Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/13626
DOI URL: http://dx.doi.org/10.21474/IJAR01/13626

RESEARCH ARTICLE

A COMPARATIVE ANALYSIS OF UNDERGRADUATES SCIENCE PROCESS SKILLS

Mathew David Femi and Abu Simon
Department of Integrated Science Kogi State College of Education, Ankpa.

Manuscript Info

Manuscript History
Received: 31 August 2021
Final Accepted: 30 September 2021
Published: October 2021

Key words:-
SPS, Public, Private, Tertiary Institutions, Undergraduates

Abstract

The concept of science process skills encompasses the conceptual understanding of the basic scientific inquiries that underlie the achievement of the trending science, technology, engineering, and mathematics (STEM) education being encouraged by governments and educators globally and which Nigeria is not exempted. Nevertheless, the importance of science process skills is well documented in the literature. However, research investigating the variation in science process skills among undergraduates is scarce. Thus, the current study aimed to compare differences in science process skills between undergraduates in public and private tertiary institutions in Nigeria. Two hundred and six undergraduates pooled from public and private tertiary institutions in Kogi State, Nigeria, participated in the study. The independent t-test found no statistically significant difference between the private and public tertiary institution students in SPS, t (204) = 1.147, p = 234. The study attributes this outcome to the poor knowledge of SPS among undergraduates in public and private tertiary educations. Thus, it is recommended that effort should be geared towards imparting SPS knowledge to the learners.

Introduction:-

Science education is an integral part of 21st-century education(Kalogiannakis et al., 2021) and is advocated early in learning(Tavares et al., 2021). The increasing series of global, technological, and scientific advancements have created the need for decent performance in science education at all levels of education(Taştan et al., 2018). Science education is a discipline concerned with imparting scientific knowledge and methods on learners without a scientific background (Ohunene &Ebele, 2014). Science education entails exposing the learners to critical thinking and basic scientific skills, including practical steps, creativity, and originality in scientific explorations. (Olayinka, 2019)referred to science as the study of knowledge that can be transformed into a system dependent on evaluative facts. Science education is a critical tool for individuals and the nation to survive and meet global economic goals. Extensive literature has linked science education with human, national and economic development (Agarkar, 2017; Alam, 2009; Clement et al., 2017; Dovgyi et al., 2020; Drori, 2000; Helen N., 2019; Jacob Kola, 2013; Kyle, 2020; Sugimoto, 2019). It is generally agreed that exposing young learners to the basic knowledge of investigating concepts in their environment may be an essential pathway to improving our society.

Science education is based on reasoning, problem-solving, and processes. Hence, one possible way to impact students' science skills is to expose them to the science process skills (Hernawati et al., 2018). Science process skills refer to learning abilities that need to be embedded, practiced, and owned by students(Wahyuni et al., 2017). It is the

Corresponding Author:- Mathew David Femi
Address:- Department of Integrated Science Kogi State College of Education, Ankpa.

procedural skills, experimental and investigative science habits of mind, or scientific inquiry abilities expected of science learners. Thus, the vital role of science education is to equip the learners with science process skills (Ekici & Erdem, 2020). Science process skills denote critical indicators of teaching objective accomplishment(Gunawan et al., 2019).Moreover, the concept of science process skills entails integrating scientific skills, knowledge, and favorable attitudes to advance a better understanding of scientific concepts. The science process skills are embedded in scientific thinking and decision-making(Yumusak, 2016). Hence, instructors are expected to focus on using facts, concepts, and theories to guide students through scientific investigation.

Basic science process skills include observing, connecting, inference, analysis, hypothesis, and defining variables operationally(Asy'ari et al., 2019). These skills are lifelong skills that allow students to generate ideas, weigh decisions intelligently and understand the evidence behind public policy-making (Olayinka, 2019). Although, inculcating science process skills in beginners is not a simple task for teachers (Suryanti et al., 2020).Exposing students to relevant science materials and experiences enhance their learning motivation and prompts them to participate in science activities.

