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Exploratory Study of Answer changing behaviour in Multiple Choice Test among Science Students in Nigerian setting

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Abstract:

This study provided empirical data on the prevalence of answer changing behaviour among science subjects; and to also find out if there is gender difference in answer changing behaviour in the subjects.   The study utilized secondary data, essentially involving responses of students in Mock 2014 Mock, administered in 2014 by the Cross River State Ministry of Education, Calabar. Subject of this study consisted 32 answer scripts (18males and 14 females) in four subjects (Mathematics, Chemistry, Physic and Biology), systematically selected from seven schools that wrote Mock 2014 in Calabar South Local Government, in Nigeria. The Mock examination is considered a standardized test, therefore reliability and validity of the instrument were assumed established by the board. Descriptive analysis (percentages and charts) were used to summarise the result with respect to answer changing behaviour in the four subjects, while chi-square analysis was used to investigate the incidence of answer changing behaviour among four subjects on one hand, and gender difference with respect to answer changing in the four subjects on the other hand. The result indicated that answer changing behaviour occurred in all the four subjects, with the most change in Mathematics and the least change in physics. Also, there was a significant gender difference in answer changing behaviour in mathematics with male students slightly higher than female students. However, there was no significant gender differences in the other three subjects.

Key words.: *Answer changing behaviour, Multiple choice test, Science students, Nigeria*

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I. INTRODUCTION

The term, multiple choice or 'objective' test as popularly called, is so common to the extent that whoever has been to school at any level, whether as a teacher, pupil/student or parents, is very familiar with the term. Multiple choice, a form of objective test has been the dominant test format used in most examination whether in the classroom or standardized large scale assessment. This type of test provides examinees with possible answers to questions posed on the stem, and only requires them to pick the correct answer from a number of possible alternatives already provided. Over the years, this form of test has gain popularity among its users owing to the many advantages, which include: the ease of administration, assessment of a large population, wider curriculum coverage, and objectivity in scoring, and many others. These advantages notwithstanding, the question format has its attendant problems, one of which is the ease at which students, especially in secondary school change answers in multiple choice examinations. A close look at students' scripts in multiple choice test attest to this fact.

It is observed that individuals generally have the tendency to modify their response to questions whether in a verbal or written communication. For that reason, it is not unusual for students to change answers in a multiple choice test given the different answer alternatives provided. Many students, especially those who do not have the ability required to answer certain examination question(s) tend to change their initial answer to another one, which they presume is right. Most times, even some who have the ability to answer

correctly may lack confidence in their personal effort and thus decide to use this strategy. Again, many students do not seem to prepare adequately for this type of test simply because they perceive it an easy examination, as 'ready-made' answers are waiting for them and all they need do is to select one answer. Although the motive for changing one's initial answer should be beneficial especially when one conceptualizes a better answer, however many students consequently, end up losing more scores, which results in poor performance (Merritt, 2009).

Previous studies reveals that answer changing behaviour is a regular occurrence among students in multiple choice examinations and when examinees lack the ability of the subject matter, it is most likely that it will not lead to increase in test score (Bauer, Kopp, & Fischer, 2007; Al-Hamly, & Coombe, 2005; Fischer, Herrmann & Kopp, 2005). When these changes occur, three possibilities comes in hand: changing from wrong to a correct answer, one that leads to increased scores; changing from a correct to a wrong answer, one that leads to a decreased scores, and lastly, changing from a wrong to another wrong answer, one which makes no change in the resulting scores (Papanastasiou, 2014; Basturk, 2010; Milia, 2007, Benjamin, et. al., 1984). Most studies on this subject matter have cut across disciplines such as business (Geiger, 1996), English language (Al-Hamly & Coombe, 2005), psychology (Kruger, et. al., 2005; Mathews, 1929), law (Milia, 2007), and nursing (Jordan & Johnson, 1990; Nieswiadomy, et. al., 2001). In most cases, these

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studies have been carried out, using college students, undergraduates or post graduate students at different times. In addition, subjects involved were drawn from single subjects, rarely are these studies focused on answer changing behaviour among four science subjects. Thus, suggesting the need for related studies in Cross River State.

