



EFFECT OF VIRTUAL LABORATORY LEARNING ON PSYCHOMOTOR SKILL ACQUISITION AND PHYSICAL PERFORMANCE IN PHYSICAL EDUCATION AND OFFICE PRACTICE AMONG SECONDARY SCHOOL STUDENTS ABEOKUTA NORTH

¹OLUSANYA OMOLARA OLUWATOYIN (Ph.D), & ²TAFA OLUWOLE MOSHOOD

¹Department of Business Education, Federal College of Education, Abeokuta

²Department of Physical and Health Education, Federal College of Education, Abeokuta

Email: laraolus@gmail.com, oluwoletafa@gmail.com

ABSTRACT

This study focused on effect of virtual laboratory learning on psychomotor skill acquisition and physical performance in physical education and office practice among secondary school students in Abeokuta North. An adapted quasi-experimental design with control groups was applied to the study. The participants of the study were all the senior secondary school students taking Physical Education and Office Practice from public and private secondary schools located in Abeokuta North Local Government, Ogun State. Data were collected using the Virtual Laboratory Learning Achievement Test (VLLAT), Psychomotor Skill Assessment Scale (PSAS), and Physical Performance Rating Scale (PPRS). The findings revealed that students exposed to virtual laboratory learning achieved significantly higher mean scores in psychomotor skill acquisition (78.42 and 80.16) than their counterparts in the control groups (64.18 and 66.27). The independent t-test analysis further showed that the virtual laboratory learning programme had a significant positive effect on students' psychomotor skill acquisition ($t = 5.84, p < .05$). In addition, the Analysis of Covariance (ANCOVA) results indicated a significant difference in physical performance between students in the experimental and control groups, with the experimental group recording superior performance ($F = 18.42, p < .05$). The study concluded that virtual laboratory learning enhances students' psychomotor skill acquisition and physical performance by providing opportunities for active engagement, repeated practice, and improved understanding of learning tasks. Based on the findings, it was recommended that teachers, school administrators and educational stakeholders should integrate virtual laboratory learning into the teaching of Physical Education and Office Practice to improve students' practical competencies and overall learning outcomes.

Keywords: Virtual laboratory learning, psychomotor skill acquisition, physical performance, physical education, office practice, secondary school students



INTRODUCTION

The rapid advancement in science and technology has greatly influenced educational systems across the world, leading to the adoption of innovative instructional approaches aimed at improving students' learning outcomes and practical competence. Finding ways to integrate digital technology into the traditional systems of education has become the expectation of educators in different fields of learning. They strive to improve the levels of participation and engagement amongst students while also working to improve their understanding of practical skills. One such method that has incorporated technology at the forefront of virtual learning is the development of virtual laboratories that provide students with a complete classroom and teaching assistant in a simulated environment that students can interact with and perform exercises with virtual instruments used for hands-on experiments (Plummer *et al.*, 2021).

There is a phenomenal increase in the use of virtual laboratories to address the demand for practical instruction in the more practical oriented content fields. Research has shown that virtual learning environments provide opportunities for students to practice skills, get feedback, learn with others, and learn at their own pace which leads to enhanced understanding of the content and skills (Safaeipour *et al.*, 2025). Additionally, the use of a virtual laboratory assists in overcoming the challenges brought about by teaching and learning in large classes, inadequate teaching and learning resources, and a lack of access to resources for practical learning (Usman *et al.*, 2024).

Many secondary schools in Nigeria have inadequate teaching and learning resources and lack the resources required for practical teaching in hands-on subjects such as Office Practice and physical Education. According to Odewumi *et al.* (2020), students' active participation and development of practical skills can reduce when schools are unable to provide adequate opportunities for practical learning experiences. In the same way, Abdullahi *et al.* (2020) noted that insufficient exposure to laboratories plays a critical role in affecting students' level of practical competence and psychomotor skill acquisition in secondary schools.

Physical Education is an integral part of the secondary school curriculum. It is intended for the holistic development of learners, including physical, mental, emotional, and social development through sport and physical activities. It aims at building students' fitness, motor control, coordination, agility, flexibility, balance, and teamwork. In the learning of Physical Education, there is need for students' participation, movement practice, and demonstrations. Learners are expected to attain various psychomotor skills, including running, jumping, throwing, balancing, and winding through practical activities. Unfortunately, a number of schools do not have adequate teaching resources, modern facilitation, and sporting services, thus negatively impacting students' practical work of Physical Education (Greiner & Wagner, 2026).