Numerous studies have explored the concept of science process skills in recent years(Arifullah et al., 2020; Duda et al., 2019; Inayah et al., 2020; Irwanto et al., 2017; Laksono et al., 2017; Langtang, 2018; Maison et al., 2020; Nuraini & Muliawan, 2020; Prabowo, 2015; Rahayu & Syarifudin, 2019; Savitri et al., 2017; Sukarmin et al., 2018; Wardani & Djukri, 2019; Yunianti et al., 2019). One study reported that a lack of essential science process skills made students perform poorly in physics practicum(Maison et al., 2019). Research contends that good science process skills could improve student's understanding of basic concepts in science subjects(Inayah et al., 2020).

Academic activities comprising basic and integrated process skills are a crucial basis for scientific education and literacy. Accordingly, one may classify these skills as fundamental and integrated due to their usage according to student's progression. For example, basic science process skills such as observing, using numbers, and classifications are the foundation for acquiring science process skills in early learning. Appropriate selections of science process skills begin in the early years of primary school, and the essential skills are considered a prerequisite to learning the integrated skills. The youngsters are allowed to observe, handle things and explore the environment (Ango, 2002). The science process enables the learners to acquire and retain cognitive, affective, and psychomotor features of scientific training, which will empower them to explore practical science as part of human culture (Akani, 2015).The science process skill at the higher education level includes observing, hypothesizing, experimenting, controlling variables, and communicating data. These basic skills relating to scientific studies have attracted increasing concern in the Nigerian tertiary institutions.

The present study compares the science process skills of undergraduates from public and private tertiary institutions in Nigeria. There is a growing concern about the declining scientific attitudes of undergraduates in the tertiary education level in Nigeria, as most students no longer demonstrate scientific behaviors in relation to observation and measurements. Perhaps, there is a wide suggestion that the trend is pervasive in the public tertiary institutions. Several factors, including the shortage of qualified scientific instructors, unequipped laboratories, institutional neglect, and lack of scientific objectives, have been implicated in declining science process skills in public institutions. However, insinuations suggest that public tertiary institutions are more equipped and designed to impart scientific knowledge to the students. Although, the difference in academic performance between public and private students is still unclear. The present study is aimed to determine the variation in science process skills among Nigerian undergraduates based on institutional differences.

Hypothesis

A hypothesis was formulated to guide the present study: thus, it was hypothesized that; the students in the public tertiary institutions would show higher science process skills than the students from private institutions.

Method:-

A total of two hundred (n=206) year-one students drawn from public and private tertiary institutions in Kogi states of Nigeria comprising males and females participated in the study. The students were generally pooled from the institution's environment and included first-year students enrolled in science courses. A cross-sectional survey design was used in this study.

Measure:-

Science process skills were measured using an instrument based on Chiapetta and Koballa's (2002) science process skill indicators. The scale was modified to suit the current study samples. The scale contains 18 items scored on a four-point Linkert-type scale ranging from (1 = strongly disagree to 4 = strongly agree). The science process skills were described in the scale, and respondents were expected to highlight the specific science process skill defined by the statement. This section required the respondents to identify the definitions of the following basic science process skills: predicting, communicating, measuring, classifying, observing, and inferring. A higher score indicates higher science process skills. A Cronbach alpha .78 was obtained on the scale following a pilot study.

Result:-

Table 1:- Table showing the t-test result comparing public students and private students on test anxiety.

Institution	N	t	df	Sig
Private institution	93	1.237	204	234
Public institution	113			

A t-test was conducted to compare differences in SPS between the public and private tertiary institution students. The result indicated no significant difference between the undergraduates from private or public tertiary institutions on SPS, t (204) = 1.147, p = 234. Thus, our hypothesis, which stated that students in the public schools would possess higher SPS than the student in the private institutions, was untrue.

