/percentage before objective test construction                                                                                                              | 14 | 1.26      | 0.86 | Disagreed |
| 5   | I always estimate the number of items to be written from each topic under each cognitive dimension appropriately                                                                                                   | 14 | 2.07      | 1.31 | Disagreed |
| 6   | The total number of items in each cell always tally with my propose number of questions                                                                                                                            | 14 | 1.93      | 1.12 | Disagreed |
| 7   | I understand that it is not all the cells that a question must come from if the cross product of my cognitive dimension and topic weight with the total number of items is not approximately up to one or greater. | 14 | 1.88      | 1.32 | Disagreed |

In table 2 above, in order to answer research question two, the scores from the responses of the respondents on the test blueprint development skill possessed by senior secondary school chemistry teachers in the construction of objective test items were analyzed. The benchmark for the decision is 2.5, whereby if the mean is  $> 2.5$ , it is agreed that the teachers possessed

the skill, and if the mean is  $< 2.5$ , then it is disagreed that the teachers does not possess the skill. The result showed that all the items had a mean below 2.5 set as bench mark, it showed that senior secondary Chemistry teachers do not possess all the skills listed on the test blueprint development for construction of objective test items.

### Research Question Three

What is the influence of teachers' qualification on their content analysis and instructional objectives development skill of senior secondary school chemistry in the development of test blueprint?

**Table 3: Mean and standard deviation of the influence of teachers' qualification on their content analysis and instructional objectives development skill of senior secondary school chemistry in the development of test blueprint**

| Teachers' Qualification | N         | Mean        | Std. Deviation |
|-------------------------|-----------|-------------|----------------|
| PhD                     | 4         | 3.36        | 0.58           |
| MSc/Med                 | 13        | 3.36        | 0.54           |
| HND/BSc/Bed             | 20        | 3.24        | 0.60           |
| OND/NCE                 | 20        | 3.08        | 0.51           |
| <b>Total</b>            | <b>57</b> | <b>3.22</b> | <b>0.55</b>    |

The result in table 3 shows the influence of teachers' qualification on their content analysis and instructional objectives development skill of senior secondary school chemistry in the development of test blueprint. The result shows the mean responses of 3.36, 3.36, 3.24 and 3.08 for Ph.D, MSc/M.Ed, HND/BSc/B.Ed, and OND/NCE with a standard

deviation of 0.58, 0.54, 0.60 and 0.51 respectively. Since the mean responses are greater than 2.50 set as benchmark for taking decision, it is indicative that the teachers' qualification influences their content analysis and instructional objectives development skill in the development of test blueprint.

### Hypothesis One

There is no significant influence of chemistry teachers' qualification on their content analysis and instructional objectives development skill in the development of test blueprint

**Table 4: ANOVA result on the influence of chemistry teachers' qualification on their content analysis and instructional objectives development skill in the development of test blueprint**

| Teachers Qualification | Sum of Squares | Df        | Mean Square | F    | Sig. |
|------------------------|----------------|-----------|-------------|------|------|
| Between Groups         | .722           | 3         | .241        | .783 | .509 |
| Within Groups          | 16.291         | 53        | .307        |      |      |
| <b>Total</b>           | <b>17.013</b>  | <b>56</b> |             |      |      |

The result in table 4 shows that an F-ratio of 0.783 with an associated probability of 0.509 was obtained for the influence of chemistry teachers' qualification on their content analysis and instructional objectives development skill in the development of test blueprint. Since the associated

probability value of 0.509 was greater than 0.05 set as benchmark for taking decision, the null hypothesis which state that there is no significant influence of chemistry teachers' qualification on their content analysis and instructional objectives development skill in the development of test blueprint was not

rejected. Inference drawn was that there is no significant influence of chemistry teachers' qualification on their content analysis and

instructional objectives development skill in the development of test blueprint.

#### Research Question Four

What is the influence of teachers' qualification on their test blueprint development skill of senior secondary school chemistry in the construction of objective test items?

**Table 5: Mean and standard deviation of the influence of teachers' qualification on their test blueprint development skill of senior secondary school chemistry in the construction of objective test items**

| Teachers Qualification | N         | Mean        | Std. Deviation |
|------------------------|-----------|-------------|----------------|
| PhD                    | 4         | 1.65        | 0.25           |
| MSc/Med                | 13        | 1.42        | 0.21           |
| HND/BSc/Bed            | 20        | 1.40        | 0.23           |
| OND/NCE                | 20        | 1.38        | 0.23           |
| <b>Total</b>           | <b>57</b> | <b>1.41</b> | <b>0.23</b>    |

The result in table 5 shows the influence of teachers' qualification on their test blueprint development skill of senior secondary school chemistry in the construction of objective test items. The result shows the mean responses of 1.65, 1.42, 1.40, and 1.38 for PhD, MSc/M.Ed, HND/BSc/B.Ed, and OND/NCE with standard deviation of 0.25, 0.21,

0.23, and 0.23 respectively. Since the mean responses are less than 2.50 set as benchmark for taking decision, it is indicative that teachers' qualification does not influence their test blueprint development skill of senior secondary school chemistry in the construction of objective test items.

