# Effect of Declarative Knowledge Approach on Students' Performance in Quantitative Economics

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## Abstract
*This study examined the effect of declarative knowledge approach (DKA) on students' performance in quantitative Economics. A sample of 156 SS II students randomly selected from six secondary schools in Oyo East, Atiba and Oyo West LGAs of Oyo State participated in the study. A quasi-experimental study, with 2 X 3 factorial designs was adopted. Participants were assigned randomly to treatment groups: Declarative Knowledge Approach (DKA) and Conventional Knowledge Approach (CKA). The instrument used to collect data were Economics Achievement Test (r= 0.94) and Numerical Ability Test (NAT) (r= 0.84). Three null hypotheses were tested at 0.05 significance level. ANCOVA was used in analysing collected data. Treatment significantly affected students' performance ($F_{(1,149)} = 1095.275, p<0.05$). Partial Eta Square ($\eta^2$) of 0.880 indicated that 88% variance observed in Economics students' achievement was due to treatment's (DKA) effect. The main effect of numerical ability was not statistically significant ($F_{(2,149)} = 0.469, p>0.05$). The interaction effect of treatment and numerical ability ($F_{(2,149)} = 1.557, p>0.05$) was not statisticallysignificant. It was thereafter suggested that teachers must permit students to supply relevant examples in the course of teaching; teachers should also employ appropriate approach such as declarative knowledge approach in the teaching of Quantitative Economics.*

**Key words:** Declarative Knowledge Approach, Numerical Ability, Performance

## Introduction
Economics is of high importance to the stability and economic growth of any nation. It serves as a catalyst for understanding the complexities of modern economic trends globally. Available literature reveals that some variables have been identified to be responsible for the students' irregular achievement in Senior Secondary School Economics. Among these are perceived difficult nature of Economics (Ogunkola & Samuel 2011): gender perception, students' poor attitude (Ogundipe, 2004), poor numerical approach, poor teaching methods, and teacher attitude to teaching (Oyediji, 2014).

WAEC's Chief Examiners' reports in the last ten years (2006-2015) have shown that Economics students failed to attain high academic excellence particularly in the area of quantitative Economics. Economics is a quantitative subject because it utilizes a step-by-step mathematical approach. For teaching approach to enhance the learning of Economics, it should embrace concepts and problem-solving methods.

Economics, if properly taught, will produce an efficient and productive person who will be able to compete perfectly and proffer solutions to the modern economic problems, and this will necessitate the use of appropriate teaching strategy. Instead of teaching the subject as a knowledge and skill-based discipline, some teachers still follow conventional approach.

Economics, by its nature, can be very useful in promoting critical and procedural thinking. Since the aim of teaching and learning of Economics is not for head-knowledge, the teaching approach used by the teacher should go beyond the mere passing of examination to systemic procedural knowledge. Availing students with knowledge and skill-based approach will go a long way in expanding intellectual skills and their ability to engage in analytical thinking.

As part of the solution to the problem of recurrent low performance, efforts have been made to imbibe innovative ways of teaching Economics in schools. In an attempt to raise level of performance in Economics, this study

therefore sought to investigate the effect of declarative knowledge approach and numerical ability on students' performance in Economics.

According to Rittle-Johnson & Koedinger (2009), declarative knowledge can be viewed as the knowledge of relevant principles and concepts of certain subjects that can be applied to new tasks. It is the knowledge which can be gained by the study of literature and media communications (Lanzer & Taatgen, 2013). Rittle-Johnson &Alibali (1999) further described it as an unambiguous kind of ideology that guides a sphere and of the connections between small portions of knowledge in an area. Declarative knowledge is hence put to use when students must comprehend how principles are put to use in solving problems, and the function of time in solving questions, and how principles are connected with the attributes of the classified problem (Turns & Meter, 2011). That is why Haapasalo & Kadijevich (2000) in Lauritzen (2012) refer to this pedagogical approach as '*educational approach.*'Hence, declarative knowledge is an approach that could enhance the learning and assessment outcomes of learners in quantitative Economics if it is properly employed.

