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APPLICATION OF ITEM OBJECTIVE CONGRUENCE INDEX (IOC-INDEX) FOR PROPER ALIGNMENT OF 2020 PHYSICS WASSCE ITEMS WITH OBJECTIVES AND CONTENT

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Abstract

This study was on the application of item objective congruence index (IOC-Index) for proper alignment of 2020 Physics WASSCE items with objectives and content of Physics. A descriptive research design was adopted for the study. One research question was raised for the study. The study was carried out in Enugu State. The population of the study comprised all Physics Experts in the area. A sample of 7 experts drawn through convenience sampling technique was used for the study. Physics 2020 WASSCE question was used as the instrument for the study. No validity was conducted for the instrument because the purpose of the study was to establish the validity indices of the test items. Frequency count and percentage were used in the analysis. The results showed that out of the 50 items, majority, 44 (88%) of the 2020 Physics WASSCE items are congruent with the content of Physics as their IOC-indices were between 0.57-1.00 which is of acceptable range while 6 (12%) of the items were not properly aligned with the content of Physics because their IOC-indices were below 0.50 benchmark. Thus, it was concluded that majority of the items of 2020 WASSCE Physics question are properly aligned with content and objectives of Physics. The study recommended among others that examination bodies such as WAEC, NECO, JAMB, among others should ensure that alongside test blueprint, Item Objective Congruence (IOC) should be employed as part of content validity to ensure that the items of the test are valid and appropriately fit.

Key word: Item Objective Congruence (IOC)-Index, Content Validity, Physics, Test Items

Introduction

Tests generally are instruments for measuring and monitoring learning progress. Tests entails structured statements for eliciting desired attributes, traits or characteristics of a learner. Test enables the teacher to ascertain the extent of instructional effectiveness and it serves as basis for many educational policies and informed decision-making. Nworgu (2019) noted that feedbacks from tests are helpful for teaching and learning as well as educational planning and administration. In view of these importance, during test development, test experts often take into account key qualities or properties that are integral for a test in order to ensure that it is of good quality and it meets its purposes. These qualities are usually dependent on the items of the test. In essence, the quality of test items determines the overall quality of the test. These properties which characterize the quality

of test items and the test instrument in general are often ensured when test developers are designing any test instruments. These properties include but are not limited to reliability, objectivity and validity. For the purpose of this study, emphasis will be on validity.

Validity is an integral component of any test development process since a test that is not valid will likely not serve any meaningful purpose. More so, validity is connected to the rigor and appropriateness of the procedures of test development. Validity of an instrument according to Hurst (2021) refers to the accuracy to which the measurement or conclusion based on an instrument correspond to what is being tested or measured. To Middleton (2023), validity is concerned with the accuracy to which an instrument measures what it is designed to measure. Based on these explanations, validity of an instrument is the degree or extent to which a measurement instrument is able to correctly and accurately measure what it is designed to measure. In this regard, one could say that validity is dependent on the purpose or objective of a test. Nworgu (2019) stated that validity of an instrument is of three major types: construct validity, criterion-related validity (predictive and concurrent) and content validity. Other forms of validity may include divergent validity, convergent validity, face validity, among others.

One or more of these forms of validation approaches is often required whenever an expert is in the business of instrument or test development. However, the type of test instrument under consideration also determines the type of validity to employ. Generally, in the development of tests or assessment instruments that are used for evaluating students` cognition, such as achievement test, the content validation approach is often employed because it is the most appropriate. This means that when assessment agencies or examination bodies such as the West African Examination (WAEC) and other related examination bodies in Nigeria develop their test, the content validation approach is often adopted.

Content validation essentially ensures that a test appropriately measures the subject matter content and instructional objectives of a given course content or domain (Nworgu, 2019). Cozby (2009) sees content validity as a process of comparing the content of a measure with the 'universe' of the content that defines the construct. Perez-Rojo, Noriega, Velasco and Lopez (2018) noted that content validation analyzes the extent to which items of an instrument measures adequately a desired domain or content. In essence, content validity is the extent or degree to which a test instrument samples a particular subject matter, content, domain, or universe appropriately. In the opinion of Nworgu (2019), content validity is often established using test blueprint or table of specification in accordance with Benjamin Bloom`s Taxonomy of Educational Measures. Reeves and Marbach-Ad (2016) noted that test blueprint is a tool that divides test instruments in two dimensions of content and cognition. This means that test blueprint is a two-way grid table which specifies the level of cognitive dimensions in relation to the content of the subject matter.