#### Hypothesis Two

There is no significant influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items

**Table 10: ANOVA result on the influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items**

| Teachers' Qualification | Sum of Squares | Df | Mean Square | F     | Sig. |
|-------------------------|----------------|----|-------------|-------|------|
| <b>Between Groups</b>   | .241           | 3  | .080        | 1.560 | .210 |
| <b>Within Groups</b>    | 2.727          | 53 | .051        |       |      |
| <b>Total</b>            | 2.967          | 56 |             |       |      |

The result in table 10 shows that an F-ratio of 1.560 with an associated probability of 0.210 was obtained for the influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items. Since the associated probability value of 0.210 was greater than 0.05 set as benchmark for taking decision, the null hypothesis which state that there is no significant influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items was not rejected. Therefore, there is no significant influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items.

qualification on their test blueprint development skill in the construction of objective test items.

#### Discussion

The result of the analysis revealed that senior secondary chemistry teachers' possessed all the skills listed on the content analysis and instructional objectives development for the development of test blueprint. This is because the mean for all the items listed had a mean value greater than 2.5 which was set as benchmark for decision making. This implies that chemistry teachers have mastery of their subject matter and adhere to the stated objectives during

teaching and learning processes thus, enhancing students academic achievement. This finding is consistent with the findings of Ogbeide and Idusogie (2019) that secondary school teachers have high competence of objective test items construction. The finding also agrees with the findings of Indrayani, Marhaeni, Paramartha and Wahyuni (2020) that the quality of teacher-made test is very good. On the contrary, the finding disagrees with the findings of Quansah, Amoako, and Ankomah (2019) that teachers had issues in constructing items with content representatives and relevance. This disagreement could be due to laxity among teachers.

The result also showed that senior secondary school chemistry teachers do not possess all the skills listed on the test blueprint development for construction of objective test items. As seen in the result, the mean values for all listed items were below 2.5 set as benchmark for decision making. This means that students' academic achievement could be affected since the test items the teacher uses to assess the students learning outcome should cover all the domains of learning as stated by Bloom and the teacher is expected to develop a test blueprint to ensure that all learning objectives were covered. Perhaps, this may lead to false judgments on the students' academic achievement. This finding is in line with the findings of Hamafyelto, Hamman-Tukur and Hamafyelto (2015) that teachers' competence in constructing test questions was low and teachers concentrated on lower level of cognitive domain than the higher levels. On the contrary, the finding disagrees with the findings of Indrayani, Marhaeni, Paramartha and Wahyuni (2020) that the quality of teacher-made test is very good with 79 items (99%) qualified as very good and 1 item qualified as good. This disagreement might be as a result of the level of knowledge available to the teacher.

The result of the findings revealed that chemistry teachers' qualification which includes Ph.D, MSc/M.Ed, HND/BSc/B.Ed, and OND/NCE has an influence on their content analysis and instructional objectives development skill. This is as shown in their mean values which are greater than 2.5 set as benchmark for decision making. This means that chemistry teachers who have attained higher in educational qualifications stand a better chance of constructing quality objective test items than teachers with lower qualifications. However, the null hypotheses which states that there is no significant influence of chemistry teachers' qualification on their

content analysis and instructional objectives development skill in the construction of objective test items was not rejected because the associated probability value was greater than 0.05 set as benchmark for decision making. The finding is consistent with the findings of Camble and Hamman-Tukur (2017) which showed that teachers' qualification influences their objective test items construction. However, the finding disagrees with the findings of Ode, Akpoghol and Odoaba (2023) which showed that teachers' qualification has no significant difference with their knowledge of Objective test items construction.

The result of the findings revealed that chemistry teachers' qualification which includes Ph.D, MSc/M.Ed, HND/BSc/B.Ed, and OND/NCE has no influence on their test blueprint development skill in the construction of objective test items. This is because their mean values are less than 2.5 set as benchmark for decision making. Also, the null hypotheses which states that there is no significant influence of chemistry teachers' qualification on their test blueprint development skill in the construction of objective test items were not rejected because their associated probability values was greater than 0.05 set as benchmark for decision making. This implies that there may be other factors/variables which could influence objective test items construction by chemistry teachers. The finding is in line with the findings of Inko-Tariah and Okon (2019) that Educational qualification did not differ significantly with the knowledge of test construction procedure. On the contrary, this finding disagrees with the findings of Ugbe and Agbim (2009) that there is significant difference between teachers' competence and students' achievement in chemistry; students taught by qualified teachers performed better than those taught by unqualified teachers.

## Conclusion

Senior secondary school chemistry teachers' possessed all the skills listed in content analysis and instructional objectives but do not possess all the skills listed in test blueprint development. Chemistry teachers' qualification influenced their content analysis and instructional objectives skills in the construction of objective test items but does not influence their test blueprint development skill. Also, Chemistry teachers' qualification do not have any significant influence ( $p > 0.05$ ) on their content analysis and instructional objective and test blueprint



development skill in the construction of objective test items.

### Recommendations

1. Educational stake holders, school owners and the ministry of education should organize free workshops, trainings, seminars and conferences to train chemistry teachers and equip them with the right skills for test blueprint development for objective test items.
2. School owners should hire competent and qualified teachers who have mastery of their subject matter as this will help to improve student academic achievement in chemistry.
3. Chemistry teachers should avoid lifting already existing test items when constructing objective test and ensure that the test items covers all the domains of learning according to Bloom.

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