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## EFFECT OF SCORING BY SESSION, REARRANGEMENT AND CONVENTIONAL PATTERNS ON SCORER RELIABILITY IN BIOLOGY ESSAY TESTS

BY  
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### ABSTRACT

Literature revealed that conventional pattern of scoring all items (CPSAI) at a time in essay tests had been criticized for not being reliable and this unreliability is more likely to be more in internal examinations than in the external examinations. Post-test only control group design was used. All 48 Biology teaches from 23 secondary schools in Enugu education zone were used. The researcher constructed Biology essay test (BET) with scoring guide (BETWSG) for data collection. The research question was answered using Kendal's (w). The hypothesis was tested using t-test. The results revealed that the use of the rearrangement of the order of the papers scoring pattern (ROPSP) was found to be the most effective followed by the dividing the scoring by sessions pattern (DSSP). Conventional pattern of the scoring all items (CPSAI) was not significance.

### Background of the Study:

One of the claimed factors that are responsible for the unreliability in scoring essay tests is the scoring pattern of essay tests. Scoring pattern are those method that are employed in the scoring of essay test in order to achieve higher scorer reliability. Some of the scoring patterns are conventional pattern of scoring all items at a time, ranking all scripts before scoring all items, re-arrangement of the order of the papers before scoring, dividing the task of scoring by sessions pattern, scoring by section pattern, scoring an item across board and use of independent scorers.

The scoring of essay test had been criticized for not being reliable because of the use of conventional pattern of scoring all items at a time. There was evidence too to show that the level of unreliability of essay tests appears more likely to be more in the internal than external examinations.

This is more apparent if we consider the fact that despite the standardized nature of the senior secondary school certificate (SSC) Examination, significant variations are found in the scores. This is exemplified by the result of SSCE Biology essay scores in the May / June, 2000. This is shown in Table 1.

Table 1: scores given by team leaders and assistant examiners in scoring Biology essay test.

S/N	Script Number	Examiners Number	Examiners		Scores	Deviation (Highest Lowest)
1.	525260/313	5024/870	Assistant	Original	15	
		5024/130	Team Leader	Vetted	17	-2
2.	525260/017	5024/873	Assistant	Original	33	
		5024/030	Team Leader	Vetted	35	-2
3.	525260/056	5024/892	Assistant	Original	19	
		5024/291	Team Leader	Vetted	28	-9
4.	525260/001	5024/820	Assistant	Original	37	
		5024/120	Team Leader	Vetted	39	-2
5.	525260/182	5024/874	Assistant	Original	35	
		5024/380	Team Leader	Vetted	32	+3

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6.	525260/073	5024/890	Assistant	Original	16	
		5024/160	Team Leader	Vetted	26	-10
7.	4290708/57	45042/570	Assistant	Original	28	
		5042/131	Team Leader	Vetted	19	-9
8.	4290708/31	5042/723	Assistant	Original	33	
		5042/13	Team Leader	Vetted	20	+13
9.	4290708/88	5042/70	Assistant	Original	33	
		5042/314	Team Leader	Vetted	27	+6
10.	4290708/236	5042/900	Assistant	Original	17	
		5042/60	Team Leader	Vetted	17	0
11.	429072/001	5042/1238	Assistant	Original	36	
		5042/48	Team Leader	Vetted	31	+5
12.	429072/010	5042/1236	Assistant	Original	14	
		5042/148	Team Leader	Vetted	19	-5
13.	429072/111	5042/394	Assistant	Original	26	
		5042/94	Team Leader	Vetted	15	+11
14.	429072/91	5042/1260	Assistant	Original	39	
		5042/230	Team Leader	Vetted	36	+3
15.	429072/187	5042/1336	Assistant	Original	27	
		5042/066	Team Leader	Vetted	17	+10
16.	429072/143	5042/1214	Assistant	Original	16	
		5042/151	Team Leader	Vetted	20	-4
17.	4290703/137	5042/187	Assistant	Original	18	
		5042/65	Team Leader	Vetted	18	0
18.	4290703/119	5042/195	Assistant	Original	12	
		5042/75	Team Leader	Vetted	20	-8
19.	4290703/218	5042/1411	Assistant	Original	33	
		5042/80	Team Leader	Vetted	25	+8
20.	4290703/317	5042/1314	Assistant	Original	30	
		5042/92	Team Leader	Vetted	27	+3

**Source: West African examination council (2008).**

Table 1 shows that out of the 20 randomly selected vetted scripts of assistant examiners by Team leader, 8 was under marked, and 10 was over marked while only 2 scripts have no deviation. Further, analysis of the relationship between the assistant examiners' scores and team leaders scores using spearman's rank order statistic indicated a coefficient of -0.10. This very low negative relationship is a pointer to the problem of different scores in scoring student's scripts even with the same marking guide. Cox, 1989 also indicated the unreliability in scoring mathematics essay tests.

