Unizik Journal of Educational Research, Science and Vocational Studies
(UJERSVOCS) Volume 1 (1); January-April, 2025; https://unilaws.org/ujervs

RELATIONSHIP BETWEEN ACTIVE LEARNING STRATEGY AND SCIENCE EDUCATION UNDERGRADUATE UNIVERSITY STUDENTS' PERFORMANCE IN ZOOLOGY COURSE

Akachukwu Esther Ebele &Dr Mbaegbu Chioma Stephanie
Department of Science Education, Nnamdi Azikiwe University, Awka
ee.akachukwu@unizik.edu.ng

ABSTRACT

This study investigated on the relationship between active learning strategy and science education undergraduate university students' performance in zoology course. The study was carried out among undergraduate higher institution students in Biology Education. Two purposes of study, two research questions and two hypotheses guided the study. The study adopted a correlation survey. The sample for this study comprised the Biology Education students in the Department of Science Education. All the 200 to 400 level undergraduates' students in the Department of Science Education Biology option (78 male and 387 female) were used totaling to 465 undergraduate students. Two instruments were used for data collection. They are Active Learning Strategy Scale (ALSS) adopted from Grace Fayombo (2012) and the Student Performance on ZOO 201 were used. The Active Learning Strategy Scale (ALSS) which shows a consistent reliability of 0.733 using Cronbach alpha. The data were collected using ALSS and students' performance on ZOO 201. The data was analysed using Pearson product moment r and R^2 were used to answer research question and ANOVA (linear and multiple) regression to test the null hypotheses at 0.05. The findings revealed among others that low positive relationship exist between active learning strategy and science education undergraduate university students' performance in zoology. However, there is no significant relationship between active learning strategy and science education undergraduate university students' performance in zoology. It was concluded that low positive relationship exists between active learning strategy and science education undergraduate university students' performance in zoology however, there is no significant relationship between active learning strategy and science education undergraduate university students' performance in zoology. From the conclusion, recommendations were made.

Key words: Biology, Undergraduate Students Performance and Active learning strategy

Introduction

Biology is the scientific study of life. It encompasses a broad scope with several unifying themes that tie it together as a single coherent field (Freeman et al., 2019). For instance, all organisms are made up of cells that process hereditary information encoded in genes, which can be transmitted to future generations (Urry et al., 2020).

More so, Biology is the science that studies all forms of living things and has a strong relationship with the environment. It focuses on genetics, bacteria, virus, ecology, evolution, microbiology, environment, and other subjects (Behzadi, 2019; Fleischner et al., 2019; Sudarisman, 2021). It is an essential part of education because it provides information that people can use in daily life because of its advance in development (Sayan & Mertoğlu, 2020). Some authors opined that development and advances in Biology need to be delivered well in the class both in the secondary

school level and higher institution such as in the university (Khalil et al., 2019; Novick & Catley, 2020).

At the university level, Biology is learned by students in the faculty of bioscience, faculty of education and faculty of health science as an introduction and taught in more depth which contains both BIO courses and ZOO courses. BIO courses are mainly study of both living and non-living organism while ZOO courses (zoology) are mainly the study of animals (Kubiatko, 2019). ZOO courses are grouped into courses with codes and titles which some may be classified as difficult to understand base on their concepts (Çimer, 2018). Several concepts are considered difficult to understand, including animal kingdom, embryology, evolution, classification, habitat, distribution of all animals, both living and extinct and how they interact with their ecosystems (Çimer, 2018; Kubiatko, 2019).

Report has it that undergraduate students that wrote ZOO 201 in last four academic sessions performed below 70%. In 2020/2021 academic session, out of 121 that enrolled for ZOO 201 only 104 passed the course at grade level pass of A to E. In 2021/2022 academic session, out of 119 that enrolled for ZOO 201 only 58 passed the course at grade level pass of A to E. More so In 2022/2023 academic session, out of 115 that enrolled for ZOO 201 only 108 passed the course at grade level pass of A to E. Finally, in 2023/2024 academic session, out of 140 that enrolled for ZOO 201 only 126 passed the course at grade level pass of A to E. From the indications above it will be observed that the performance of undergraduate students in the said ZOO course is fluctuating. Knowing fully well that before a student will graduate from the university, he/she must pass all the courses. With this, there is need to make sure that greater percentage of students or even all passes the Biology related course to enable them graduate from the university.

