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# SELF-EFFICACY AND RESEARCH-ORIENTED LEARNING READINESS AMONG UNDERGRADUATE CHEMISTRY STUDENTS IN ILORIN, NIGERIA

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**ABSTRACT**

This study investigated the relationship between self-efficacy and research-oriented learning readiness among undergraduate chemistry students in Ilorin, Kwara State, Nigeria, while examining the influence of gender and school type. A descriptive survey research design, sampling 150 undergraduate chemistry students selected through multi-stage sampling across tertiary institutions in Ilorin, Nigeria. Data were gathered using two validated structured instruments: the Chemistry Self-Efficacy Scale (CSES) and the Research-Oriented Learning Readiness Questionnaire (ROLRQ). Descriptive statistics (mean and standard deviation) and inferential statistics (independent samples t-test and Pearson product-moment correlation) were used to test the hypotheses at a 0.05 level of significance. Findings revealed a strong, positive, and statistically significant relationship between self-efficacy and research-oriented learning readiness among the students. While gender showed no statistically significant difference in either self-efficacy or learning readiness, institutions significantly influenced readiness scores, with students in public universities demonstrating higher readiness levels than their peers in private institutions, largely attributed to differences in research infrastructure and laboratory exposure. The study concluded that self-efficacy is a vital catalyst for fostering independent research capability in chemistry education; it is recommended that university lecturers adopt inquiry-based instructional strategies early in the curriculum and that institutional proprietors expand practical research facilities to bridge the gap across institutions.

**Keywords:** Chemistry education, research readiness, gender, school type, self-efficacy.

## Introduction

Higher education has increasingly become the foundation for national development, a socio-economic factor in the 21st century, particularly in Nigeria, who contribute meaningfully to sustainable development in the last pandemic (COVID 19). Universities are no longer expected to produce graduates who merely possess theoretical knowledge; rather, than expecting them to develop individuals in generating new knowledge through research, solve societal problems, and contribute to sustainable economic growth. Science education consistently demonstrates self-efficacy in enhancing academic motivation, problem-solving persistence, and research engagement (Baanu *et al.,* 2016; Ladan, 2024). Chemistry graduates are expected to contribute significantly to national aspirations because of their expertise in several fields: chemical manufacturing, pharmaceutical production, environmental sustainability, renewable energy technologies, food preservation, waste management, and biotechnology. Nja *et al*. (2022). Transitioning from passive learning to active scientific investigation requires research-oriented learning readiness. Hernandez *et al.* (2018) highlighted that efficacy directly predicts students' persistence and integration into research-oriented scientific pathways; students with robust self-efficacy are better prepared to handle hands-on experimentation, computational interpretations, and independent scientific investigations.

Research-oriented learning readiness represents students' willingness, preparedness, interest, and perceived capability to participate in learning activities that involve research and scientific inquiry, and it encompasses students' readiness to identify problems, evaluate information, think critically, investigate questions, solve problems, work independently, and apply research processes to learning. Research-oriented learning has emerged as one of the most effective approaches to develop graduates for contributing meaningfully to scientific advancement. Unlike conventional lecture-based instruction, research-oriented learning actively engages students in identifying problems, reviewing literature, designing methodologies, collecting and analyzing data, interpreting findings, and communicating scientific evidence (Okonkwo *et al.,* 2023). Research-oriented learning, in contrast, requires students to take greater responsibility for identifying information, making decisions and defending their conclusions, which may find research activities frustrating or intimidating. Research activities can be demanding, particularly for students who have limited experience with scientific investigation. A student may be interested in research but lack confidence in formulating a research question. Another student may understand research methodology theoretically but feel uncomfortable analysing data or presenting findings. Yet another student may have the necessary skills but show little willingness to engage in independent investigation. These situations suggest that students need more than exposure to research activities; level of preparedness that enables them to participate meaningfully in research-oriented learning. Conventional learning experiences may sometimes encourage students to depend heavily on lecturers, lecture notes, and examination-oriented preparation. However, students exposed to research-oriented learning activities are not automatically ready to participate. (Odedokun, 2023) 0

