Differential Effect of Prior Knowledge of Instructional Objectives on Some Urban and Rural Benue Senior Secondary Students’ Achievement in Biology

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Abstract

This study determined the differential effect of prior knowledge of instructional objectives on the achievement of urban and rural students in zone ‘C’ of Benue State. One research question and two hypotheses were formulated to guide the research. Data were collected from 640 senior secondary 2 (SSII) students using a validated instrument; the Biology Achievement Test Items (BATI), which yielded a reliability coefficient (r) of 0.84. The research question was answered using the mean and standard deviation scores while the hypotheses were tested at 0.05 significant level using Analysis of Covariance (ANCOVA). Urban students obtained significantly higher scores in Biology than the rural students (F_{1, 639} = 481.907; p < 0.05). Also, interaction effect of method and location on achievement was significant; F_{1, 639}=92.816, p<.05. It was recommended among others that, deliberate efforts should be made to post qualified and experienced teachers of Biology to rural schools to enhance students’ achievement; the provision of facilities, such as libraries, standard laboratories, electricity and adequate source of water for rural schools will also go a long way to improve students’ academic pursuit.

Introduction

There has been much concern expressed about the apparent fall in the standard of education and specifically in the sciences at the secondary school level in Nigeria, since she got her independence in 1960. For example, Awodi (1984), Nwosu and Okeke (1995), Madu (2004), Okebukola (2005) and Umoren and Aniashi (2007) working separately have lamented the fall in the standard of science teaching in Nigeria. According to Ajagun (2000), the achievement of students in senior secondary sciences in Nigeria has remained consistently poor. In fact, a survey of the achievement in senior secondary school science in Nigeria over the years reveals a discernable decline (Ojerinde, 1998). This phenomenon has remained a source of concern to science educators and specifically Biology experts (Nnaka & Anaekwe, 2004).
As a matter of fact, Ojerinde (1998), Ajagun (2000), Nnaka and Anaekwe (2004) in their separate findings have attributed the problem to non-availability of necessary facilities for the teaching of sciences among other things, in addition to students’ socio-economic background and level of intelligence. The teacher on his own part blames the management of the system, for not providing adequate equipment or materials as well as poor conditions of service. Ogbeba (2007), in agreement with these claims has confirmed that there are inadequate laboratory facilities in our secondary schools. The researcher wonders if this observable decline cuts across geographical locations. This study investigated if providing instructional objectives to students could help to improve achievement.

In this regard, Alasia (2003) noted that available evidence suggests that two different factors, school conditions and economic conditions, combine to discourage rural students from educational achievement. Nielsen (2004) observed that rural schools tend to be smaller than urban schools and that this has a number of benefits since rural students’ class sizes tend to be smaller, students enjoy more individual attention from their teachers as their teachers know almost all the students individually. He has also observed that small rural schools can be more effective in helping their students learn better, behave better and participate more effectively in school activities. Rural students, according to Neilsen (2004) show a clear awareness of the benefit of attending small schools.

On the other hand, Hu (2003) has stated that rural schools face challenges that can lead to unfavorable educational outcomes for their students. One problem, which Hu observes is that, it is difficult for small rural schools in Canada to attract and retain qualified teaching staff. Such schools often result into feeling the vacancies with younger, less experienced teachers. The question is whether these young teachers have the capacity to use appropriate methodology, which this research tends to address.

Ertl and Plante (2004) identified the major disadvantage of rural to urban school in terms of Information and Communication Technology (ICT) usage, which they say is lacking in the rural areas. Perhaps, the use of prior instructional objectives, which is not a prerogative of any locality, could help enhance rural achievement.

Most of the related studies considered in this paper were carried out outside Nigeria. A few carried out in Nigeria did not focus on the area of the present study which is Benue State. More importantly is the fact that there is no agreement on the influence of location on science students’ achievement. It is on the basis of these that the current study investigates differential effect of prior knowledge of instructional objectives on some urban and rural Benue senior secondary students’ achievement in biology.
Research Question

1. What is the difference in the mean achievement scores between urban and rural students taught Biology with prior knowledge of instructional objectives?