Considering the relevance of quantitative Economics in the modern world, it is evident that failure to have numerical control is equivalent to low and poor performance in problem-solving skills. Without mathematical ability, students of Economics will find it difficult to excel in this world of numbers. Akinsola & Odeyemi (2014) then viewed numerical ability as the capability of students to perform some arithmetical or mathematical calculations off-hand or without the use of any mechanical device, an ability that could be high, medium or low. Therefore, students must have minimum numerical ability skills necessary for passing Economics. That is why Fatoke, Ogunlade, & Ibidiran (2013), asserted that problem-solving methods are more effective and reliable methods of promoting numerical skills in students and that the students of high numerical aptitude will perform better than their counterpart with low numerical ability. Akinsola & Odeyemi (2014) affirm further that students' numerical ability could influence learning and retention and academic attainment, and also determine the imagination, language, perception, concepts formation and problem-solving ability of learners.

Concerning the stated problems, the study tested three null hypotheses at 0.05 significance level and they are as follows:

**Ho1:** The main effect of treatment has no significance on students' performance in quantitative Economics.

**Ho2:** The main effect of numerical abilityhas no significance on students' performance in quantitative Economics.

**Ho3:** The interaction effect of treatment and numerical ability has no significance on students' performance in quantitative Economics.

**Methodology**

A 2 X 3 factorial, quasi-experimental design was used to establish the effect of independent variable and also provided an avenue to look into the weight of independent and moderating variable (numerical ability) on the dependent variable.The focused population for the study was the SS2 students offering Economics in public secondary schools in Oyo East, Atiba, and Oyo West LGAs of Oyo State. Two public secondary schools were randomly picked from each local government. Six schools were used while a total number of 156 students partook in the study.Two (2) instruments were used for the study. These included: Quantitative Economics Achievement Test (QEAT) and Numerical Ability Test (NAT).

Quantitative Economics Achievement Test (QEAT) questions were adopted from the West African Examination Council (WAEC) past questions series from 1988 to 2015 for both pre and post-test covering quantitative content of concept of cost and revenue, and taxation. 30 objectives questions were used on the participants of this study and each item consists of four options A-D. The reliability of the test was determined with K-R 20 and the value was 0.94.

Numerical Ability Test (NAT) was a 9-item test adopted for use from the Newcastle University Numerical Reasoning Tests. The test was used to determine the ability of learners to reason with numbers or acquire mathematical ability, and to classify the participants of this study into three numerical ability levels (High, Medium and Low) using percentiles: Low = 0-33%; Medium = 34% - 66% and High 67% - 100%. The test was validated, and the reliability coefficient was0.84 with Kudar-Richardson (KR-20).

Procedure for the Treatment Group(Declarative Knowledge Approach Group (DKAG))

This group was taught with the prepared teaching module and was characterised by the following:

1. Concept-based teaching approach. Learning was acquired through the knowledge of concepts.
2. Expository approach group, where factual and specific information, characteristics, terminologies, properties, phenomena, concepts, principles, and techniques were used in teaching the content.
3. Learners provided relevant examples in line with the teaching, and the teacher buttressed on the provided examples.

Mode of teaching in DKA

1. In this group, after the introduction of the content to be taught, the objectives of the lesson were made known to students;
2. Teachers initiated the teaching by explaining the fundamental component of the concept;
3. At least two students gave practical examples using the explained concept;
4. After that, the teacher of this group defined the concept in line with examples supplied by the student;
5. Objective questions were administered on students as class practice.

Data Collection

A week before treatment's application, the researcher administered Numerical Ability Test ( NAT) and Quantitative Economics Achievement Test (QEAT) on participants. Responses on both instruments were immediately collected since the post-test data also depended on the same instruments. The researcher was not part of the teaching, but monitored the treatment's execution. The treatment was carried out for six weeks, thereafter QEAT was re-applied on participant as post-test.