Although the use of test blueprint has been instrumental in the establishment of content validation, but according to Crocker and Algina as cited in Turner and Carlson (2003), the use of test blueprint is not an evidence of item validity component of content validation. In essence, even though the test blueprint ensures content coverage, it does not guarantee the

validity or quality of the test items which makes up the test instrument. Based on this, Crocker and Algina (1986) as well as Rovinelli and Hambleton (1977) stated that the use of independent experts panel to objectively ensure the appropriateness and validity of test items is a more reliable approach. This process is perhaps achieved through what is termed as item-objective congruence (IOC)-Index

The Item Objective Congruence (IOC) is an item validation approach that compares the responses of subject matter experts. ICO was introduced by Rovinelli and Hambleton in 1977). According to Tuner and Carlson (2003), the IOC is a quantitative measure of items by content experts in order to find out if there is a fit between test items and the table of specification. It basically examines if there is a congruent between test items and the objectives. Turner *et al*. as cited in Ismail and Zubairi (2022) described IOC as a process in which experts rate test items based on the degree or extent to which the items of a test are in line with the objectives or purposes stated by the test developers. Ismail and Zubairi further noted that in IOC, items are evaluated such that a rating of 1 is assigned to items that measure the objectives appropriately, -1 to items that do not clearly measure the objectives while 0 to items that are not clear or undecided. These results are then estimated or calculated for each item based on the experts` rating in order to create an index for each item called IOC-Index.

Generally, items with IOC-index of 0.5 to 1.00 is within the acceptable range and are considered fitting whereas, items with IOC-Index below 0.5 are considered not acceptable and should be removed or modified (Brown, 2005; Supparekchaisakil, Mohan & Fansler, 2017). This also agrees with the suggestion of Takwin, Pansri, Parnichjparinchai and Vibulrangson (2018). As noted by Berk (1984), establishing a fit or match between items and objectives is one of the most crucial things to do during content validation. IOC is very crucial because item analysis is almost a meaningless process if there are no sufficient evidence that items are measuring what they are intended to measure (Ismail & Zubairi, 2022). Although, ICO has been considered highly relevant in establishing item validity of the component of content validity, it has gain little or no attention as test experts and examination bodies such as WAEC relies more on the use of test blueprint. This process may not be completely adequate. Thus, it becomes imperative to apply IOC in establishing the content validity of test items of WAEC examination, especially, the 2020 WAEC question paper. This is because the outbreak of COVID-19 pandemic affected many academic activities. This could in a way influence the development of the test items and can invariably influence how students performed on the examination since if items of test instruments are not appropriate and in line with test objectives, it could bring about poor performance for students. Therefore, the current study sought to apply IOC-index in order to determine whether or not the items of 2020 Physics WASSCE are in line with the objectives and content of Physics. The choice of Physics is because of its role in the development of mankind and in the understanding of other related science subjects (Okeke, Ocheni, Oguguo & Asongo, 2022).

The purpose of this study was to determine the item objective congruence index (IOC-Index) for proper alignment of 2020 Physics WASSCE items with objectives and contents. Specifically, this study addressed the research question: *Which of the items of the 2020*

Physics WASSCE questions are properly aligned with the objectives and contents of Physics based on their IOC-Index?

Methods

In this study, descriptive research design was adopted. This design was used because the study sought to describe the qualities of the items of 2020 WASSCE Physics question in line with the test content. The study was carried out in Enugu State, Nigeria. The population of the study comprised all Physics experts in the area. A sample of 7 Physics experts were selected and used for the study through convenience sampling technique. The choice of 7 Physics teachers is because, in the estimation of IOC-index, a minimum number of 5 experts is required. This study used 7 experts because the higher the sample size, the more normal the distribution and the more accurate the result.