Research Hypotheses

1. There is no significant mean difference in mean Biology achievement between urban and rural students taught with prior knowledge of instructional objectives.
2. There is no significant interaction effect of method and location on the mean achievement of students taught Biology with prior knowledge of instructional objectives.

Research Method

The study employed quasi-experimental non-randomized control group-prettest-posttest design. The study was conducted in zone “C” of Benue State of Nigeria. The population of study comprised of all the SSII students in the ninety-four granted-aided senior secondary schools in zone ‘C’. A sample of 640 male and female students in zone ‘C’ was drawn using purposive and random sampling techniques. The Biology Achievement Test Items (BATI), which served as both pre and post test items, were administered to all the sixteen classes before the lessons started, to establish the students entry behaviour on the topics to be taught. In the experimental classes (8 urban and 8 rural schools) each student was provided with a list of instructional objectives for the particular topic to be taught before teaching started.

Eight Biology teachers taught the classes using the inquiry method for which they were earlier trained by the researcher. The teachers read aloud the relevant objectives at the start of the lesson, after which they proceeded with the lesson. In the control classes, the teachers taught similar lessons as in the experimental classes, using the same method except that no instructional objectives were given to the students. After six weeks of experiment, the BATI, which served as the pretest, was administered as posttest to both the urban and rural students to determine the effects of the treatment. Classroom observation was carried out at random by the researcher during the period of experimentation to monitor the adherence to procedures in both the experimental and control classes. Different schools were used as control and experimental to avoid undue interference.

Results

The results of the posttest are presented in tables for the research question and hypotheses for the achievement variable. The results are analyzed and interpreted at 0.05 significant level.
Research Question 1: What is the difference in the mean achievement scores between urban and rural students taught Biology with prior knowledge of instructional objectives? Answer to research question 1 is contained in Table 1.

### Table 1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Group</th>
<th>N</th>
<th>Mean Pretest</th>
<th>Mean Posttest</th>
<th>SD</th>
<th>Mean Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>Experimental</td>
<td>156</td>
<td>10.92</td>
<td>19.70</td>
<td>4.414</td>
<td>8.78</td>
</tr>
</tbody>
</table>

Table 1 shows that the post-test mean achievement scores of urban and rural students taught Biology with prior knowledge of instructional objectives were 26.40 with SD 4.581 and 19.70 with SD 4.414 respectively while their pretest means scores were 11.85 and 10.92. Thus urban students had mean gain of 14.55 while the rural students had mean gain of 8.78. This implies that Biology students in urban areas had a higher mean gain score than their rural counterparts. To verify the significance of the means of these two groups, hypothesis one was tested.

**Hypothesis 1.**

There is no significant mean difference in Biology achievement between urban and rural students taught with prior knowledge of instructional objectives. Test of hypothesis 1 is contained in Table 2.

### Table 2.

ANCOVA of the Mean Achievement Scores of Students taught with Prior Knowledge of instructional objectives by location and their interaction effect.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected model</td>
<td>21715.814^a</td>
<td>8</td>
<td>2714.477</td>
<td>247.987</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>24720.988</td>
<td>1</td>
<td>24720.988</td>
<td>2258.438</td>
<td>.000</td>
</tr>
<tr>
<td>Pre Achievement</td>
<td>3339.024</td>
<td>1</td>
<td>3339.024</td>
<td>305.044</td>
<td>.000</td>
</tr>
<tr>
<td>Location</td>
<td>5274.984</td>
<td>1</td>
<td>5274.984</td>
<td>481.907</td>
<td>.000</td>
</tr>
<tr>
<td>Method</td>
<td>4488.687</td>
<td>1</td>
<td>4488.687</td>
<td>410.073</td>
<td>.000</td>
</tr>
<tr>
<td>Loc*Method</td>
<td>1015.974</td>
<td>1</td>
<td>1015.974</td>
<td>92.816</td>
<td>.000</td>
</tr>
<tr>
<td>Error</td>
<td>6906.961</td>
<td>631</td>
<td>10.946</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>373282.000</td>
<td>640</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>28622.775</td>
<td>639</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
a. \[ R \text{ Squared}= .759 \quad (\text{Adjusted R Squared}= .756) \quad S = \text{Significant at } P < 0.05 \]