Discussion:-

This study aimed to compare the conceptual understanding of basic science process skills between undergraduates from public and private tertiary institutions in Nigeria. The analysis conducted on the data showed that the majority of the student from the public and private institutions had a poor conceptual understanding of SPS. It was observed that most of the respondents could not identify the correct definitions for predicting, communicating, observing, and inferring. Moreover, the independent t-test established no significant difference between the students from public and private tertiary institutions. Thus, the expectation of the study was not supported. The importance of science process skills in developing scientific inquiry skills is well documented (Deta et al., 2020; Gultepe, 2016; Molefe et al., 2016; Mushani, 2021; Tan et al., 2020). It is assumed that the higher education approach of teachingbasic science processes does not allow the learners to acquire the required practical knowledge relating to scientific methodologies. Hence, a poor conceptual understanding of basic SPSby the students. Especially in predicting, communicating, observing, and inferring. The results suggest that the students from the public and private schools did not have sufficient conceptual understanding of SPS, which explains the inability to establish a differential outcome in the study. This revelation entails that the students may face challenges in conducting basic research requirements in their respective disciplines and jeopardize their competence in conducting scientific inquiries in their future career endeavors.

Conclusion:-

The findings from this study have tremendous implications for the sustenance of science education and the development of scientific skills in the Nigerian educational system. The undergraduates' poor conceptual understanding of SPS is of great concern bearing in mind they are expected by society to drive the country towards the technological trend. Additionally, the inability of the present study to establish a difference between the students from public and private institutions relating to SPS suggests that the trend is pervasive in the higher education system of Nigeria. However, the sample size and the study parameter pose challenges relating to the generalization of the outcome. Nevertheless, the study recommends that attention be given to SPS in all levels of education in Nigeria. This is because the present study provided insight into the condition of SPS in the education setting. Future research should explore a more comprehensive understanding of the conditions that could explain the current revelation.

References:-

1. Agarkar, S. C. (2017). Science education for national development: Indian perspective. In Science Education: A Global Perspective. https://doi.org/10.1007/978-3-319-32351-0_6
2. Alam, G. M. (2009). The role of science and technology education at network age population for sustainable development of Bangladesh through human resource advancement. Scientific Research and Essays, 4(11).