Purpose/Objectives

The present study is designed to examine the extent of answer changing behaviour among secondary school students offering four science subjects in Calabar, Cross River State. Specifically, the study sought to: provide empirical data on the prevalence of answer changing behaviour among science subjects; and if there is gender difference in answer changing behaviour in the subjects.

Research questions and hypotheses

Research question 1: What is the extent of answer changing behavior of students in the four science subjects?

Hypothesis 1: The incidence of answer changing behaviour is independent of the subject area.

Hypothesis 2: There is no significant gender difference in the answer changing behaviour of students in the four subjects.

II. LITERATURE REVIEW

Answer changing, also known as answer switching or item review is commonly referred to a situation where students, in an attempt to give correct answer to questions in a multiple choice test change their preselected option(s) to another option, which they presume is correct. Answer review involves the practice of permitting test-takers during a test to revisit their initial answer, and perhaps alter answers that had initially been picked by the same test-taker (Papanastasiou, 2005). Although answer changing regularly occur on paper-and-pencil test, the phenomenon was hardly allowed in a test written on a computer when they were initially observed, owing to different issues related to answer changing, which include the problem of dishonest methods used on a test. This propelled researchers to carry out different studies exploring the issues of answer changing (Vispoeal, 1998; Vispoes, Henderickson & Bleiber, 2000; Papanastasiou, 2001).

In most examinations, especially in Multiple Choice (MC) test, answer changing has remained a regular behaviour observed on students' script given the number of students who actually changed answers compared to those who did not. Earliest studies shows that in a standard multiple choice test written in paper-and-pencil, where examinees have the fairest chance to go back and change answers, majority of students who wrote such exams, for instance (97%) changed at least one answer, and among the changers, about 70% of the test scores of the examinees was improved through answer changing (Geiger, 1996; Schwartz, McMorris & DeMers, 1991; Wagner, Cook, & Friedman, 1998).

However, results from recent empirical studies have confirmed that answer changing phenomenon is a regular phenomenon among students, and that students actually benefit from such changes. Noorbala and Mohammadi (2011) carried out a survey to assess the routine of changing answers in multiple choice questions and to jugde if such changes promote the test-takers scores. The authors administered 472 multiple choice questions to 614 students offering medical courses in dermatology. At the end of the examination, about88.2% of the examinees (41.7% male and 46.5% female) changed answers in the examination. In the same vein, Al-Hamly and Coombe, (2005) confirmed in their study that about 67% of students used in an examination changed answers. While about 44% changed their wrong options to correct answers, a total of 57% and 19% of examinees increased or decreased scores respectively. In another study, Revuelta, Ximenez and Olea (2003), established that approximately 90% Spanish testees who participated in their study actually changed answers, with about 65% profiting from such changes (Revuelta, Ximenez & Olea, 2003). Similarly, Fischer, Herrmann and Kopp, (2005) explained that nearly55% medical students changed wrong answers to correct answer, 25% of the students changed from correct to wrong answer and 20% made wrong to wrong changes. In other words, the first set of students increased their final test score, the group that followed reduced their test score and the last group did not make any change in their resulting scores. They concluded that answer changing behavior is a usual phenomenon among students during multiple choice tests, and when examinees carry out this behavior, it is usually for the sake of benefiting from such change.

In the same vein, Bauer, Kopp and Fischer, (2007) examined the benefit of answer changing behaviour among 79 students (45females and 34 male) from medical field in Munich University. The students were divided into two groups, the first group was made to know the benefits attached changing answers in a multiple choice test, the second group on the other hand were not informed of the benefit associated with answer changing. The two groups were allowed to partake in examination. The result of the study showed that 72 students (91%) had changed at least one answer. There was a significant difference between the groups. On the average, about 48.2% of the students changed wrong answers to correct ones, about 21.6% replaced their correct options with wrong ones, and lastly, nearly 30.2% of the students replaced wrong answers with other wrong ones.