Some researchers believed that the reason why both secondary school students and undergraduate students performed below percentage expectation in Biological concept of animal courses/subject (Zoology) is as a result of learning strategy (Kubiatko, 2019; Freeman et al., 2020; Aji & Khan 2019). According to Kubiatko (2019) some of the learning strategies includes visual perception, auditory, kinesthetic, reading and writing, flipped classroom, gamification, logical learning, peer instruction, management, spaced repetition, brainstorming, concept mapping, culturally responsive teaching, mnemonic, reciprocal questioning, role playing, acronyms, active learning, solitary learners, experiential learning, differentiation, nature learners, social learners and asynchronous learning.

While some groups of researchers like Fayombo, (2012), Mohammed and Jimoh (2024), Alhawiti (2021) and Freeman et. al. (2014) revealed in their different studies that there is a relationship between active learning strategy and undergraduate students' performance, Bileti (2022) observed that there is there was no significant relationship between active learning strategy and undergraduate students' performance in secondary school. This argument could be the reason why some researchers have different opinion on learning strategies based on their findings in different fields and locations. But due the present study, this study focused on active learning strategy among undergraduate students.

Active learning strategy is a form of learning strategy in which teachers/instructors/lecturers try to involve students in the learning process. It means active participation of students with learning

materials in the classroom through think-pair-share, peer discussion, collaborative work, analysis and application rather than to listen and memorize (Kubiatko, 2019). Soltanzadeh et. al. (2023) itemized the active learning strategy as video clips simulation, discussions, group work, role play, game show, five-minute paper and clarification pause. More so, active learning strategy may take place in different ways such as formative quizzes, role play, group discussion, study tour, lab work, individual assignment, debate, uses of ICT, poster making, presentation and others (Soltanzadeh et al., 2023; Freeman et al., 2020). Daniel (2022) observed that there is a moderate positive relationship between secondary school students' performance in Biology and their active learning process. Klodiana and Emilda (2022) reported that there is a low positive relationship between students' online learning engagement and students' active learning strategy. Soltanzadeh et. al. (2023) averred that there is a low negative relationship between students' performance in Biology courses and their active learning strategy not minding their genders.

Gender is that which distinguishes between the roles of boys and girls based on culture and society. According to Ng'ang'a et. al. (2019), gender is that social construction based on masculinity and femininity which is related to behaviours and attributes. Therefore, the roles as constructed by the society could influence individuals. Boy and girl students experience in involvement in active learning may affect their academic performance (Shahzad et al., 2022). While both genders experience in active learning vary in degrees, Sibomana et. al. (2021) showed that gender had no impact in the connection between active learning and academic performance. Active learning was not shown to be a significant predictor of average success scores for boy or girl students (Khesht-Masjedi et al., 2019). Nevertheless, all over the world and Nigeria in particular, the impact of gender on students' performance has continued to attract interest among science education researchers due to its generated controversies; as Nwafor et. al. (2023) averred that university science subjects are boy dominated due to the gender stereotyped by educational administrators. Empirically, the moderating impact of gender on learners' university science performance has been contradictory. While other researchers, such as those by Paulo et. al. (2017), Shahzad et al. (2022), are in favor of girls. While Bileti (2022) argued that other learning strategies can be a remedial solution for low student achievement and their research output not minding their gender and sex.

From the above, it can be deduced that issue of gender is inclusive and there is need to investigate more on it. However, despite the importance of Biology as regard to ZOO and BIO courses to humanity, there are evidence of fluctuating performance among science education undergraduate students especially in ZOO 201. This has affected the students' performance in the course. For some reasons many researchers believed that learning strategy like the active learning strategy may help in boosting students' performance especially higher institutions if implemented.

More so, the growing body of research highlighting the potential benefits of active learning strategies in enhancing student engagement, conceptual understanding, and academic performance, the adoption and implementation of this strategy in undergraduate Biology courses seems to be rare. Many universities and higher institution instructors continue to rely heavily on lecture-based approaches, which may not effectively address the diverse learning needs and preferences of students. Thus, this study focused on relationship between active learning strategy and science education undergraduate students' performance in zoology.

Purpose of the Study

The purpose of the study was to investigate the relationship between active learning strategy and science education undergraduate university students' performance in zoology course. Specifically, the study determined the:

1. To determine the relationship between active learning strategy and science education undergraduate students' performance in zoology course.
2. To determine the relationship between active learning strategy and science education undergraduate students' performance in zoology course as moderated by gender.

Research Questions

The following research questions guided to the study:

1. What is the relationship between active learning strategy and science education undergraduate students' performance in zoology course?
2. What is the relationship between active learning strategy and science education undergraduate students' performance as moderated by gender?

Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology course.
2. There is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology course as moderated by gender.