3. Ango, M. (2002). Mastery of Science Process Skills and Their Effective Use in the Teaching of Science: An Educology of Science Education in the Nigerian Context. Online Submission, 16(1).
4. Arifullah, Halim, A., Syukri, M., & Nurfadilla, E. (2020). The development of student worksheets with PhET assisted in improving student science process skills. Journal of Physics: Conference Series, 1460(1). https://doi.org/10.1088/1742-6596/1460/1/012144
5. Asy'ari, M., Fitriani, H., Zubaidah, S., & Mahanal, S. (2019). The science process skills of prospective biology teachers in plant cell material based on gender. International Journal of Emerging Technologies in Learning, 14(19). https://doi.org/10.3991/ijet.v14i19.11208
6. Catherine Ohunene, O., & Bernadette Ebele, O. (2014). Science Education and Sustainable Development in Nigeria. American Journal of Educational Research, 2(8). https://doi.org/10.12691/education-2-8-6
7. Chiappetta, E. L. & Koballa, T. R. (2002). Science instruction in the middle and secondary schools (5th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.
8. Clement, I., Bello, M., & Abdullahi Sunusi, S. (2017). Science Education and Nigeria National Development Effort: The Missing Link. In International Journal of Education and Evaluation (Vol. 3, Issue 5). www.iiardpub.org
9. Deta, U. A., Prakoso, I., Agustina, P. Z. R., Fadillah, R. N., Lestari, N. A., Yantidewi, M., Admoko, S., Zainuddin, A., Nurlailiyah, A., & Prahani, B. K. (2020). Science Process Skills Profile of Non-Science Undergraduate Student in Universitas Negeri Surabaya. Journal of Physics: Conference Series, 1491(1). https://doi.org/10.1088/1742-6596/1491/1/012067
10. Dovgyi, S., Nebrat, V., Svyrydenko, D., & Babiichuk, S. (2020). Science education in the age of industry 4.0: Challenges to economic development and human capital growth in Ukraine. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2020(1). https://doi.org/10.33271/nvngu/2020-1/146
11. Drori, G. S. (2000). Science education and economic development: Trends, relationships, and research agenda. In Studies in Science Education (Vol. 35, Issue 1). https://doi.org/10.1080/03057260008560154
12. Duda, H. J., Susilo, H., & Newcombe, P. (2019). Enhancing different ethnicity science process skills: Problem-based learning through practicum and authentic assessment. International Journal of Instruction, 12(1). https://doi.org/10.29333/iji.2019.12177a
13. Ekici, M., & Erdem, M. (2020). Developing Science Process Skills through Mobile Scientific Inquiry. Thinking Skills and Creativity, 36. https://doi.org/10.1016/j.tsc.2020.100658
14. Gultepe, N. (2016). High school science teachers' views on science process skills. International Journal of Environmental and Science Education, 11(5). https://doi.org/10.12973/ijese.2016.348a
15. Gunawan, Harjono, A., Hermansyah, & Herayanti, L. (2019). Guided inquiry model through the virtual laboratory to enhance students' science process skills on heat concept. Cakrawala Pendidikan, 38(2). https://doi.org/10.21831/cp.v38i2.23345
16. Helen N., E. (2019). Science Education: A Panacea for National Security and Economic Development. International Journal of Integrated Research in Education. https://doi.org/10.36265/ijired.2019.010110
17. Hernawati, D., Amin, M., Irawati, M. H., Indriwati, S. E., & Omar, N. (2018). The effectiveness of the scientific approach using encyclopedia as learning materials in improving students' science process skills in science. Jurnal Pendidikan IPA Indonesia, 7(3). https://doi.org/10.15294/jpii.v7i3.14459
18. Inayah, A. D., Ristanto, R. H., Sigit, D. V., & Miarsyah, M. (2020). Analysis of science process skills in senior high school students. Universal Journal of Educational Research, 8(4 A). https://doi.org/10.13189/ujer.2020.081803
19. Irwanto, Rohaeti, E., Widjajanti, E., & Suyanta. (2017). Students' science process skills and analytical thinking ability in chemistry learning. AIP Conference Proceedings, 1868. https://doi.org/10.1063/1.4995100
20. Jacob Kola, A. (2013). Importance of Science Education to National Development and Problems Militating Against Its Development. American Journal of Educational Research, 1(7). https://doi.org/10.12691/education-1-7-2
21. Kalogiannakis, M., Papadakis, S., & Zourmpakis, A. I. (2021). Gamification in science education. A systematic review of the literature. Education Sciences, 11(1). https://doi.org/10.3390/educsci11010022
22. Kyle, W. C. (2020). Expanding our views of science education to address sustainable development, empowerment, and social transformation. Disciplinary and Interdisciplinary Science Education Research, 2(1). https://doi.org/10.1186/s43031-019-0018-5
23. Laksono, E. W., Rohaeti, E., Suyanta, -, & Irwanto, -. (2017). The evaluation instrument of analytical thinking and science process skill in chemistry subject. Jurnal Kependidikan: Penelitian Inovasi Pembelajaran, 1(1). https://doi.org/10.21831/jk.v1i1.8205