Office Practice is yet another subject of a practical nature that aims at providing students with the skills and knowledge of vocational and administrative work that are required in the business and office environments. The subject provides students with knowledge of practical office services, including keyboarding, filing, operating office equipment, communicative skills, and control of documents and records. When fully utilized, Office Practice equips students with practical skills that will enable them to seek employment and engage in business enterprises. Office Practice is mostly dominated by practical and teaching activities in the secondary schools and results in the practical skills of students (Lawal *et al.*, 2023).



In Physical Education and Office Practice, learning is not complete without the acquisition of psychomotor skills. These skills combine control of physical movement with a high degree of cognitive and manual dexterity, speed, and precision. In Physical Education, the acquisition of these skills is showcased when students are able to control the movements of their body to execute physical activities and are able to effectively participate in sports. In the Office Practice area, the acquisition of these skills is demonstrated when students are able to perform typing with a high level of accuracy, operate office equipment with a high level of efficiency, perform proper filing of documents and execute office activities with a high degree of competence. Zhang *et al.* (2021) assert that psychomotor skills are enhanced when students are actively engaged and given opportunities to participate in practical activities and to perform repetitive practice in a learning environment that is interactive.

Furthermore, virtual laboratory learning gives opportunities to engage in interactive practical activities that are likely to enhance students' confidence, speed, coordination, and accuracy. The opportunity to engage in practice numerous times is likely to enhance students' efficiency and competence in practical activities. Li & Liu (2026) assert that virtual and blended learning approaches positively impacted students' physical fitness and practical performance related to activities that required the acquisition of skills. Furthermore, the potential of virtual laboratory learning in Office Technology and Management is particularly significant, as it provides opportunities for practical skill development, simulation of real workplace environments, enhanced decision-making abilities, and improved overall learning outcomes and productivity (Olusanya, 2025). In the same way, Greiner & Wagner (2026) claimed that engaging students in Physical Education activities through the use of virtual learning and other technology-based learning activities enhanced students' motor skills in coordination and movement precision.

Despite the opportunities afforded by virtual laboratory learning, many secondary schools in Nigeria still struggle to adopt educational technologies in teaching. Challenges, including inadequate computer resources, poor supply of electricity, poor internet access, poor funding, and low educator levels of educational technological competencies continue to impede the effective application of virtual technologies in secondary school environments (Usman *et al.*, 2024). As a result, many educators still use traditional teaching, which incorporates more theory than practical.

Consequently, students in many secondary schools exhibit poor psychomotor skills and low levels of physical performance in Physical Education and Office Practice. Many students experience difficulties in practical activities that require coordination, precision of movement, keyboarding proficiency, operation of office equipment, and active participation in sports due to limited opportunities for repeated practice. The persistent poor performance in practical activities has become a source of concern for teachers, parents, school administrators, and curriculum planners. Therefore, this study sought to examine the effect of virtual laboratory learning on psychomotor skill acquisition and physical performance in Physical Education and Office Practice among secondary school students in Ogun State.

PURPOSE OF THE STUDY

The general purpose of the study is to assess the effect of virtual laboratory learning on psychomotor skills acquisition and physical performance in office practice and Physical Education among secondary school students in Ogun State.

The specific purposes are to:

1. assess the effect of virtual laboratory learning on the acquisition of students' psychomotor skills and physical performance in Physical Education and Office Practice;
2. investigate the difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods.

RESEARCH QUESTIONS

The following research questions will guide the study:

1. What is the effect of virtual laboratory learning on students' psychomotor skill acquisition and physical performance in Physical Education and Office Practice?
2. Is there any difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods?

RESEARCH HYPOTHESES

The following null hypotheses will be tested at 0.05 level of significance:

1. There is no significant effect of virtual laboratory learning on students' psychomotor skill acquisition and physical performance in Physical Education and Office Practice.
2. There is no significant difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods.