Method

This study adopted correlation design. The area of the study was a federal university in Anambra State. The population of the study comprised of all the science education undergraduate Biology option students in Department of science education in the federal university in Anambra State. The sample size for the study consisted of 638 undergraduate students that offer ZOO 201 from Department of Science Education Nnamdi Azikiwe University, Awka. Simple random sampling was use to select the 465 out of 638 undergraduate students that responded the questionnaire via online administration. The reason was that the students' results are already available at the Department (78 male and 387 female).

Instrument

Two (2) instruments were used for data collection. They are Active Learning Strategy Scale (ALSS) and students' performance in zoology course gotten from the Department of Science Education 2021/2022 – 2023-2024 academic session**.** The ALSS was adapted by the researcher from Grace A Fayombo PhD thesis 2012 which was developed by Grace A Fayombo. It has two sections. Section A comprises of the demographic variables such as gender, faculty/department, year of study. Section B consists of seven (7) items in each of the subscale. Each subscale consists of one positively and one negatively worded item. The four (4) point scale response format ranging from strongly agree (4points), agree (3 points), disagree (2 points), and strongly disagree (1 point). It has a reliability coefficient of 0.733, the seven (7) items modified to suit the purpose of the instrument.

Data generated from the study was analysed using Pearson product moment correlation (r) was used to answer research questions. In interpreting the correlation coefficients, the rule posited by Nworgu (2015) about the interpretation was adopted for the interpretation of the study using the range of scores as thus: ±0.80 to ± 1.00 was assigned to high positive or negative relationships, ±0.31 to ± 0.79 was assigned to moderate positive or negative relationship, ±0.00 to ± 0.30 was assigned to low positive or negative relationship. In interpreting the null hypotheses, the decision rule is that when P-value is less than or equal to 0.05 ($P \leq 0.05$) the null hypotheses was rejected. On the other hand, when P-value is greater than the alpha level 0.05 ($P \geq 0.05$), the null hypotheses was not rejected (accepted).

Results

Data collected were analysed and presented in tables according to research questions and hypotheses.

Research Questions 1: What is the relationship between active learning strategy and science education undergraduate students' performance in zoology course?

Table 1: Pearson Correlation Coefficient for the Relationship between Active Learning Strategy (ALS) and Science Education Undergraduate Students' Performance in Zoology

Variables & Direction	N	r	R^2	Magnitude	Sig	Decision
ALS Performance	465	.022	.000	low positive relationship	0. 755[b] Not Significant	

Key: R^2 = coefficient of determination

Table 1 reveals correlation coefficients of the relationship between active learning strategy (ALS) and science education undergraduate students' performance in zoology as .022. This means there is a low positive relationship between active learning strategy (ALS) and science education undergraduate students' performance in zoology. The coefficient of determination (.000) also known as the relationship value means that 0% of active learning strategy (ALS) accounted for the variation in science education undergraduate students' performance in zoology. This is an indication that 100% of variation in science education undergraduate students' performance in zoology courses is attributed to other factors other than active learning strategy (ALS).

Research Questions 2: What is the relationship between active learning strategy and science education undergraduate students' performance in zoology course as moderated by gender?

Table 2: Pearson Correlation Coefficient for the Relationship between Active Learning Strategy (ALS) and Science Education Undergraduate Students' Performance in Zoology as Moderated by Gender

Variables & Direction	N	r	R^2	Magnitude	Sig	Decision
ALS Performance	465	.046	.001	low positive relationship	0. 675[b] Not Significant	

Key: R^2 = coefficient of determination

Table 2 shows correlation coefficients of the relationship between active learning strategy and science education undergraduate students' performance in zoology course when moderated by gender as 0.046. This means there was a low positive relationship between male and female students' active learning strategy (ALS) and science education undergraduate students' performance in zoology course. The coefficient of determination (.001) also known as the relationship value means that 1% of male and female students' active learning strategy (ALS) accounted for the variation in undergraduate students' performance in zoology. This is an indication that 99% of variation in science education undergraduate students' performance is attributed to other factors other than active learning strategy (ALS).

Hypothesis 1: There is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology course.

Table 1 revealed the Pearson correlation coefficient for the relationship between active learning strategy (ALS) and science education undergraduate students' performance in zoology. A low positive relationship was found r (465) =.022, p=0.00>0.05) indicating no significant relationship between the two variables. The null hypothesis which stated that there is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology course is therefore uphold. The inference drawn is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology course.

Hypothesis 2: There is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology as moderated by gender.