The WASSCE Physics question for 2020 was used as the instrument for the study. No validation was conducted for the instrument because the purpose of the study is to establish the validity of the items of the instrument. The instruments were administered to the Physics teachers, and they were allowed to take 3 days to respond to the instrument after explaining the modalities of responses to the instrument. The expert where to indicate with "Align" (A) for items that correctly measures the objectives, "Not Align" (NA) for items not measuring the objectives and "Undecided "(U) for items that are not clear. There was a 100% return rate. The instruments were then collected, and the data were coded for analysis using Statistical Package for Social Sciences (SPSS) version 23. Items rated with A were assigned 1, NA as -1 and U as 0. The ratings were then aggregated, and the analysis was done using frequency count and percentage. The results obtained were presented in Tables. Items with IOC-index of 0.5 and above were accepted as being in alignment with the objectives and content of Physics while items with IOC-index below 0.5 were rejected.

Table 1: IOC-Indices for Items of 2020 Physics WASSCE Question

Item S/No:	E1	E2	E3	E4	E5	E6	E7	A	NA	U	IOC	Dec.
1	1	1	1	1	1	1	1	7	0	0	1.00	Acc
2	1	0	1	1	1	1	1	6	0	1	0.86	Acc
3	1	-1	1	1	1	1	0	5	1	1	0.71	Acc
4	1	1	1	1	1	1	1	7	0	0	1.00	Acc
5	1	1	1	1	1	1	1	7	0	0	1.00	Acc
6	1	1	0	1	1	1	1	6	0	1	0.86	Acc
7	1	1	1	1	1	1	1	7	0	0	1.00	Acc
8	1	1	1	1	1	1	1	7	0	0	1.00	Acc
9	1	-1	-1	1	1	-1	1	4	3	0	0.57	Acc
10	1	1	-1	1	1	-1	1	5	2	0	0.71	Acc
11	1	-1	1	1	1	-1	1	5	2	0	0.71	Acc
12	1	0	0	1	1	0	1	4	3	0	0.57	Acc
13	1	0	1	1	1	1	1	6	0	1	0.86	Acc
14	1	-1	1	1	1	1	1	6	1	0	0.86	Acc
15	1	-1	-1	0	0	1	0	2	2	3	0.29	**Rej**
16	1	1	0	1	1	1	1	6	0	1	0.86	Acc

17	1	1	1	1	1	1	1	7	0	0	1.00	Acc
18	1	1	1	1	1	1	1	7	0	0	1.00	Acc
19	1	-1	1	1	1	1	1	6	1	0	0.86	Acc
20	1	0	0	1	1	-1	1	4	1	2	0.57	Acc
21	1	0	1	1	1	1	1	6	0	1	0.86	Acc
22	1	-1	1	1	1	1	1	6	1	0	0.86	Acc
23	1	1	0	1	1	1	1	6	0	1	0.86	Acc
24	1	-1	1	1	1	1	1	6	1	0	0.86	Acc
25	1	-1	0	1	0	1	1	4	1	2	0.57	Acc
26	1	-1	0	1	0	1	1	4	1	2	0.57	Acc
27	1	-1	0	1	0	0	1	3	2	3	0.43	**Rej**
28	1	-1	1	1	0	1	1	5	1	1	0.71	Acc
29	1	1	1	1	0	-1	1	5	1	1	0.71	Acc
30	1	-1	1	1	0	1	1	5	1	1	0.71	Acc
31	1	0	1	1	0	1	1	5	0	1	0.71	Acc
32	1	-1	0	1	0	-1	1	3	2	2	0.43	**Rej**
33	1	0	-1	1	0	0	1	3	2	3	0.43	**Rej**
34	1	-1	1	1	0	1	1	5	1	1	0.71	Acc
35	1	0	0	0	0	1	1	3	0	4	0.43	**Rej**
36	1	1	-1	0	0	1	1	4	1	2	0.57	Acc
37	1	1	1	1	1	1	1	7	0	0	1.00	Acc
38	1	1	-1	1	1	-1	1	5	2	0	0.71	Acc
39	1	-1	1	1	1	1	1	6	1	0	0.86	Acc
40	1	-1	-1	1	1	-1	1	4	3	0	0.57	Acc
41	1	1	0	1	1	1	1	6	0	1	0.86	Acc
42	1	0	1	1	1	1	1	6	1	0	0.86	Acc
43	1	-1	-1	1	0	0	1	3	2	2	0.43	**Rej**
44	1	1	0	1	1	1	1	6	0	1	0.86	Acc
45	1	1	0	-1	1	1	1	5	1	1	0.71	Acc
46	1	-1	-1	1	1	1	1	5	2	0	0.71	Acc
47	1	1	1	1	1	1	1	7	0	0	1.00	Acc
48	1	1	1	1	1	1	1	7	0	0	1.00	Acc
49	1	0	1	1	1	1	1	6	0	1	0.86	Acc
50	1	-1	1	1	1	1	1	6	0	1	0.86	Acc