The table 2 indicates the various scores awarded by five different scores on scripts of 10 students.

Table 2. Scores given to students by five scorers in mathematics essay test.

Students	Scores					Deviation(highest-Lowest scores)
	A	B	C	D	E	

1	0	1	17	13	8	17
2	1	1	18	11	7	17
3	1	6	13	5	2	12
4	11	2	10	8	5	9
5	2	10	10	3	0	10
6	5	14	24	3	1	23
7	0	9	15	3	3	15
8	2	9	19	13	3	17
9	1	1	9	15	21	20
10	1	3	20	14	6	19

**Source: COX (1989)**

It appeared that in the scoring of senior secondary essay tests, scorers are more conversant with the use of the conventional pattern of scoring essay test than they are with other patterns. A question that arises is: is the conventional pattern better than the other patterns in achieving higher scorer reliability? It appears that there is no empirical study so far that compared relative effectiveness of scoring by session, re-arrangement and conventional patterns in scoring biology essay tests in terms of which one engenders higher scorer reliability than others using the patterns above.

#### **Statement of the problem**

The scoring of essay test had been reliable because of the use of conventional pattern of scoring all items at a time. There was evidence too to show that the level of unreliability of essay tests appears more likely to be more in the internal examination than in external examinations as shown in tables 1 and 2 above. The low level of the scorer reliability had been attributed to a number of factors. It was claimed that low level of scorer reliability has been blamed on a non standardization of essay test and inappropriate use of scoring patterns in scoring essay tests.

#### **Purpose of the study:**

The purpose of the study was to investigate the effects of three different scoring (dividing the scoring into sessions, rearrangement of the order of papers and conventional patterns) on scorer reliability in biology essay tests.

#### **Research Question**

The research question was formulated to guide the study.  
What is the difference in the scores awarded by scorers in the three different scoring patterns (scoring by session, rearrangement and conventional pattern).

#### **Research Hypothesis:**

The null hypothesis was tested at 0.05 level of significance.  
There is no significant relationship in the correlation coefficient of the scoring patterns of scorers who scored biology essay tests using the three different scoring patterns.

#### **Review of scoring patterns;**

Scoring patterns in this study mean the various methods that are employed by scorers to obtain the quantitative performance of learners. Various scoring patterns have been reported in literature:

They are;

- i. Scoring by section pattern (SBSP)(Ukeje, 1984 and Ezeudu, 1997).
- ii. Ranking all scripts before scoring all items (RASBSAI) (Ezeoke, 1986).
- iii. Scoring an item across board (SAIAB)(Harbor peters, 1997).
- iv. Use of independent scores (UISP)(Ezeoke, 1986, Harbor peters 1999).
- v. Another reported pattern of scoring essay test is where the scoring involves dividing the task of scoring into sessions (DSISP) (Lovegroove, 1984).

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- vi. Rearrangement of the order of papers scoring pattern (ROPSP) (Horrocks and Shoonover, 1998).
- vii. Conventional pattern of scoring all items (CPSAI) in a script before picking up another script (Maduabum, 1984 and Ezeoke, 1986).

However, among these scoring patterns reported above, patterned scoring in form of scoring by session, rearrangement of the order of the paper and conventional pattern of scoring all items in a script before picking up another script appears to be most popular in scoring essay tests.

In view of the above, the essay test scoring patterns employed in this study are:

- i. Dividing the scoring into sessions pattern (DSISP).
- ii. Re-arrangement of the order of the papers patterns (ROPSP)
- iii. Conventional pattern of scoring all items (CPSAI).

#### **i. Dividing the Scoring into Sessions Pattern (DSISP).**

Anastasi (1981) and Ezeudu 1997 showed evidence to suggest that it is more reliable to divide the task of scoring into sessions. Moreso, in a situation where a large number of papers (scripts) are to be scored, the scorer could find it necessary to divide the task of scoring into several sessions. This is because, every person has changes in mood which affects his values and tolerance.

The scorers are no exceptions. A times, the scorer is more lenient and willing to accept work indicating less degree of competence. This tendency can be reduced if the scorer at the second session of scoring will read through some of the papers which were scored during the first scoring period/session. This helps to ensure reliability in scoring standards and maintain that all papers were checked nearly the same. It is pertinent to point out here that greater effectiveness of this theory as opposed to comparing the whole examinations to other examinations.