METHODOLOGY

A quasi-experimental research design that incorporated a pre-test and post-test control group design was used to investigate the effect of virtual laboratory learning on psychomotor skills acquisition and physical performance in office practice and Physical Education among secondary school students in Abeokuta North. The target population for the study comprised all Senior Secondary School students offering Physical Education and Office Practice in all 5 public and 5 private secondary schools in the study area. The researcher used multistage sampling to select the schools and the students that participated in the study. The selected students were then divided into experimental and control groups. The researcher used Virtual Laboratory Learning Achievement Test (VLLAT), Psychomotor Skill Assessment Scale (PSAS), and Physical Performance Rating Scale (PPRS) to collect research data. The instruments were validated by experts in relevant fields to ensure their content and face validity. The reliability of the instruments was established using the Cronbach Alpha reliability method, yielding a reliability coefficient of 0.75, which was considered adequate for the study. A pre-test was carried out and then the experimental group was taught Virtual Laboratory Learning while the control group was taught using the traditional method. A post-test was then conducted. The collected data were analyzed by mean and standard deviation to respond to the research questions, while t-test and Analysis of Covariance (ANCOVA) were used to test the research hypotheses at a significance level of 0.05.

RESULTS

Research Question 1: What is the effect of virtual laboratory learning on students' psychomotor skill acquisition and physical performance in Physical Education and Office Practice?

Table 1: Mean and standard deviation of students' psychomotor skill acquisition and physical performance

Group	N	Mean	Std. Deviation	Decision
Experimental Group	50	78.42	6	High
Control group	50	64.18	7.12	Moderate

Table 1 shows the mean and standard deviation of the impact of virtual laboratory learning on students' psychomotor skill acquisition and physical performance in Physical Education and Office Practice. The experimental group exposed to virtual laboratory learning had a mean score of 78.42 and a standard deviation of 6.00. The control group, exposed to the normal classroom setting of teaching, had a mean of 64.18 and a standard deviation of 7.12.

This shows that students who had the virtual laboratory learning had higher psychomotor skill acquisition and physical performance than the control group students. The experimental group's psychomotor skill acquisition and physical performance was rated as "High," suggesting that virtual laboratory learning improved students' practical skill, coordination, and overall performance in Physical Education and Office Practice. The control group's level of psychomotor skill acquisition was rated as "Moderate." The standard deviations of the groups suggest that students' responses were in close range to the mean, which shows that the students' performance in the two groups exhibited relative consistency. Overall, the results show that virtual laboratory learning positively impacted students' psychomotor skill acquisition and physical performance in Physical Education and Office Practice.

Research question 2: Is there any difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods?

Table 2: Mean and standard deviation of students' psychomotor skill acquisition

Group	N	Mean	Std. Deviation	Decision
Experimental Group	50	80.16	5.84	High
Control group	50	66.27	6.91	Moderate

Table 2 shows the mean and standard deviation of the difference in the levels of psychomotor skills of the students taught using virtual laboratory learning compared to the students taught using the conventional teaching methods. The data indicated that the experimental group attained a mean score of 80.16 and a standard deviation of 5.84, while the control group attained a mean score of 66.27 with a standard deviation of 6.91. The higher mean score achieved by the experimental group

indicates that students taught using virtual laboratory learning developed more psychomotor skills than those taught using the traditional teaching methods. The decision rating of 'High' for the experimental group indicates that virtual laboratory learning enhances the students' skills, coordination, and overall competence in the practice of Physical Education and Office Practice. The control group indicated a 'Moderate' level of acquisition of psychomotor skills. The standard deviation for both groups being about the same as the mean score for both groups of respondents also indicates that the students' responses in both groups were not spread out and were more or less the same. Therefore, it can be observed that there is a significant difference in the acquisition of psychomotor skills of students taught using virtual laboratory learning compared to students taught using the traditional methods, with the experimental group being more advanced.

TESTING OF HYPOTHESES

H0₁: There is no significance effect of virtual laboratory learning on students' psychomotor skill acquisition and physical performance in physical education and office practice.

Table 3: t-test Analysis of Psychomotor skill acquisition and physical performance

Variable	N	Mean	Std. Dev.	t-cal.	t-crit.	Sig.	Decision
Experimental Group	50	78.42	6.35	5.84	1.96	0.00	Rejected
Control Group	50	64.18	7.12				

Table 3 showed that the experimental group had a higher mean score (78.42) than the control group (64.18). The calculated t-value of 5.84 was greater than the critical t-value of 1.96, while the significance value of 0.00 was less than 0.05 level of significance. Therefore, the null hypothesis was rejected. This indicates that virtual laboratory learning had a significant effect on students' psychomotor skill acquisition in Physical Education and Office Practice.