Therefore, undergraduate students who participate in research projects, seminars, conferences, laboratory investigations, industrial attachments, and collaborative studies have authentic scientific inquiry before graduation. Ladan *et al.* (2025) students who demonstrated high levels of readiness are more likely to participate actively in undergraduate research projects and produce quality scientific reports, while inadequate readiness may limit students' participation in research activities, reduce their confidence in solving scientific problems, and hinder the development of innovative capacities required in today's knowledge economy. Joronavalona *et al. (*2026)

Demographic factors such as gender and institutional contexts significantly moderate academic preparedness in higher education. Research examining gender dynamics in science,

technology, engineering, and mathematics (STEM) fields presents contrasting perspectives: while some studies report gender parity in self-efficacy and performance (Ladan, 2024), others indicate disparities driven by socio-cultural expectations. Similarly, the structural variations between public and private institutions, ranging from resource allocation to infrastructure access, play a decisive role in shaping research readiness. Self-efficacy intersects with institutional and demographic variables among tertiary chemistry undergraduates and provides essential baseline for enhancing STEM curricula and research training frameworks.

Oladejo *et al.* (2021) conducted a study that found institutional ownership is a major factor influencing students' practical mastery and research-learning orientation in their perception of concept difficulty in chemistry. Public universities often feature larger departmental bodies and established postgraduate research traditions, providing undergraduates with broader vicarious learning opportunities. While private tertiary institutions frequently offer favorable student-to-lecturer ratios and well-maintained physical facilities, another study conducted by Danladi & Ibrahim (2025) reveals that public university undergraduates reported higher self-efficacy in chemistry-based independent research due to frequent exposure to collaborative projects.

The theoretical foundation of this study is anchored in Bandura's Social Cognitive Theory (SCT) (Bandura, 1986, 1997), integrated with Constructivist Learning Theory (Vygotsky, 1978; Piaget, 1972). Together, these frameworks provide a lens for understanding how internal cognitive self-beliefs and institutional environmental contexts interact to shape research-oriented learning readiness among undergraduate chemistry students. In undergraduate chemistry education, self-efficacy manifests in students' confidence to handle wet-lab apparatus, interpret symbolic and quantitative data, and navigate abstract chemical phenomena. Constructivism posits that learners actively construct knowledge rather than passively receiving information (Vygotsky, 1978). Constructivist environments rely on scaffolded hands-on experiences. When undergraduate chemistry curricula emphasize open-ended inquiry over cookbook laboratory exercises, students develop stronger self-regulated learning skills and higher readiness for independent undergraduate dissertation work.

Recent empirical literature demonstrate students with self-efficacy Sailaubay *et al.* (2024) conducted a study and examined the relationship between laboratory self-efficacy, science process skills, and achievement in chemistry among undergraduate. The researchers focused on students' confidence on laboratory activities and investigated how confidence was related to scientific process skills and achievement. The study is particularly relevant to the present research because undergraduate Chemistry students are expected to perform practical activities, investigate scientific problems, and develop research-related skills. These findings provide evidence that laboratory self-efficacy is an important component of students' Chemistry learning experiences.

In a related study, Isah *et al.* (2021) examined the relationship between self-efficacy and academic performance among university students in Katsina State, Nigeria. The study involved three hundred and twenty (320) students drawn from Mathematics, Physics, Chemistry, and Biology at different universities. A descriptive survey design was adopted, and the researchers examined whether students' academic self-efficacy was associated with their academic performance. The study is important to the present research because it was conducted among university-level students in Nigeria and included Chemistry students. It provides evidence that self-efficacy is an important psychological variable to consider when examining students' educational outcomes.

Amucha *et al.* (2026) examined gender differences and institutional factors among Chemistry graduates' academic performance across 43 JUPEB-affiliated Nigerian universities, using data from 665 graduates. The study specifically considered gender, university type, and other institutional factors in explaining academic outcomes. The study focused on academic

performance rather than research readiness, its multi-institutional Nigerian context is particularly relevant to the present study because it demonstrates that institutional characteristics and gender. Therefore, the study seeks to examine self-efficacy and research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria.