#### **ii. Re-Arrangement of the Order of the Papers Pattern (ROPSP)**

The rearrangement of the order of the papers as a pattern of scoring essay tests has been suggested (Horrocks and Shoonover, 1998). The proponents think that the scorer may find it more helpful to re-arrange the order of the papers from time to time by reading the first item on three or four papers by good and bad students before grouping them according to quality. The items are therefore in terms of quality from paper to paper.

The advantage of this pattern is that item comparison is achieved and this is better complete test comparison. The quality of an item immediately proceeding the one being scored may have the same effect. More so, this provides for some estimate of the expected and obtained level of responses and serves as a check on the completeness of the scoring outline. This scoring pattern may some times predispose a scorer to subjective scoring. For instance, a scorer may score a student poorly because of performance proceeding item.

#### **Conventional Pattern of scoring all items (CPSAI)**

The conventional pattern presupposes that the teacher/scorer scores all items in a script before attempting to score any other script. The method has been strongly criticized by scholars. One of its major criticisms is that teacher/ scorer biases are made manifest in the way they score the scripts. It would be most difficult to be consistent when handling

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different items in a script one after another. That is, to give the same score to similar answers to a particular question in all the scripts that are scored (Ezeoke, 1986).

Another disadvantage of this pattern is that it causes "halo effect." This means that if the answer to a question is a very good one. It influences the scoring of the next answer/items. Likewise, if the first item to be scored is a poor item, the subsequent items could be scored within the same context.

In view of the above the avoidance of the halo effect can be achieved according to Powell and Lobster (1974) if each response is judged on its merit without regard to other success or failure. The scorer must guard against allowing his scoring to be influenced by any general impression the scorer formed of the subject/candidate's ability. There is a natural tendency to over-estimate the ability of a bright, self-confident, talkative child. An examiner has to be very careful to avoid scoring the responses of such a child too leniently. Scoring must not be tempered with any conviction that the subject could have been answering correctly. The task is to score the response which has actually been given.

## **Research Methodology**

### **Design of the study**

The research is a true experimental study of a post-test only control groups design. The subjects are assigned to the groups by randomization. No pre-test is used. The randomization controls for the possible extraneous variables and assures that any initial difference between the groups are attributed only to chance and therefore followed the laws of probability (Ary, Jacobs and Razavieh, 1979). The scorers were randomly assigned to experimental group I, experimental group II and control group III. The treatment of the subject (scores) was done as indicated below:

**Table 3:**

Assignment of scorers to treatment groups

	Groups		Independent Variables	Pos-test scores
Experimental Group I	R	E <sub>1</sub>	DSISP	O <sub>2</sub>
Experimental Group II	R	E <sub>2</sub>	ROPSP	O <sub>2</sub>
Experimental Group III	R	C	CPSAI	O <sub>2</sub>

Where,

E<sub>1</sub> = Experimental Group One

E<sub>2</sub> = Experimental Group Two

C = Experimental Group Three

O<sub>2</sub> = Post-test treatment and observations

R = Randomization

DSISP = Dividing the scoring into session pattern treatment on experimental group.

ROPSP = Re-arrangement of the order of the papers pattern treatment on experimental group.

CPSAI = Conventional pattern of scoring all items on Control group three

### **Area of the study**

The study covered all the schools in Enugu Education zone of Enugu State. The researcher adopted the educational administrative structure in which Enugu State is divided into six education zones. These are Enugu, Udi, Nkanu, Awgu, Nsukka and Oboloafor Zones.

The choice of this area is because of logistical convenience and the researcher see the zones as a thickly populated zone in terms of Biology teachers among all the six zones in Enugu State.

### **Population of the study**

- (a) The population for this study comprises all the 48 secondary school Biology teachers in all the 23 secondary schools in Enugu Education Zone.

### **Sample and Sampling Techniques**

In consideration of the fact that only secondary school Biology teachers were used for the study and because the number of Biology teachers is not too large, the researcher used all the Biology teachers for the study. The use of all the Biology teachers further helped the researcher in avoiding sampling errors. The Biology teachers were randomly assigned to Experimental Group 1, Experimental Group 11 and Control Group 111 (See Table 3)

All the schools in Enugu Education zone were stratified into Enugu East, Local Government Area; Enugu North Local Government Area and Isi-Uzo Local Government Area. The random sampling technique was used to select three secondary schools from each of the three local government areas making a total of nine secondary schools. The schools selected had up to one or more streams (classes) of SS III students. A simple random sampling technique was used to select 20% of students in the schools picked. A total of 220 SS III students were finally selected.