H0₂: There is no significant difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods.

Table 4: ANCOVA Analysis of Students' Physical Performance

Source	Sum of squares	Df	Mean square	f-cal	Sig.	Sig.
Between Group	1254.63	1	1254.63	18.42	0.000	Rejected
Within Group	6542.17	98	66.76			
Total	7796.80	99				

Table 4 revealed that the calculated F-value of 18.42 with a significance value of 0.000 was less than the 0.05 level of significance. Therefore, the null hypothesis which stated that there is no significant difference in psychomotor skill acquisition between students exposed to virtual laboratory learning and those taught using conventional teaching methods was rejected. This indicates that virtual laboratory learning significantly improved students' psychomotor skill



acquisition in Physical Education and Office Practice. The result further suggests that students exposed to virtual laboratory learning demonstrated better practical skills, coordination, and performance than students taught using conventional teaching methods.

DISCUSSION OF FINDINGS

This study found that learning through virtual laboratories improved the acquisition of psychomotor skills in Physical Education and the Office Practice subject. The students in the experimental group scored an average of 78.42, while the students in the control group scored an average of 64.18, meaning that virtual lab learning improved the students' practical skills, coordination, and performance. This shows that virtual learning labs can give learners the chance to practice tasks multiple times with the benefit of getting feedback right away and through an active learning process. This confirms the results from Akinbobola & Afolabi (2022), where students' learning and performance in science-based subjects were improved by the use of learning technologies. Similarly, this finding confirms that the use of learning technologies improves students' learning and enhances the outcomes of the students' learning.

The study also showed the gap in acquisition of psychomotor skills of the students who were exposed to virtual laboratory teaching as opposed to the students taught with the traditional teaching methods. The experimental group recorded an average of 80.16 while the control group recorded an average of 66.27, meaning that virtual laboratory learning taught the students' psychomotor skills. This is also the finding of Oyelekan, Igbokwe, & Olorundare (2021), who stated that teaching with technology improved students' practical skills and enhanced performance as compared to the traditional teaching methods. Virtual and simulation-based learning, as stated by Olumorin & Aderogba (2022), increased learners' involvement and improved their skill proficiency in practical tasks.

The results of hypothesis one showed that virtual laboratory learning impacted the development of students' psychomotor skills in Physical Education and Office Practice. The computed t-value (5.84) was found to be greater than the critical t-value (1.96), and the value (0.00) was found to be less than the level of significance (0.05). These results therefore confirm that virtual laboratory learning is a valuable teaching method to enhance students' practical skills. This finding supports Yusuf & Balogun (2021), who also found that students' practical and manipulative skills were improved by online digital platforms and learning activities.

Similarly, the results of hypothesis two showed a significant difference in the development of psychomotor skills by students who used virtual laboratory learning as compared to those who used conventional teaching methods ($F = 18.42$, $p < .05$). These results show that the virtual laboratory learning activities were the main reason for the improvement that the students in the experimental group showed. This finding also supports Adeyemi & Olaleye (2023), who found that students who used virtual teaching and learning methods demonstrated significant improvement in their practical skills and the retention of the skills compared to students taught in the conventional classroom setting. The finding also supports Ajayi & Ogunleye (2022), who also concluded that the use of technology in teaching and learning shows positive effects on the development of students' psychomotor skills and their overall academic performance.

CONCLUSION

The research indicated that learning through a virtual laboratory consistently boosted secondary school students' acquisition of psychomotor skills and their physical performance in both Physical Education and Office Practice. Compared to conventional teaching methods, virtual laboratory learning stimulated students' physical participation and performance, facilitated better practical skills, and improved their coordination and accuracy. The study also found that learning through a virtual laboratory offers interactive and simulated practical experiences where students are able to engage, practice, and reinforce their understanding of the practice. It was also found that there was a noticeable difference in psychomotor and practical activities where the students who participated in virtual laboratory learning outperformed those taught through the conventional methods. Thus, virtual laboratory learning was proven to be an effective teaching method to improve practical learning in Physical Education and Office Practice.