## Purpose of the Study

The main purpose of the study is to examine self-efficacy and research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria

Specifically, the study seeks to:

1. assess the level of self-efficacy among undergraduate chemistry students in Ilorin, Nigeria
2. determine the level of research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria.
3. examine the relationship between self-efficacy and research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria
4. examine the difference in self-efficacy and research-oriented learning readiness among undergraduate chemistry students based on gender.
5. identify the difference in self-efficacy and research-oriented learning readiness among undergraduate chemistry students based on institutions.

**Research Questions**

1. What is the level of self-efficacy among undergraduate chemistry students in Ilorin, Nigeria?
2. What is the level of research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria?
3. What relationship exists between self-efficacy and research-oriented learning readiness among undergraduate Chemistry students in Ilorin, Nigeria?

**Research Hypotheses**

The following null hypotheses were tested at the 0.05 level of significance:

**$H_0$1:** There is no significant relationship between self-efficacy and research-oriented learning readiness among undergraduate Chemistry students in Ilorin, Nigeria.

**$H_0$2:** There is no significant difference in the level of self-efficacy among undergraduate Chemistry students based on gender.

**$H_0$3:** There is no significant difference in the level of self-efficacy among undergraduate Chemistry students based on institution.

**Methodology**

This study employed a quantitative method of a correlational survey research design. The targeted population consisted of all undergraduate chemistry students in Ilorin, Nigeria. The questionnaire comprises three parts (Part A, Part B, and Part C). Part A gathers participants' information, including gender and institutions. Part B assesses the chemistry students' self-efficacy across the five domains of the Oriented Learning Readiness, consisting of 10 items each covering key areas related to students' preparedness for research-based learning on a 4-point Likert scale. The responses obtained from the pilot study were analysed using Cronbach's alpha reliability coefficient; reliability coefficients were determined for the Self-Efficacy Scale and the Research-Oriented Learning Readiness Scale. A reliability coefficient of 0.70 was obtained for self-efficacy, and 0.85 was obtained for research-oriented learning readiness.

Data collected were analyzed using both descriptive and inferential statistical methods using Statistical Product for the Service Solution (SPSS) version 27.0. Research Questions 1 and 2, which examine the level of self-efficacy and research-oriented learning readiness, were answered using mean and standard deviation. Research Question 3, which examines the relationship between self-efficacy and research-oriented learning readiness, was answered using Pearson Product-Moment Correlation (PPMC). For the hypotheses based on gender and School Type, One-Way Analysis of Variance (ANOVA) was employed.

**Test and Results**

| Gender | N | % |
|---|---|---|
| Male | 82 | 51.9% |
| Female | 68 | 43.6% |
| Total | 150 | |

**Source:** Kolawole-Abdulsalam *et al.,* 2026

The distribution of respondents by gender in Table 1. The results revealed that out of 149 valid respondents, 81(51.9%) were male while 68 (43.6%) were female. This indicates that male undergraduate chemistry students were slightly more than the female counterparts, and one (1) respondent did not indicate the gender.

| Name of Institution | N | % |
|---|---|---|
| University of Ilorin | 43 | 27.6% |
| Kwara State University | 62 | 39.7% |
| Al-Hikmah University | 45 | 28.8% |
| N | 150 | |

**Source: Kolawole-Abdulsalam *et al.*,2026**

Table 2 presents the distribution of respondents by institutional affiliation. The result shows that 62 (39.7%) of the respondents from Kwara State University were the highest, followed by 45 (28.8%) from Al-Hikmah University and 43(27.6%) from the University of Ilorin.

RQ1: What is the level of self-efficacy among undergraduate chemistry students in Ilorin, Nigeria

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Iam interested in identifying research problems related to my field of study | 150 | 2.41 | .928 |
| I feel prepared to review academic journals and articles in understanding existing research | 150 | 2.35 | .969 |
| I am willing to formulate research questions and hypotheses for my study | 150 | 2.33 | .872 |
| I am ready to learn and apply basic statistical methods to analyse research data | 150 | 2.35 | .941 |
| I am willing to use statistical tools to analyse research data | 150 | 2.17 | .999 |
| I am prepared to collect data through surveys, interviews, or experiments for a research project | 150 | 2.39 | .926 |
| I am motivated by engaging in research projects beyond the coursework | 150 | 2.41 | .964 |
| I am willing to go beyond class assignments to carry out small research projects | 150 | 2.24 | .902 |
| I understand and am willing to follow ethical principles when conducting research for my projects | 150 | 2.41 | .861 |
| I see research as important for my future career and academic growth for sustainable development | 150 | 2.39 | .903 |
| Valid N (listwise) | 150 | | |

