# Statistical Testing on Basic Science Practical on Students' Performance in Ilorin East, Kwara State

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| Article Info | Abstract |
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| | It is urgent to address a systematic and objective approach to evaluating students' practical skills. Exceptionally, current subjective assessment methods for students' practical performance are to be provided with a more objective evaluation. Hence the study investigated the statistical testing on Basic Science practical on students' academic performance in students in Ilorin East, Kwara State, Nigeria. The study was a descriptive research survey type. 120 students were sampled in secondary schools in Ilorin East LGA using a purposive sampling technique. The researchers designed a questionnaire was used to accumulate information from respondents. Data collected were analyzed using percentage, mean, frequency count, independent t-test, and ANOVA at 0.05 alpha significance level. The findings revealed that Basic Science practical has a great influence on school students' academic performance and also on the level of understanding and retention capabilities of students but there was no significant influence on students' academic performance based on gender as well as class size. Also, student's academic performance in Basic Science was not significantly influenced by gender or class size partially. It is recommended that all Basic Science teachers should engage students more in practical activities than the theory aspect to facilitate better understanding among the students. |
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| **Info Artikel** | **Abstrak** |
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Pendekatan sistematis dan obyektif dalam mengevaluasi keterampilan praktis siswa merupakan hal yang mendesak untuk dilakukan. Khususnya, metode penilaian subjektif saat ini untuk kinerja praktik siswa harus diberikan dengan evaluasi yang lebih obyektif. Oleh karena itu penelitian ini menyelidiki pengujian statistik pada praktik Sains Dasar terhadap kinerja akademik siswa di Ilorin East, Negara Bagian Kwara, Nigeria. Penelitian ini merupakan penelitian deskriptif dengan jenis survei. Sampel yang diambil adalah 120 siswa sekolah menengah di LGA Ilorin Timur dengan menggunakan teknik purposive sampling. Kuesioner yang dirancang peneliti digunakan untuk mengumpulkan informasi dari responden. Data yang terkumpul dianalisis menggunakan persentase, mean, penghitungan frekuensi, uji t independen, dan ANOVA pada tingkat signifikansi alpha 0,05. Temuan mengungkapkan bahwa praktik Sains Dasar mempunyai pengaruh yang besar terhadap kinerja akademik siswa sekolah dan juga pada tingkat pemahaman dan kemampuan retensi siswa, namun tidak ada pengaruh yang signifikan terhadap kinerja akademik siswa berdasarkan gender serta ukuran kelas. Selain itu, prestasi akademik siswa dalam Ilmu Pengetahuan Dasar tidak dipengaruhi secara signifikan oleh gender atau ukuran kelas secara terpisah. Disarankan agar semua guru IPA Dasar harus lebih melibatkan siswa dalam kegiatan praktik daripada aspek teori untuk memfasilitasi pemahaman yang lebih baik di kalangan siswa.

| **Kata Kunci:** | Praktik IPA Dasar, Kinerja Siswa, Uji Statistik |
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## INTRODUCTION

The exploration of science, defined as a comprehensive system of acquiring knowledge through observation and experimentation, is intrinsically woven into the educational fabric of Junior Secondary Schools in Nigeria. The Basic Science curriculum, designed by the Nigerian Educational Research and Development Centre (NERDC, 2007), actively involves learners in inquiry and related activities to foster critical thinking skills. This curriculum aims to enable students to develop an interest in science, acquire fundamental knowledge and skills, and prepare for further studies and careers in science and technology.

Nwafor & Oka (2016) observed that basic science formally known as integrated science is a subject taught at both public and private schools at the Junior Secondary school level. Basic Science is an introductory course to the study of the sciences in the senior secondary school. Basic science, just as the name implies is the foundational part of science education that has to do with the impartation of the basic knowledge needed to understand science. Basic science is taught at elementary or basic schools which comprises classes from basic one (Primary One to Basic Nine). It is obvious that Basic science is the major determinant of the performance of study and practice of science but unfortunately, the learning of Basic Science as a subject in Nigerian is not elective because of the poor performance of the students resulting from various problems associated with the teaching of Basic Science (Amoo, 2019).