**Results**

**Table 1: Summary of Analysis of Covariance (ANCOVA) of Students' Performance in Economics by Treatment and Numerical Ability**

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 9448.966a | 6 | 1574.828 | 250.535 | 0.000 | 0.910 |
| Intercept | 1616.044 | 1 | 1616.044 | 257.092 | 0.000 | 0.633 |
| Pre-Achievement | 35.181 | 1 | 35.181 | 5.597 | 0.019 | 0.036 |
| Treatments | 6884.739 | 1 | 6884.739 | 1095.275 | 0.000 | 0.880 |
| Numerical | 5.901 | 2 | 2.951 | 0.469 | 0.626 | 0.006 |
| Treatments * Numerical | 19.572 | 2 | 9.786 | 1.557 | 0.214 | 0.020 |
| Error | 936.592 | 149 | 6.286 | | | |
| Total | 32491 | 156 | | | | |
| Corrected Total | 10385.56 | 155 | | | | |

*a R Squared = 0.910 (Adjusted R Squared = .906)*

$F_{(2,149)} = 1.557\ p<0.05$

**Hypothesis 1:**The main effect of treatment has no significance on students' performance in quantitative Economics.

Table 1 shows the summary of Analysis of Covariance (ANCOVA) of students' post-test achievement scores in Economics by treatment and numerical ability. The result revealed that the effect of treatments on Economics students' achievement was statistically significant ($F_{(1,149)}$= 1095.275, p< 0.05); therefore, there was rejection of null hypothesis. Table 1 further showed that the Partial Eta Square ($\eta^2$) of 0.88 indicated that 88% variance observed in Economics students' achievement was due to treatment's effect. Sidak Post-hoc analysis was carried out to decide which group differs significantly among the two treatment groups, and this can be found in Table 2.

| Treatments | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| Declarative group | 21.173a | 0.364 | 20.454 | 21.892 |
| Control group | 5.418a | 0.299 | 4.827 | 6.008 |

*Pre-Achievement score = 8.4872.*

Table 3: **Estimated Marginal M eans for Post -Achievement Score of Treatment**

| (I) Groups | (J) Groups | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Declarative group | Control group | 15.755* | 0.476 | 0.000 | 14.814 | 16.696 |
| Control group | Declarative group | -15.755* | 0.476 | 0.000 | -16.696 | -14.814 |

*Based on estimated marginal means*

** The mean difference is significant at the .05 level.*

*b Adjustment for multiple comparisons: Sidak.*

From Table 2, participants in Declarative group had higher adjusted mean score of (X= 21.173) than those in control group (X= 5.418). Table 3 confirms that the distinction between treatment and control groups was statistically significant.

**Hypothesis 2:**The main effect of numerical abilityhas no significance on students' performance in quantitative Economics.

The outcome in table 1 revealed that the effect of numerical ability on students' performance in quantitative Economics was not statistically significant ($F_{(2,149)}$= 0.469, p> 0.05); therefore the null hypothesis was sustained. Table 1 further showed that the Partial Eta Square ($\eta^2$) of 0.05 (0.6%) accounted for variance observed in Economics students' achievement. Adjusted Estimated Mean was done to conclude which ability level differs significantly among the three in Table 4.

**Table 4: Estimated Marginal Means for Post-Achievement Score of Numerical Ability**

| Numerical Level | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| Low Ability | 13.567a | 0.275 | 13.023 | 14.111 |
| Moderate Ability | 13.231a | 0.423 | 12.396 | 14.066 |
| High Ability | 13.088a | 0.484 | 12.132 | 14.044 |

*Pre-Achievement score = 8.4872.*

Table 4 reveals that the highest adjusted mean score (13.567) could be traced to the low ability participants, followed by moderate ability (13.231), while the lowest adjusted mean score (13.088) was found among the high ability participants.