### **Instruments for Data Collection**

The researcher constructed Biology Essay Test (BET) with scoring Guide on Biology Essay Test (SGBET) for the study.

### **Biology Essay Test (BET)**

The Biology Essay Test (BET) was developed based on the following Biological topics: cell organization, sense organs, nutrition and transportation in living things. The BET contained five essay items with 3 sub items in each item, which ranged from A to E. The BET was both restricted and unrestricted Biology essay tests. The items measured objectives in the cognitive and psychomotor domains of Blooms (1956) taxonomy of educational objectives. The weight of the objective levels were based on the proportion of low and high order levels of cognitive and psychomotor domains as suggested by Margret (1990) in the same units of study in the senior secondary school Biology Curriculum. This is because, it was observed that students do not normally exceed the comprehension level (higher cognitive level) by the time they had completed senior secondary school programme (Sturoges, 1972)

### **SGBET**

Scoring guide was developed for the scoring of the Biology Essay Test (SGBET). The SGBET contained all the answers to the five items of the BET with 3 sub answers in each item which ranged from A to E. The responses are restricted response type. SGBET was developed to guide the scorers to score the BET using the three scoring patterns (scoring by session, re-arrangement of scripts and conventional pattern of scoring all items).

### **Validation of the Instruments**

#### **BET**

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The test blueprint (table of specification) helped to measure the content validity of the instrument. The test blue-print on the BET as well as the BET were face validated by five experts drawn from the sub-department of science Education (two Biology specialists and three Measurement and Evaluation specialists of University of Nigeria, Nsukka and Enugu state University of Science and Technology. Their criticism and vetting helped in modifying and/or replacing some test items. The weight of objective level on cognitive domain was based on the proportion of low order level (memorization of facts) and higher order level (application) (Margret, 1990).

### **SGBET**

The SGBET was face validated by three specialists in Measurement and Evaluation as well as two specialists in Biology Education of Enugu State University of Science and Technology, Enugu and University of Nigeria, Nsukka. Their criticism and vetting helped in modifying and /or replacing some answers and items.

### **Reliability of the Instruments**

In order to establish the coefficient of internal consistency of the instruments used for the study, the following steps were taken.

#### **Biology Essay Test**

In establishing the coefficient of internal consistency of BET, scores generated from the 20 SS III Biology students used for the trial test were subjected to the Cronbach Alpha formula and found 0.88. The Cronbach Alpha was considered appropriate since BET consisted of essay items. This internal consistency gives homogeneity of the test items in the instrument.

#### **Experimental Procedure**

The 48 Biology teachers drawn from the 23 secondary schools in Enugu Education zone were randomly assigned to the treatment conditions as Experimental Group 1, Experimental Group II and the third regular scorers were the control group. 16 Biology teachers were assigned to each experimental group through simple random sampling. Balloting without replacement was done using the names of the Biology teachers.

1. Experimental group I: Scoring into session pattern of scoring all items (DSISP)
2. Experimental group II: Re-arrangement of order of the papers Scoring pattern (ROPSP) .
3. Control group III: Used conventional pattern of scoring all items (CPSAI)

The scores were tested on one dependent variable namely, reliability after the experimental treatment. The experiment lasted for three days of coordination and 10 days of scoring the Biology essay test. This was also the only period the school authorities in the schools could allow the researchers to use the scorers.

#### **Method of Data Analysis**

The research question was answered using the mean and Kendall's Coefficient of Concordance (W). The t-test was used in testing the null hypothesis. All analysis was carried out using computer.

## **RESULTS**

### **RESEARCH QUESTIONS ONE**

What is the mean difference in the scores awarded by scorers in the three different scoring patterns in scoring Biology Essay Tests?

The result in response to research question one is shown in table 4

**Table 4:** Mean scores of the scorers who used the three different scoring patterns (DSISP, ROPSP and CPSAI) in scoring Biology essay test.

Scoring pattern	Mean scores
DSISP (Group I)	16.84
ROPSP (Group II)	19.96
CPSAI (Group III)	11.92

Table 4 showed that the mean scores for experimental group II experimental group I and control group III were 19.96, 16.84 and 11.92 respectively. This means that scorers who scored by re-arrangement of order of paper scoring pattern had the highest mean scores of 19.96 followed by those who scored by session pattern with a mean scores of 16.84 and the group who scored with conventional pattern of scoring all items had the least mean of 11.92.