Ibe & Abonyi (2014) noted that a serious aberration in the quality of science in Nigeria is due to the over-emphasis on mastery of subject content, theory, and excessive examination consciousness against practical orientation toward science-based disciplines. This according to them led to the failure of the science education program in developing countries and Nigeria in particular

Multiple studies showed that practical work confers many advantages, including developing laboratory skills and scientific knowledge, as well as understanding science concepts and theories (Schwichow et al., 2016). Practical work has been able to promote students' positive attitudes and enhance motivation for effective learning in science as described by Okam and Zakari (2017). Consequently, a positive attitude toward the importance of practical work meaningfully affects students' achievement in science (Hinneh, 2017). Etiubon & Udoh (2017) posited that practical activities develop students' manipulative skills, attitudes, and interests that simplify science concepts. It makes difficult and abstract concepts real, removes misconceptions, ignites, increases, and sustains students' interest in science through various activities using sourced science materials to enrich science learning experiences. This is aimed at preparing students to become productive individuals in the workplace and has opened access to creativity and knowledge. Buba & Marcel (2019) investigated the effect of practical teaching methods on the academic achievement of senior secondary biology students in Mubi Educational Zone, Adamawa State. The findings show that there is a significant effect of practical teaching methods on students' academic achievement in biology. Ayanwoye (2016) reported that senior secondary school students in small-sized classes show higher achievement in mathematics relative to their colleagues in large-sized classes, there is an inverse relationship between class size and students' achievement in mathematics. Furthermore, there is an interaction effect of gender and class size in students' achievement in Senior Secondary School Mathematics.

However, the pursuit of academic achievement within this educational framework places a significant burden on students, teachers, and the entire educational system. Academic achievement, a pivotal metric for success, is closely linked to fulfilling national educational goals. This pressure is heightened by the perceived correlation between academic achievement and the ability to effectively perform roles in society.

The gender disparity observed in the sciences within the Nigerian educational landscape further influences academic achievement. Historically, girls tend to underperform compared to their male counterparts in various levels of science

education, though recent observations suggest a nuanced shift in this dynamic. Studies vary on the sensitivity of students' achievement in basic science to gender, with some finding no significant differences and others noting distinctions based on exposure to practical activities. Akinwunmi & Falemu (2020) reported that there was no significant in the performance of male and female. Similarly, Ogunleye & Babajide (2011) reported that there was no significant gender difference among students who were exposed to practical activities at the senior secondary school level. Bello (2014) reported that although there is little difference in the mean score of both male and females, the overall result revealed that gender has no significant moderating effect on pupils' practical skills in Basic Science

Eboatu & Ehirim, (2018) reported that school population, large class sizes, and teaching methods are among the school factors that impact students' academic performance. According to Ruffina et al. (2018), class size refers to the actual number of learners taught by a teacher at a particular time. Omwirhiren & Anderson (2018) explained class size as the number of learners to whom a teacher is primarily responsible during a school year. The class size could be large or small. Olurotimi & Nike (2021) noted that class can be said to be large when the student number is more than 30.

A study by Yusuf et al. (2016) recommended 30 or 40 students per classroom for public secondary schools. Additionally, a large class size falls within 41 and above learners to one teacher while a small class size is within 15-40 learners to one teacher. Adolphus & Godgift (2022) reported that large class size has a negative influence on the teaching and learning of basic science in schools, as more time is taken by teachers in class control and discipline which affects the content delivery. Blatchford & Lai (in Rono et al., 2022) reported that it is harder for teachers to maintain students' discipline in large classes.