Fischer, Herrmann and Kopp (2005) carried out a study to corroborate the result of previous study on if answers switching during a multiple-choice test lead to an enhanced test score as had been reported in earliest studies. The authors employed a sample of 36 answer booklets used in German Second National Medical Board Examination comprising 580 multiple choice questions with five option alternatives. The result established that medical students indeed improved their scores in the test, when answers were switched once, as further change of answer did not lead to increased score. The authors suggested among others that students be allowed to replace their initial answers in multiple choice tests, after much thought reveals that their new answers could yield a better answer based on the benefit inherent in such change.

In a related research, Kruger, Wirtz and Miller (2005) investigated counterfactual thinking and the first instinct fallacy, specifically to investigate why examinees chose to stay with their initial answers on a test even though research reports available strictly disproves it. The authors proposed that the conviction can be linked partly to a bias in memory which is produced by 'counterfactual thinking'.

They conducted four studies to test these hypotheses. In one of their studies, they compared the expected and real result of 'staying' versus 'changing' among testees to examine whether students really do overrate the result of staying with their initial answer (study one), they intended to find out if this was the case. The sample was made up of 1,561 students (49% men, 51% women) from higher institution in Illinois, who wrote a mid-term multiple choice examinations in psychology. Fifty-one students were randomly selected to provide their perception about what they feel will be the outcome of the study. The testees in the study were informed that scripts from their class would be cross-checked for possibly evidence of erasures and outcome of such changes recorded. They were further required to specify the amount of changes expected in each group and the number of changers that would most likely benefit from answer changing on one hand, and those that will be hurt by it on the other hand, or neither benefit nor hurt. The authors contrast the result of changes with perception of students about the result of these changes to see if switching answer is a risky behaviour even for the students who benefited. However, it was observed that the students used in the study saw answer changing as a priviledge of correcting themselves when in doubt, which was beneficial when faced under examination-induced tension. This confirmed the ownership of the process by the students themselves and the desire to continue with the practice.

On the method of detecting answer changing behavior in multiple choice tests, various authors have employed different methods to measure the number and results of changed answers on multiple choice tests. They include; detection of erasures and cross-outs (McMorris & Weideman, 1986; Schwarz, et. al, 1991; Kruger et. al., 2005); the use of inter-observer agreement to check the degree of accuracy associated with the measurement of changes (McMorris, & Weideman., 1986; Milia,2007). Other obtrusive measures are also used to get at the "true number and direction of answer changes. These include the use of scannable answer sheets (McMorris & Weideman, 1986; Schwarz, et. al., 1991); the use of computerized sheets (Shatz & Best, 1987); instructing students not to erase, but to rather circle or draw a line through their first judgment so that the first option could be clearly seen (Noorbala & Mohammadi, 2011; Linden & Jeon, 2012); the use of computer-readable answer sheet (Bauer, Kopp & Fischer,2007); the use of special answer sheets which include sheets with spaces for marking subsequent, as well as initial answers; ; and the use of sheets with carbon backing; the use of erasure analyses (Linden & Jeon, 2012). The extent of answer changing behavior is viewed either in terms of the proportion of the persons changing answers (McMorris & Weideman, 1986; Shatz & Best, 1987) or in terms of the proportions of answers changed (Mueller & Weasser, 1977; Ramsey, et al., 1987).