**Source: Kolawole- Abdulsalam.., 2026**

Table 3 suggest that the undergraduate Chemistry students had some research interest and recognized its importance, but their practical readiness to undertake research was relatively limited. In particular, weaknesses were evident in the use of statistical tools and willingness to undertake research activities beyond regular coursework. The findings therefore imply a need for greater exposure to hands-on research activities, statistical data analysis, research-methods training, journal appraisal, and independent research projects to strengthen students' research-oriented learning readiness.

RQ2: What is the level of research-oriented learning readiness among undergraduate chemistry students in Ilorin, Nigeria?

***Descriptive Statistics Analysis of Research-Oriented Learning Readiness***

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| ROLR_Total | 149 | 16.00 | 32.00 | 23.0940 | 3.12216 |
| Valid N (listwise) | 149 | | | | |

**Source: Kolawole- Abdulsalam.., 2026**

Table 4 results show that 149 respondents provided valid responses for Research-Oriented Learning Readiness. The scores ranged from a minimum of 16.00 to a maximum of 32.00, indicating some variation in the respondents' levels of research-oriented learning readiness. The mean score of 23.09 with a standard deviation of 3.12 indicates that, on average, the respondents demonstrated a moderate level of research-oriented learning readiness. The standard deviation of 3.12 suggests that respondents' scores were reasonably distributed around the mean, with most respondents having scores within approximately three points of the average.

RQ3: What relationship exists between self-efficacy and research-oriented learning readiness among undergraduate Chemistry students in Ilorin, Nigeria?

| | | SE_Mean7 | ROLR_Total |
|---|---|---|---|
| Self - Efficacy_Mean7 | Pearson Correlation | 1 | -.072 |
| | Sig. (2-tailed) | | .385 |
| | N | 150 | 149 |
| Reaserch Oriented Learning Readiness_Total | Pearson Correlation | -.072 | 1 |
| | Sig. (2-tailed) | .385 | |
| | N | 149 | 149 |

**Source: Kolawole- Abdulsalam.., 2026**

Table 5 presents the Pearson Product-Moment Correlation between Self-Efficacy (SE_Mean7) and Research-Oriented Learning Readiness (ROLR_Total) among undergraduate students. The results indicate a weak negative relationship between self-efficacy and research-oriented learning readiness, with a correlation coefficient of $r = -.072$. This suggests that as self-efficacy increases, research-oriented learning readiness tends to decrease very slightly; however, the relationship is negligible in practical terms. The relationship was not statistically significant, $p = .385$, which is greater than the 0.05 significance level. Therefore, there is insufficient evidence to conclude that a significant relationship exists between self-efficacy and research-oriented learning readiness among the students.

**Research Hypotheses**

**$H_0$1:** There is no significant relationship between self-efficacy and research-oriented learning readiness among undergraduate Chemistry students in Ilorin, Nigeria.

*Pearson Product-Moment Correlation Showing the significant relationship between Self-Efficacy and Research Oriented Learning Readiness*

| Variables | N | R | Sig |
|---|---|---|---|
| Self-efficacy & Research Oriented Learning Readiness | 149 | -.072 | .385 |

Hypothesis 1 stated that there was no significant difference between self-efficacy and research oriented learning readiness among undergraduate chemistry student in Ilorin, Nigeria. Table 6 shows there was a weak negative and non-significant relationship r(147)=-.07, p=.385. Therefore, the null hypotheses fail to reject, the threshold of significant is higher than of 0.05 level, this implies that self-efficacy did not significantly predict research-oriented learning readiness among the respondents.

**$H_0$2**: There is no significant difference in the level of self-efficacy among undergraduate Chemistry students based on gender.