Similarly, the small class resulted in many advantages. Rubin (2012) reported that teachers spend more time with individual students in small classes to make sure that each student understands the concept of the subject matter. Altinok & Kingdom (2012) also

reported that class pedagogies can include project work where students are individually monitored and provided with continuous feedback on investigative tasks designed to develop higher thinking skills is more effective in small class sizes. Gwamna et al. (2021) reported that small class sizes have a positive effect on performance and attitude in ecology among secondary school students in Sabon-Tasha Education Zone, Kaduna State, Nigeria.

The National Policy on Education (2013) establishes a standard class size in Nigeria, distinguishing between large and small classes. Discussions on the influence of class size on performance, with concerns over bloated class sizes affecting the junior secondary level, pave the way for insights from researchers like Rubin (2012) emphasizing the benefits of individual attention in smaller classes.

As a natural progression, the study aligns with various researchers' inquiries into the effects of practical teaching methods, class size, and laboratory practicals on students' academic performance. This research acknowledges the existing gaps, particularly in understanding the intersection of gender and class size, and aims to contribute critical insights to inform and enhance science education policies and practices in Nigeria

The main purpose of this study is to examine the Statistical testing on Basic Science practical influence on students' academic performance in Ilorin East, Kwara State, Nigeria. Specifically, the study investigated; (1) the influence of gender on students' performance in Basic Science practicals; and (2) the influence of Basic Science practicals on Students' Performance Based on Class Size. This research hypothesizes that there is no significant influence of gender on students' performance in basic science practicals ($H_{01}$) and there is no significant influence of basic science practicals on students' performance based on class size ($H_{02}$).

## METHODS

The study employed descriptive research of the survey type. Survey type of research describes and interprets events and ideas the way they are without any external

manipulation. Hence, a survey method was appropriate for this study.

The population for this study comprised selected students in secondary schools in Ilorin East L.G.A in Kwara State. The target population consisted of biology students from both public and private secondary schools. There are 348 public secondary schools and 114 registered private schools in Kwara State making a grand total of 362 secondary schools in Kwara State. The total number of public secondary schools in Ilorin East LGA is 30 while private secondary schools are 25 making a grand total of 55 secondary Schools in Ilorin East LGA. Purposive sampling was used to select 6 secondary Schools consisting of three (3) private and three (3) public schools. The target population consisted of one hundred and twenty (120) Basic students from public and private secondary schools. The students were selected from the sampled schools using a purposive sampling technique; schools that have basic science teachers and practical laboratories were considered as the sample for the study.

This study made use of a self-designed questionnaire tagged "Statistical Testing on Basic Science Practical on Students' Performance". The questionnaire items were constructed as 29 much as possible to elicit correct and accumulated information required for the study from the respondents. The questionnaire consisted of two sections A and B. Section A included information on the personal data of the respondents, which included: the name of the school, gender, and class size while section B contained items carefully organized concerning the research questions raised. The section required the respondents to choose from four options of a Likert scale answer by ticking their choice: SA (Strongly Agreed), A (Agreed), D (Disagreed), and SD (Strongly Disagreed).

The data collected from the study was utilized to answer the research questions and to test the hypotheses. The data was analyzed using descriptive and inferential statistics. Demographic information was subjected to frequency and percentage (%), and the research questions were answered using Mean. Hypothesis 1 was tested with t-test while hypothesis 2 was tested using ANOVA (Analysis of Variance) in order to test the

secondary school students' influence of basic science practicals on their performance. The hypotheses were tested at 0.05 alpha level of significance.

## RESULTS AND DISCUSSION
### Demographic Profile of the Respondents

**Table 1.** Demographic Information of Respondents

|  | Variable | Frequency | % |
|---|---|---|---|
| **Gender** | Male | 48 | 40 |
|  | Female | 72 | 60 |
|  | **Total** | **120** | 100 |
| **Class Size** | Low Class | 22 | 18 |
|  | Middle Class | 61 | 51 |
|  | High Class | 37 | 31 |
|  | **Total** | **120** | 100 |

Table 1 shows the frequency and percentage distribution of respondents according to gender and class size. Out of 120 students sampled in this survey, 48 students which correspond with 40% of the total respondents were male while 72 students which correspond with 60% were female. This implies that the majority of the respondents are female. Class size showed that 22 (18%) of respondents were in the low class, 61 (51%) were in the middle and 37(31%) were in the high class. This implies that the respondents were evenly represented based on their class size.