The variables of answer changing can be categorized into: subject variables and typical variables. The subject variables of answer changing behaviours can be studied by differentiating between changer and non-changer and among gainers (individuals who improve their scores through answer changing), samers (those whose scores are neither raised or lowered) and losers (those whose scores are lowered after making changes) based on some external criterion

(Benjamin, et al., 1984) in other words, gainers are those who make wrong-to-right (WR) changes, samers are those who make wrong-to-wrong (W-W) changes, and losers are those who make right-to-wrong (RW) changes. It can also be studied by comparing the percentage of change (PCHNG) and the percentage of gain (PGAIN). PCHNG is define as the amount of items changed divide it by the amount of questions answered multiplied by 100.

$$PCHG=(X \div Y_1) \times 100 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

Where:

$PCHG$ = Percentage of change
X = No. of items changed
Y_1 = No. of items answered

PGAIN is defined as the number of right-to-wrong (RW) subtracted from the number of wrong-to-right (WR) changes divided by the number of items on the test multiplied by 100 (McMorris & Weideman, 1986; McMorris, et al., 1991).

$$PGAIN=((WR-RW) \div Y_2) \times 100 \dots\dots\dots\dots\dots\dots\dots\dots(2)$$

Where:

$PGAIN$ = Percentage of Gain
RW = Right to Wrong changes
WR = Wrong to Right changes
Y_2 = No. of items on the test

III. METHODOLOGY

Research design

The research design used for this study is the survey design type. This is the most suitable in this study because the study sought to describe the nature of a situation as it exists at the time of the investigation, and draw inferences about the population based on sample evidence. In this case, the researcher collected required data to analyze answer changing behavior in students' answer scripts and described same as precisely as possible. In doing so, the researcher collected a copy of the question paper with their keys, and carefully selected the required numbers of answer scripts to obtain data for the study.

Instrumentation

The study is limited to responses of students in Mock 2014 Mock, administered in 2014 by the Cross River State Ministry of Education, Calabar. Subject of this study consisted 32 answer scripts (18males and 14 females) in four subjects (Mathematics, Chemistry, Physic and Biology), were systematically selected from seven schools that wrote Mock 2014 in Calabar South Local Government. The Mock 2014 examination is considered a standardized test, therefore reliability and validity of the instrument were assumed established by the board.

Method of data analysis

Descriptive analysis (percentages and charts) were used to summarise the result with respect to answer changing behaviour in the four subjects, while chi-square analysis was used to investigate the incidence of answer changing behaviour among four subjects on one hand, and gender difference with respect to answer changing in the four subjects on the other hand.

IV. RESULTS AND DISCUSSION

Results

The result is presented in appropriate tables.

Research question 1: What is the extent of answer changing behavior of students in the four science subjects?

To provide data on answer changing behaviour in the four subject areas, answers to this research question, frequencies and percentages were used to summarise the data. Students' answer changing status were collapsed into two (changers and non-changers), that is all answer scripts with changed responses (that is whether wrong to right, right to wrong and wrong to wrong) were collapse in to one (changers), and the answer scripts with responses that were not changed at all were also collapsed into one (non-changers). Based on this, their corresponding frequencies were converted to percentages, using Microsoft Excel 2007 to run a descriptive analysis of simple percentage and bar charts. Result of the analysis is presented in Table 1.

Table 1: Summary of answer changing behaviour among four science subjects in Mock 2014 multiple choice examination

Subject	Changers	Non Changers	Total change
Mathematics	28(87.50)	4 (12.50)	133 (39.93)
Biology	22(69.00)	10 (31.30)	86 (25.82)
Chemistry	18(56.30)	14 (43.80)	68 (20.42)
Physics	14(34.80)	18 (56.50)	46 (13.81)
Total	82	46	333

The result on Table 1 is a summary of answer changing behavior among four science subjects in Mock 2014. Data from Table 1 showed that all the students (represented by scripts) selected offered four science subjects (Mathematics, Physics, Biology and Chemistry). Among the four subjects, 28 (87.5%) students changed answers in Mathematics, 22(69%) changed in Biology, 18 (56.3%) students changed in Chemistry while 14 (34.8%) students changed in Physics. Table 1 also reveals that mathematics had the highest percentage change in answers, having 39.9%, while Biology had 25.8%, Chemistry had 20.4% and Physics had the least, having 13.8%, with their corresponding mean and standard deviation of the total scores.