Key: E=Expert; A=Aligned; NA=Not Aligned; U=Undecided; Acc=Accepted; Rec=Rejected

The analysis of the data presented in Tale 1 shows the ratings of Physics experts on all the items of 2020 WASSCE Physics past question. The Table also reveals the IOC-indices for all the items. Based on the result, items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 34, 36, 37, 38, 39, 40, 41, 42, 44, 45, 46, 47, 48, 49 and 50 all have IOC-Indices between 0.57-1.00 which are within the acceptable range. This mean that these items of 2020 Physics WASSCE question properly aligns with the objectives and content of Physics whereas, items 15, 27, 32, 33, 35 and 43 have IOC-indices below 0.50 which is below the acceptable benchmark, hence, they were rejected as

not measuring the objectives or content of 2020 Physics WASSCE question. This result is an indication that 88% of 2020 Physics WASSCE properly aligns with the objectives or content of Physics, whereas 12% of the items are not congruent or properly aligned with the objectives or content of Physics.

Discussion of the Findings

The findings of this study revealed that 88% of items on Physics WASSCE question for 2020 have acceptable value of IOC-index and as such are considered to be properly aligned with the objectives and content of Physics and should be used for assessing students` progress or abilities in Physics, whereas, only 12% of the items are not of acceptable IOC-indices and as such, should be discarded as rated by Physics experts. In essence, 44 of the items measure the objectives of Physics while 6 of the items do not address the content of Physics as rated by the judges. This result could have been like this because the Covid-19 pandemic impacted on the development process of the test items as there was not enough time for experts to meet or review the items and content properly. More so, this result could mean that the content validity approach using test blueprint is not completely adequate to ensure test item validity, as such, attention should be given to IOC approach in addition to the use of test blueprint. This study supports the findings of Ismail and Zubairi (2022) who found in their study that only 38 items of a reading test were of acceptable IOC indices. This is also in line with the study of Perez-Rojo et al (2018) who reported that 56% of items properly align with the objective of a good practice scale instrument. These results are an indication that establishing content validity using test blueprint is not adequate in ensuring test items validity. As such, there is a need to consider IOC.

Conclusion

In accordance with the findings of this study, it was concluded that out of the 50 items, majority (44 which represent 88%) of the items of WASSCE Physics question for 2020 are appropriately aligned with the content of Physics since their IOC-indices were all between 0.57-1.00 which are within the acceptable range of 0.50-1.00; whereas a few (6 which represent 12%) of the items are not congruent with the objectives because their IOC-indices were below the benchmark of 0.50.

Recommendations

In line with the findings of this study, it was recommended that:

1. Examination bodies such as WAEC, NECO, JAMB, among others should ensure that alongside test blueprint, Item Objective Congruence (IOC) should be employed as part of content validity to ensure that the items of the test are valid and appropriately fit.
2. Test developers and subject experts should ensure that they perform IOC approach whenever they are developing a test.
3. Government and relevant stakeholders should make efforts to organize for in-service training of teachers and test experts on the need to consider, and how to appropriately.

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