**Research Question 1:** Does gender influence performance students' performance in Basic Science practicals?

**Table 2.** Mean Response of Basic Science Practical Influence on Students' Performance

| No | Item | Mean | |
|---|---|---|---|
|  |  | **Male** | **Female** |
| 1 | Students equally benefit from the practical components of Basic Science in terms of academic achievement | 2.83 | 2.76 |
| 2 | Students exhibit noticeable improvement in | 2.67 | 2.89 |

| No | Item | | |
|---|---|---|---|
| | problem-solving skills when actively participating in Basic Science practical sessions | | |
| 3 | Students' retention of Basic Science knowledge is positively influenced by engaging in practical experiments | 2.96 | 2.90 |
| 4 | Only female students show increased academic proficiency in Basic Science as a result of participating in practical experiments. | 2.00 | 1.71 |
| 5 | The utilization of laboratory facilities in Basic Science has a more significant effect on the academic performance of only male students. | 2.16 | 1.93 |
| 6 | Students demonstrate improved understanding of Basic Science concepts through practical laboratory work. | 2.93 | 2.79 |
| 7 | The inclusion of practical sessions in Basic Science positively influences the academic performance of both male and female students. | 2.77 | 2.99 |
| 8 | Students' grasp of theoretical concepts in Basic Science is reinforced through hands-on practical activities. | 2.76 | 3.10 |
| | **Grand Mean** | **2.64** | **2.63** |

Table 2 shows that items 1, 2, 3, 6, and 7 have a mean score above 2.5 while table 5 and 6 have a mean score below 2,5 respectively. This implies that basic science practical influence on students' academic performance is not based on gender.

**Research Question 2:** Does Basic Science practical have an influence on students' academic performance based on class size?

**Table 3.** Mean Response of Basic Science Practical on Male and Female Students' Performance

| No | Item | Mean | | |
|---|---|---|---|---|
| | | Low class | Middle class | High class |
| 1 | In large class sizes, students may face challenges in actively participating and benefiting from science practicals, impacting their academic performance | 2.89 | 2.59 | 2.76 |
| 2 | The effectiveness of science practicals in enhancing academic performance is more pronounced in classes with fewer students | 3.14 | 2.92 | 2.69 |
| 3 | Small class sizes allow for better-individualized attention during science practicals, leading to improved understanding and performance | 3.53 | 3.11 | 2.89 |
| 4 | Participating in science practical activities significantly enhances students' academic performance in smaller class sizes | 3.92 | 2.68 | 3.01 |
| 5 | The opportunity for hands-on science experiments positively contributes to academic success, especially in smaller class settings | 3.88 | 3.11 | 3.03 |
| | **Grand Mean** | **3.47** | **2.88** | **2.88** |

Table 3 shows that items 1, 2, 3, 4, and 5 have a mean score above 2.5. The respondents agreed that in large class sizes, students may face challenges in actively participating and benefiting from science practicals, impacting their academic performance. In addition, the effectiveness of science practicals in enhancing academic

performance is more pronounced in classes with fewer students, small class sizes allow for better individualized attention during science practicals, leading to improved understanding and performance. Also, smaller class sizes allow for better-individualized attention during science practicals, leading to improved understanding and performance. Furthermore, the opportunity for hands-on science experiments positively contributes to academic success, especially in smaller class settings.

**Hypotheses Testing**

$H_{01}$: There is no significant influence of gender on students' performance in basic science practicals.