Table 2 reveals that location is a significant factor in students’ mean achievement in Biology. The Table shows the calculated \( F \)-value of 481.907 at \( P = 0.001 < 0.05 \) significance level. This therefore implies that the difference in mean scores of the urban and rural students was significant. Thus the null hypothesis is rejected which means that there is a significant difference between mean achievement of urban and rural students in biology who had prior knowledge of behavioural objectives before content was taught to them.

### Hypothesis 2

There is no significant interaction effect of method and location on the mean achievement of students taught Biology with prior knowledge of instructional objectives.

Again Table 2 indicates the interaction effects of method and location on the achievement of Biology students taught with prior knowledge of instructional objectives. It shows that the interaction effect of method and location is significant. This is because the calculated \( F \)-Value of 92.816 at \( P = 0.001 < 0.05 \) significant level. Thus, the null hypothesis is rejected and this means that the effects of the interaction of method of teaching and the moderator variable (i.e. location) on the mean achievement of students were significant.

### Discussion

The main issue addressed in the study was to determine the effect of prior knowledge of instructional objectives on urban and rural senior secondary school students’ achievement in Biology. The study also examined the interaction effect of method and location on achievement.

Results from Table 1 shows that students in urban schools have a higher mean gain compared with their rural counterparts in the experimental groups. This is further confirmed by results in Table 2, which shows that a significant difference exists in the mean achievement scores of students in urban and rural schools in favour of the urban students. This result agrees with other findings (Achor, 2003; Alasia, 2003; Hu, 2003; Ertl & Plante, 2004), which suggest that students in urban schools have less difficulties and fear for sciences than those from rural schools and thus often perform better. This confirms Ertl and Plante’s (2004) study that identified a disadvantage of rural schools in terms of access to Information and Communication Technology (ICT). Even though the use of instructional objectives was not a prerogative of any of the two locations, the urban students benefited more from it than the rural students. The result of this study is also in compliance with the findings of Fry and Coe (1990) and Nzewi (1990), which revealed that urban students achieved greater in biology than their rural counterparts.
This result is however, at variance with that of Nelsen (2004), who observed an advantage for rural students who tend to be smaller in number than urban students, and as a result enjoy more individual attention from their teachers. Achor (2005) also found that rural students outperformed the urban students in both cognitive task 2 and cognitive attainment generally. From Table 2 also, the interaction effect of method and school location was significant. This implies that location and method interacted and that the effect of the interaction on students’ achievement is significant. By implication therefore, the effect arising from interaction of teaching method with location variable or vice versa was high enough to the extent that both have a significant combined effect on students’ achievement in biology.

**Conclusion and Recommendations**

The following conclusions are made based on the findings of this study:

The results of this study provided empirical evidence that the use of prior knowledge of instructional objectives enhance urban students’ achievement in Biology better than the rural students under the same study condition. Accordingly, urban students performed better than their rural counterparts in biology achievement. Based on the aforementioned, the following recommendations are made for this study:

a. Since prior knowledge of instructional objectives is found to be an effective strategy for improving achievement in Biology teaching, Biology teachers should be made to provide students with relevant instructional objectives before lessons are taught, whether in the urban or rural areas.

b. The use of prior knowledge of instructional objectives should be included in the teacher-training institutions’ curriculum or course content. This will ensure the training of pre-service Biology teachers on the use of instructional objectives in this regard. Thus if adequately exposed to the method of instruction, the little variation due to location may mean nothing to the learners in terms of achievement.

c. Facilities such as good libraries, standard laboratories, electricity and water should be provided for rural schools to improve students’ academic pursuits and to be able to compete favourably with the rural students in biology learning.

**References**