### Research Hypothesis One

There is no significant relationship in the correlation coefficient of the scoring patterns of scorers who scored Biology Essay Test using the three different scoring patterns.

The hypothesis one above was stated to investigate the significant relationship of the three scoring patterns in scoring Biology Essay Test and to test the statistical significance at five percent level of significance.

The result of the analysis of the significant relationship obtained from the three different scoring pattern were shown in the table 5 below.

**Table 5:** Kendall's (W) and t-test of the relationship in the scorer reliability of the three group of scorers.

Scoring patterns	No of Scorers	Kendal's (W)	Calculated- t	Critical -t
DSISP	16	0.52*	3.57	2.15
ROPSP	16	0.64*	4.68	2.15
CPSAI	16	0.12	1.08	2.15

\* = **Significant relationship**

Table 5 provided data for testing hypothesis of this study. It was observed that significant relationship existed among group I and II, group I and group III, group II and group III. This implied that group II scored significantly higher than group I and group III, and that group II scored significantly higher than group III.

The implication of the results is that use of re-arrangement of order of the paper pattern indicated superiority over first and third patterns of scoring biology essay Test. Similarly, the scoring by session pattern showed superiority over the third pattern of scoring biology essay Test. Mean level is a measure of superiority.

### Discussion of the Result

The result are discussed according to the formulated research question and hypothesis which were presented under the heading below:



**The Effects of the three scoring patterns on scorer reliability in scoring Biology essay test.**

It was found out that the relationship of scores of the scorers who used re-arrangement pattern, scored by session and scored all items pattern were positive. The magnitudes of their positive correlations coefficients were 0.64\* for re-arrangement pattern, 0.52\* for scoring into session pattern and 0.12 for conventional pattern of scoring all items respectively. The magnitude of the positive correlation coefficient for ROPSP, DSISP were high medium relationship while CPSAI had very low relationship respectively.

The relationship was significant for those group of scorers who scored biology essay test using re-arrangement pattern (ROPSP) and scoring by session pattern (DSISP). This is because the calculated t value of 4.68 for ROPSP was much higher than the critical t value (2.15) and the calculated t value of 3.57 for CPSAI was more than critical t value of 2.15. Contrary, the calculated t value of 1.08 for CPSAI lower than critical t value of 2.15. This implied that the use of re-arrangement pattern and scoring by session pattern had significant relationship on scorer reliability in scoring Biology essay test.

Further, analysis in order to determine the mean differences among the various groups of scores were carried out. From table 4, it was observed that the mean scorers for experimented group I, experimental group II and control group III were 16.84, 19.96 and 11.92 for DSISP, ROPSP and CPSAI respectively. This means that scorers who scored using re-arrangement pattern (experimental group II, had the highest mean scorers of 19.96 followed by those who scored by session pattern had 16.84 and the group who scored with the conventional pattern of scoring all items (experimental group III) had the least mean score of 11.92.

This finding was in line with those of similar experimental studies in science and science related subjects (Ezeudu 1995; Osisoma, 1995 and Okafor 2000) where the experimental treatment groups proved better than the control group.

**Conclusion**

The following conclusions are drawn based on the findings of the study:

Re-arrangement of order papers scoring pattern and divide the scoring into session has positive significant relationship in scoring Biology essay test.

Furthermore, use of re-arrangement pattern was found to be outstandingly more efficacious than scoring by session pattern. The effect of the conventional pattern of scoring all items was not significant on scorer reliability in scoring biology essay test.

**Recommendation**

Based on the findings of the study, the following recommendations are made:

1. The use of re-arrangement pattern and scoring by session pattern were found efficacious in engendering scorer reliability in scoring biology essay test and since the techniques are not yet popular in our school system. They should be incorporated in the curriculum for teacher training institutions.
2. Obviously, the serving teachers lack the necessary competencies to develop the re-arrangement and scoring into session patterns. To equip these categories of serving teachers, professional association such as Measurement and Evaluation Association of Nigeria (MEAN) and government agencies should organize workshops, seminars and conferences for them on the two patterns.
3. On acquiring the necessary skills, the teachers should be encouraged to employ these techniques more in scoring Biology essay test so that scorers (teachers) will no longer be scared because of the tediousness of scoring essay test.

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4. The opinion of the researcher is that any professional development for pre-service and in-service teachers must include opportunities to learn the scoring patterns. Biology teachers in Nigeria must not be left out. It is necessary to ensure that Biology teachers in Nigeria acquire the required patterns to be used in scoring biology essay test and move beyond the use of the conventional approach in scoring Biology essay tests.

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