A T-test was conducted to test the influence of Basic Science practicals on students' academic performance between male and female. Table 4 shows the mean score of male students is 39.91(SD=3.41) while that of the female students is 43.17 (SD= 3.78) at df = 118, t -value = -0.12, and $p>$ .05 alpha level. The null hypothesis which states that there is no significant influence of gender on students' performance in basic science practicals is accepted. This implies that there was no significant influence of basic science practicals on students' performance based on gender

**Table 4.** T-test Analysis on Influence of Gender on Students' Performance in Basic Science Practical

| Gender | N | Mean | SD | T | Df | Sig. |
|--------|-----|-------|------|------|-----|------|
| Male | 48 | 39.91 | 3.41 | 0.12 | 118 | 1.01 |
| Female | 72 | 43.17 | 3.78 | | | |

$H_{02}$: There is no significant influence of Basic Science on class size on students' academic performance in Secondary School.

An analysis of variance (ANOVA) was conducted to test for the influence of Basic Science practicals on students' academic performance based on class size as presented in Table 5. The analysis conducted shows that there was no statistically significant {$F$ (0.157) $p>$05.}. Therefore, the null hypothesis which states that there is no significant influence of class size on Basic Science practicals on

students' academic performance in Secondary School is accepted.

**Table 5.** Analysis of Variance (ANOVA) on Influence of Basic Science Practical on Students' Academic Performance based on Class Size

| Class size | Sum of Squares | Df | Mean Square | F | Sig. |
|------------|----------------|------|-------------|-------|------|
| Between Groups | 20.21 | 7 | 2.89 | 0.157 | 0.40 |
| Within Groups | 245.0590 | 2.72 | | | |
| Total | 265.27 | 56 | | | |

**Discussion**

This study examined the influence of Basic Science practicals on students' academic performance of Secondary School Students in Ilorin East Local Government Area, Kwara State. The finding of the study revealed that there was no significant influence of gender on students' performance in basic science practicals. This result indicated that both male and female Biology students hold similar views on the perceived influence of Biology laboratory practical

The result revealed that there was an influence of Basic Science practicals on students' academic performance. This is in line with the findings of Abidoye et al. (2022) investigated the availability and utilization of basic science laboratory facilities in junior secondary schools. The result indicated a significant difference in the performance of students when learning is supported by the laboratory. The existing laboratory is impactful for basic science learning (Abidoye & Adedeji, 2022).

This is in agreement with the findings of Akinwunmi & Falemu (2020) observed the effects of biology practicals on the academic performance of secondary school students in Biology in Ikere Local Government Area of Ekiti State, Nigeria. The result indicated that there was no significant in the performance of male and female. Contrarily, the study by Bello, (2014) reported that gender has no significant moderating effect on pupils' practical skills in Basic Science. The different findings may come from the level of school and subject matter.

The finding revealed that there is a significant influence of class size on the perceived influence of Biology laboratory practicals on students' academic performance in senior secondary school in Ilorin. Adolphus & Godgift (2022) reported that large class size has a negative influence on the teaching and learning of basic science in schools, as more time is taken by teachers in class control and discipline which affects the content delivery. In addition, the result is in line with Rono et al. (2022) who reported that it is harder for teachers to maintain students' discipline in large classes so which correlates to pupils' acquisition competencies. Similarly, Evans & Rubin (2021) reported that teachers spend more time with individual students in small classes to make sure that each student understands the concept of the subject matter and correlates to mental well-being.

## CONCLUSION

With respect to the findings of this study, it is concluded that student's academic performance in Basic Science was significant in Ilorin East, Kwara State. Also, students' academic performance in Basic Science practicals was not significantly influenced by gender. Male students did not perform better than their female counterparts in Basic Science but were significantly influenced by class size. It was found that class size also did not influence students' academic performance in Basic Science practicals.

Based on the findings of this study, the researchers therefore recommended that:

1. The Ministry of Education should provide well-equipped laboratory facilities and a good laboratory environment to promote the spirit of curiosity in students.
2. All Basic Science teachers should engage students more in Basic practical activities to facilitate better learning and understanding among male and female students.
3. The class size should be controlled and the stakeholders in the field of education should ensure that Basic Science practical facilities are properly maintained.

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