24. Langtang, K. D. F. M. D. (2018). Development of a Simple Heat Learning Media to Enhance Students Science Process Skill. International Journal of Science and Research (IJSR), 7(5).
25. Maison, Darmaji, Aatalini, Kurniawan, D. A., Haryanto, Kurniawan, W., Suryani, A., Lumbantoruan, A., & Dewi, U. P. (2020). Science process skill in science program higher education. Universal Journal of Educational Research, 8(2). https://doi.org/10.13189/ujer.2020.080238
26. Maison, Darmaji, Astalini, Kurniawan, D. A., & Indrawati, P. S. (2019). Science process skills and motivation. Humanities and Social Sciences Reviews, 7(5). https://doi.org/10.18510/hssr.2019.756
27. Molefe, L., Stears, M., & Hobden, S. (2016). Exploring student teachers' views of science process skills in their initial teacher education programs. South African Journal of Education, 36(3). https://doi.org/10.15700/saje.v36n3a1279
28. Mushani, M. (2021). A Review on Teachers' Understanding of Science Process Skills and Its Importance in Science Education for Africa. Journal of International Development and Cooperation, 27(1–2). https://doi.org/10.15027/50484
29. Nuraini, & Muliawan, W. (2020). Development of Science Learning with Project-Based Learning on Science Process Skill: A Needs Analysis Study. Journal of Physics: Conference Series, 1539(1). https://doi.org/10.1088/1742-6596/1539/1/012055
30. Olayinka Olajide, S. (2019). Effects of Field Trip and Peer Tutoring Instructional Strategies on Students' Science Process Skills Acquisition in Basic Science and Technology in Junior Secondary Schools in Osun State. Journal of Education, Society and Behavioral Science. https://doi.org/10.9734/jesbs/2019/v32i430186
31. Prabowo, S. A. (2015). The effectiveness of scientific-based learning towards science process skill mastery of PGSD students. Jurnal Pendidikan IPA Indonesia, 4(1). https://doi.org/10.15294/jpii.v4i1.3495
32. Akani, A. O. (2015). Levels of Possession of Science Process Skills by Final Year Students of Colleges of Education in the South-Eastern states of Nigeria. 6(27).
33. Rahayu, A. H., & Syarifudin, B. F. (2019). Developing Science Teaching Material to Increase Elementary Students' Science Process Skill. Journal of Teaching and Learning in Elementary Education, 2(1). https://doi.org/10.33578/jtlee.v2i1.6854
34. Savitri, E. N., Wusqo, I. U., Ardhi, M. W., & Putra, P. D. (2017). Enhancement of science students' process skills through implementing the green learning method (GeLeM) with a conservation-based inquiry approach. Jurnal Pendidikan IPA Indonesia, 6(2). https://doi.org/10.15294/jpii.v6i2.11286
35. Sugimoto, T. (2019). Study on Science Education and Science Teaching Methods that Contribute to Human Resources Development Leading the Next Generation of Science Technology and Innovation towards Society 5.0. Journal of Research in Science Education, 60(2). https://doi.org/10.11639/sjst.19014
36. Sukarmin, S., Ratnasari, D., & Suparmi, S. (2018). The Instrument Implementation of Two-tier Multiple Choice to Analyze Students' Science Process Skill Profile. IJPTE: International Journal of Pedagogy and Teacher Education, 2. https://doi.org/10.20961/ijpte.v2i0.19820
37. Suryanti, Widodo, W., & Budijastuti, W. (2020). Guided discovery problem-posing: An attempt to improve science process skills in elementary school. International Journal of Instruction, 13(3). https://doi.org/10.29333/iji.2020.1336a
38. Tan, R. M., Yangco, R. T., & Que, E. N. (2020). Students' conceptual understanding and science process skills in an inquiry-based flipped classroom environment. Malaysian Journal of Learning and Instruction, 17(1). https://doi.org/10.32890/mjli2020.17.1.7
    Taştan, S. B., Davoudi, S. M. M., Masalimova, A. R., Bersanov, A. S., Kurbanov, R. A., Boiarchuk, A. V., & Pavlushin, A. A. (2018). The impacts of teachers' efficacy and motivation on student's academic achievement in science education among secondary and high school students. Eurasia Journal of Mathematics, Science and Technology Education, 14(6). https://doi.org/10.29333/ejmste/89579
39. Tavares, R., Vieira, R. M., & Pedro, L. (2021). Mobile app for science education: Designing the learning approach. Education Sciences, 11(2). https://doi.org/10.3390/educsci11020079
40. Wahyuni, S., Indrawati, I., Sudarti, S., & Suana, W. (2017). Developing science process skills and problem-solving abilities based on outdoor learning in junior high school. Jurnal Pendidikan IPA Indonesia, 6(1). https://doi.org/10.15294/jpii.v6i1.6849
41. Wardani, I., & Djukri, D. (2019). Teaching science process skill using guided inquiry model with starter experiment approach: an experimental study. Jurnal Pendidikan Biologi Indonesia, 5(2). https://doi.org/10.22219/jpbi.v5i2.8429
42. Yumusak, G. K. (2016). Science Process Skills in Science Curricula Applied in Turkey. Journal of Education and Practice, 7(20).
43. Yunianti, A. U., Wasis, & Nur, M. (2019). The Effectiveness of Guided Inquiry Learning Model to Improve Science Process Skill on Heat Matter. Journal of Physics: Conference Series, 1417(1). https://doi.org/10.1088/1742-6596/1417/1/012080.