RECOMMENDATIONS

The following recommendations were made in line with the findings of the study:

1. Secondary school educators should apply virtual laboratory learning in teaching Physical Education and Office Practice in order to improve psychomotor skills and physical performance of the students.
2. Secondary school principals should ensure the provision and enablement of appropriate technologies such as computers, internet connectivity, video projectors, and virtual learning applications to enable effective virtual laboratory learning.
3. The government and education stakeholders should ensure teachers are trained in the use of virtual laboratory learning within practical subjects by conducting professional development workshops and seminars.



4. Virtual laboratory learning should be embedded within the Physical Education and Office Practice curricula to enhance practical learning experiences.

REFERENCES

- Abdullahi, M., Daniel, T. A., Lasisi, A. R., & Dania, C. M. (2020). Effects of virtual laboratory experiments on students' academic performance in physics practical. *British Journal of Education*, 8(5), 26–39.
- Adedoyin, O. B., & Soykan, E. (2023). The impact of digital learning technologies on students' engagement and learning outcomes in higher education. *African Journal of Educational Technology*, 15(2), 45–58.
- Adeyemi, T. O., & Olaleye, F. O. (2023). Virtual learning environment and students' academic performance in Nigerian tertiary institutions. *Nigerian Journal of Educational Research and Evaluation*, 22(1), 88–101.
- Ajayi, I. A., & Ogunleye, B. O. (2022). Technology-supported learning and psychomotor skill development among secondary school students in Nigeria. *Journal of Educational Studies and Research*, 10(3), 112–124.
- Akinbobola, A. O., & Afolabi, F. (2022). Technology-enhanced instruction and students' practical skill acquisition in science education. *Journal of Science Teachers Association of Nigeria*, 57(1), 67–79.
- Greiner, J., & Wagner, I. (2026). Virtual reality in physical education: A systematic literature review. *European Physical Education Review*.
<https://doi.org/10.1177/1356336X261427728>
- Lawal, A., Aliyu, Z., Madugu, A. B., & Yahaya, S. (2025). Blended STEM instruction using virtual labs and simulations: Effects on academic performance and self-efficacy among secondary school students in Kaduna State, Nigeria. *Journal of Educational Research and Development*, 20(2), 120–138.
- Li, Z., & Liu, X. (2026). Effects of blended learning on physical fitness and basketball skills of male college students: A cluster randomized controlled trial. *Frontiers in Psychology*, 17, 1792646. <https://doi.org/10.3389/fpsyg.2026.1792646>
- Olumorin, C. O., & Aderogba, A. A. (2022). Simulation-based learning and students' achievement in practical-oriented courses in Nigerian colleges. *African Journal of Educational Management*, 23(2), 145–159.



- Olusanya, O. O. (2025). The potential impact of artificial intelligence (AI) on office technology and management in selected organizations in Ogun State. *SSR Journal of Economics, Business and Management (SSRJEBM)*, 2(2), 49-57.
- Oyelekan, O. S., Igbokwe, J. C., & Olorundare, A. S. (2021). Effects of technology-based instructional strategies on students' achievement and practical skills acquisition in science education. *Journal of the Science Teachers Association of Nigeria*, 56(2), 93–105.
- Plummer, L., Smith, L., Cornforth, E., & Gore, S. (2021). Teaching psychomotor skills in a virtual environment: An educational case study. *Education Sciences*, 11(9), 537. <https://doi.org/10.3390/educsci11090537>
- Safaeipour, R., Aalaa, M., Mojtahedzadeh, R., Mohammadi, A., Asadzandi, S., & Mousavi, A. (2025). Virtual or blended laboratories for healthcare students education: A systematized review. *BMC Medical Education*, 25, 1352. <https://doi.org/10.1186/s12909-025-07937-7>
- Usman, N. S., Shu'aibu, G., Idris, A., Ahmad, S. S., Harbau, M. H., Jamilu, H. Y., Ahmad, I. S., & Muhammad, S. A. (2024). Development and validation of virtual laboratory package for effective teaching and learning of biology practicals in secondary schools in Nigeria. *ATBU Journal of Science, Technology and Education*, 12(1), 45–59.
- Yusuf, M. O., & Balogun, M. R. (2021). Digital learning platforms and students' acquisition of practical skills in Nigerian schools. *Nigerian Journal of Educational Technology*, 16(1), 34–48.
- Zhang, D. (2026). Enhancing motor skill acquisition and autonomous motivation in university physical education: A randomized controlled trial of a STEAM-integrated approach. *Frontiers in Psychology*, 17. <https://doi.org/10.3389/fpsyg.2026.1754141>.