**Hypothesis 3:** The interaction effect of treatment and numerical ability has no significance on students' performance in quantitative Economics.
The findings in table 1 revealed that the interaction effect of treatment and numerical ability on students' performance in quantitative Economics was not statistically significant ($F_{(2,149)}= 1.557$, $p> 0.05$); therefore the null hypothesis was upheld. Partial Eta Square ($\eta^2$) of 0.020 in Table 1 indicated that both the treatment and numerical ability could only account for 2.0% variance observed in Economics students' achievement. Adjusted Estimated Mean in table 5 was explored to resolve which variables differ significantly between the two treatment groups and the ability levels.

Table 5: **Estimated Marginal Means for Post-Achievement Score of Treatment and Numerical Ability**

| **Groups** | **Numerical Level** | **Mean** | **Std. Error** | **95% Confidence Interval** | |
|---|---|---|---|---|---|
| | | | | **Lower Bound** | **Upper Bound** |
| Declarative group | Low Ability | 21.539a | 0.404 | 20.741 | 22.337 |
| | Moderate Ability | 21.625a | 0.726 | 20.191 | 23.059 |
| | High Ability | 20.354a | 0.697 | 18.976 | 21.732 |
| Control group | Low Ability | 5.595a | 0.374 | 4.856 | 6.333 |
| | Moderate Ability | 4.836a | 0.44 | 3.967 | 5.706 |
| | High Ability | 5.822a | 0.678 | 4.482 | 7.163 |

*Pre-Achievement score = 8.4872.*

The highest adjusted mean score in Table 5 was traced to students of Declarative group of low, moderate and high ability levels (21.539, 21.625 & 20.354 respectively) while control group had the lowest adjusted mean score of low, moderate and high ability levels (5.595, 4.836 & 5.822 respectively).

**Discussion**
The result showed that the main effect of treatment on students' performance in quantitative Economics was significant. The finding was in agreement with Rittle-Johnson and Alibali's (1999) report that found that conceptual knowledge significantly influenced Mathematics students' performance. In this study, participants that were exposed to declarative knowledge approach were far better than those in the control group. Thus, it could be explained that declarative knowledge approach proved more facilitative as far as achievement in quantitative Economics is concerned.

This study is in conformity with Brian's (2016) view that the numerical score alone is not enough to predict students' ability in Mathematics which also calls for a high level of abstract reasoning. This implies that students' performance in quantitative Economics is not a function of their numerical abilities. The result further reveals that higher adjusted mean score wrong with students of low ability, and this is closely followed by moderate ability students, while high ability students had the lowest adjusted mean score. The numerical ability of most students in this study was low. However, this study contravenes the finding of Fatoke, Ogunlade and Ibidiran (2013) and Akinsola and Odeyemi (2014), which states that the higher the numerical ability, the higher the students' performance.

The result of this study showed further that the interaction effect of treatment and numerical ability on students' performance in Economics

was not significant. This finding is in line with Bull (2009) which indicated negative correlation between students' math anxiety levels and their math (numerical) test scores. This is in agreement with Falaye (2006) which attested to non-significant effect of treatment and numerical ability on students' self-perception. This finding reveals that the interplay of treatment and numerical ability cannot justify high performance in quantitative content of Economics. This finding is contrary to Emeke and Adegoke (2001) that concluded that numerical ability has the power to impact on students' performance.

**Conclusion**

It can be deduced that the treatment (Declarative knowledge Approach) has significant influence on students' performance in quantitative Economics. This finding shows that when appropriate approach is employed in the teaching and learning of Economics, students' performance will be highly influenced positively. It was also discovered that students' participation in supplying practical examples during the teaching facilitated their performances. There was also a clear indication that numerical ability does not determine high performance provided an appropriate instructional approach is engaged.

**Recommendations**

In line with the findings of this study, it is suggested that learners should take part in the teaching and learning processes of quantitative Economics. Teachers must allow students to supply relevant examples to the teaching of Economics. They should also employ appropriate approach such as declarative knowledge approach in the teaching of Economics. Writers and authors should explore the fitness of Declarative Knowledge Approach while writing Economics texts. Nigerian Educational Research and Development Council (NERDC) should experiment the applicability of DKA to Economics and other quantitative-based subjects. Finally, researchers can delve into the usefulness of this knowledge approach to other subjects.

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