Hypothesis 1: The incidence of answer changing behaviour is independent of the subject area. Chi square test of fit was used to test this hypothesis. The result is presented on Table 2.

Table 2: Summary of chi-square analysis showing incidence of answer changing behaviour among four subjects

	Changers	Non changers	N	Df	X^2	p-level
Mathematics	28	4	32	1	18.000	.000
Biology	22	10	32	1	4.500	.034
Chemistry	18	14	32	1	.500	.480
Physics	14	18	32	1	.500	.480

Hypothesis 2: There is no significant gender difference in the answer changing behaviour of students in the four subjects. To test this hypothesis, Chi square test of difference was used. The result is presented on Table 3

Table 3: Gender group difference of answer changing behaviour among four subjects.

	Change behavior	Gender	N	Df	X^2	p-level
Mathematics	Changers	Male	15	3	18.50	.000
		Female	13			
	Non Changers	Male	3			
		Female	1			
Biology	Changers	Male	13	3	5.50	.139
		Female	9			
	Non Changers	Male	5			
		Female	5			
Chemistry	Changers	Male	9	3	1.50	.682
		Female	9			
	Non Changers	Male	9			
		Female	5			
Physics	Changers	Male	8	3	1.00	.801
		Female	6			
	Non Changers	Male	10			
		Female	8			

V. DISCUSSION OF FINDINGS

It appears from the result that answer changing behavior occurred more in some science subjects than the other. For example, more answer changes occurred in Mathematics and Biology, than it occurred in Chemistry and Physics. In addition, scores in the four subjects increased as answer changing behaviour increased. However, answer changes in Maths and Biology helped the students to improve their performances as shown in their mean and percentage changes in performance. On the other hand, answers changed on Chemistry and Physics scripts were not able to improve the test performance. Apparently the students changed few answers in these subjects, and it is most likely these changes were from right to wrong or from wrong to wrong answers, andso were not able to improve their performances in these two subjects. This result supports previous research on the subject matter of answer changing behaviour in the sense that answer changing is beneficial to students if such change is from wrong to right answers. In this study, such change helped the students to improve their test scores in Mathematics and Biology. It is therefore a good idea to allow students change their initial answers if they can conceptualize a better answer. Answer changing will most likely lead to a better score, if students have a knowledge of the subject matter (Bauer, Kopp, & Fischer, 2007; Al-Hamly & Coombe, 2005; & Kruger, et. al., 2005). Furthermore, there is a significant gender difference in answer changing behaviour in mathematics.. Male students changed answers sightly higher than their female counterpart. However, there is no significant gender differences in Physics, biology and chemistry.

VI. CONCLUSION AND POLICY IMPLICATIONS

Conclusion

It is observed that individuals, especially students have the tendency to modify their response to questions whether in a

verbal or written communication such in an examination situation. Answer changing behaviour is a regular phenomenon among secondary school students in multiple choice test. Most students employ this test strategy during multiple choice test in order to improve their test scores. This is most likely the case if the changes are from wrong answers to correct ones. However, answer changing behaviour is more prominent in some subjects than in others. Answer changing behaviour among four science subjects (Mathematics, Biology, Chemistry and Physics) reveals that Mathematics has more changed answers than other subjects.

Policy implications

This result of this study has implication to examination bodies as well as teachers in test situations, to include instructions that will encourage students use answer changing strategy when they are in doubt of their initial answers. This can help them to improve their performance in any examination, especially multiple choice. The frequency in which answers are changed in Mathematics and Biology could be indicative of the systematic errors (either clerical or structural) in the questions used in the examination. The result could also be indicative that students finds it difficult to understand certain concepts used in these subjects either on the test or during classroom lessons . Teachers as well as test developers should be more meticulous during item development and selection process, they should pay attention to items that are susceptible to frequent change in answer. This may go along way to strengthen educational test process.

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