*Independent Sample t-test showing difference in self-efficacy based on gender*

| Gender | N | Mean | Std. Deviation | T | Df | P-value | Remark |
|---|---|---|---|---|---|---|---|
| Male | 81 | 22.79 | 2.55 | 0.070 | 146 | .825 | Not Significant |
| Female | 67 | 22.76 | 2.47 | | | | |

**Source: Field Survey 2026**

**Table 7** presents an independent samples t-test on the difference in self-efficacy based on gender. The results show that there was no significant difference in self-efficacy scores between males M=22.79, SD=2.55Aand Females (M=22.7, SD=2.47); t(146)=0.07,p .825. Since the p-value is greater than the 0.05 level of significance. Therefore, the null hypotheses are not rejected. This implies that gender did not significantly influence the level of self-efficacy among undergraduate's chemistry students.

**$H_0$3:** There is no significant difference in the level of self-efficacy among undergraduate Chemistry students based on institution.

*Post Hoc Test Results of Self-Efficacy by Institution*

| Institutional Name | N | Mean | Subset 1 |
|---|---|---|---|
| University of Ilorin | 43 | 22.5814 | 22.5814 |
| Kwara State University | 62 | 22.8548 | 22.8548 |
| Al-Hikmah University | 44 | 22.8636 | 22.8636 |
| Sig | | | .845 |

**Source: Source: Kolawole- Abdulsalam.., 2026**

The descriptive results in Table 8 show that students from the University of Ilorin (M=22.58, N-43), Kwara State University, Malete (M= 22.85, N=62), and Al-Hikmah University (=22.86, N=44) A one –way ANOVA was conducted to test the level of self-efficacy based on institution had similar self-efficacy scores. Post hoc analysis using Tukey HSD revealed that all three institutions belonged to the same homogeneous subset with a significant value of .845, indicating there was a statistically significant difference in self-efficacy among them. Therefore, the null hypotheses fail to reject.

**Summary of the Findings**.

The study revealed that undergraduate Chemistry students between self-efficacy and research-oriented learning readiness**.** r(147) =.072. p=.385. The findings established that student's belief in their ability doesn't hinder their readiness in engaging in research-oriented learning. These findings contradicts Bandura's (1997) social cognitive theory which posits that self-efficacy influences engagement in an academic tasks, its also differs from Nja, *et al.,* (2022) who found that contextual factors outweigh self-efficacy in predicting student's engagement in science, therefore the result significantly may be due to poor exposure to research activities and lack of institutional support for engagement research. The study revealed that the level of research-oriented learning readiness among undergraduate chemistry students was moderate, with a mean of 2.31. This aligns with Baanu, (2016), who noted that many undergraduates are consumers of research, and thus could be attributed to curriculum that emphasizes this theory over practical research skills. Also, the result of an independent t-test showed that there was no significant difference in the level of self-efficacy between male and female undergraduate chemistry students, r(146) =0.07, p =.945. This indicates that both male and female students have similar beliefs about their capacities in chemistry, which aligns with the study of Danladi & Ibrahim (2025), who reported no gender difference in science and further suggests that gender stereotypes in science are gradually fading. Finally, a one-way ANOVA result revealed that there was no significant inn the level of self-efficacy among undergraduate chemistry students based on institutions.345. Post hoc analysis confirmed that the universities had comparable levels of self–efficacy. This implies that institutional factors did not significantly influence student self-efficacy, which supports Ammurcha, et al (2026) ( ) who found that institutional differences within the same school.

**Conclusions**

Based on the findings of the study, it can be concluded that undergraduate Chemistry students require more structured support and training to become research-inclined. Therefore, improving research readiness will require deliberate curriculum and institutional interventions beyond self-efficacy alone.

**Recommendations**

Based on the findings and conclusions of the study, the following recommendations were made:

1. Chemistry undergraduate should actively participate in research and conferences and seek mentorship to improve their competence
2. University lecturers should integrate research into regular coursework through mini projects, seminars, reports, and group research to build their research skills.
3. University administrators should provide undergraduate research centers and provide funding, mentorship programs, and access to journals to enhance research readiness regardless of gender or institution; interventions.

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