Table 2 revealed the Pearson correlation coefficient for the relationship between active learning strategy (ALS) and science education undergraduate students' performance in zoology when moderated with gender. Low positive relationship was found r (465) = 0.046, p = 0.00 < 0.05 indicating no significant relationship between the two variables. The null hypothesis which stated that there is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology when moderated with gender is therefore uphold. The inference drawn is no significant relationship between active learning strategy and undergraduate students' performance in zoology when moderated with gender.

Discussion of Findings

The result on Table 1 shows correlation coefficients of the relationship between active learning strategy and science education undergraduate students' performance. The finding revealed a low positive relationship between active learning strategy (ALS) and science education undergraduate students' performance in zoology. Hence, there is is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology. This finding portrays active learning strategy plays no important role in science education undergraduate students' performance in zoology. The finding of this study is not supported by Kolb Experiential Learning Theory which is narrowed as the dynamics of the learning process supports performance improvement, learning and development. This finding is not in line with some groups of researchers who revealed that there is a relationship between active learning strategy and undergraduate students' performance (Fayombo, 2012; Mohammed & Jimoh, 2024; Alhawiti, 2021; Freeman et al., 2014). But the finding is in line with Bileti (2022) who observed that there is there was no significant relationship between active learning strategy and undergraduate students' performance in secondary school. The low positive relationship between active learning strategy and science education undergraduate students' performance in zoology and no significant relationship between active learning strategy and science education undergraduate students' performance in zoology is attributed to other factors other than active learning strategy (ALS). By virtue of this finding, this research has joined the school of thought there no relationship between active learning strategy and science education undergraduate students' performance.

The result on Table 2 shows correlation coefficients of the relationship between the active learning strategy and science education undergraduate students' performance in zoology when moderated by gender. The finding revealed a low positive relationship between active learning strategy and science education undergraduate students' performance in zoology as moderated by gender. Hence, there is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology when moderated by gender. This finding portrays no significant relationship between active learning strategy and science education undergraduate students' performance in zoology when moderated by gender. This finding is in consonance with Bileti (2022) who argued that other learning strategies can be a remedial solution for low student achievement and their research output not minding their gender and sex. The findings are also line with researchers who reported that gender had no impact in the connection between active learning and academic performance and that active learning was not shown to be a significant predictor of average success scores for boy or girl students (Khesht-Masjedi et al., 2019; Sibomana et al., 2021). By virtue of this finding, this research has joined the school of thought that opined that there is no relationship between active learning strategy and science education undergraduate students' performance in zoology when moderated by gender.

Recommendations

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

1. Science education undergraduate Students should constantly make use of the available zoology laboratory in our tertiary institutions. This will help them develop positive attitude towards zoology courses.

2. There is need for a greater attention to the intellectual wellbeing of the science education undergraduate students in order for them to improve their academic performance in zoology courses
3. University lecturers especially those ones in the Department of Bioscience and the ones in charge of students in Biology option in Science Education Department should endeavour to create and inculcate right active learning strategy or skills to students to enable them have right attitude towards zoology courses in order for them to perform better.

Conclusion

Based on the investigation on the relationship between active learning strategy and undergraduate science education students' performance in zoology it can be concluded among others that low positive relationship exists between active learning strategy and science education undergraduate students' performance in zoology courses. However, there is no significant relationship between active learning strategy and science education undergraduate students' performance in zoology.

Finally, it can be concluded low positive relationship exists between active learning strategy and science education undergraduate students' performance in zoology when moderated with gender. Hence, there is no significant differences in relationship between active learning strategy and science education undergraduate students' performance in zoology when moderated with gender.

REFERENCES

Aji, C. A., & Khan, M. J. (2019). The impact of active learning on students' academic performance. *Open Journal of Social Sciences,* 7 (2), 204-211.

Alhawiti, N. A (2021). The influence of active earning on the development of learner capabilities in the college of applied medical sciences: mixed-methods study. *Natural Learning in Higher Education. Encyclopedia of the Sciences of Learning*, 9(4), 276-280.

Behzadi, P. E. B. (2019). The realm of applied microbiology, biotechnology and genetic engineering through the millennia: from prehistoric era to modern era. *Open Access Journal of Microbiology & Biotechnology*, 1(1), 10–13. https://doi.org/10.23880/oajmb-16000101

Bileti, A. E (2022). Active teaching & learning practices and students' academic performance in secondary schools in Arua District. *Journal of Development, Miami.* 3(4), 4865-488

Çimer, A. (2018). What makes biology learning difficult and effective: students' views. *Educational Research and Reviews,* 7(3), 61–71. https://doi.org/10.5897/ERR11.205

Daniel, K. L. (2022). Impacts of active learning on student outcomes in large-lecture biology courses. *The American Biology Teacher*, 78(8), 651-655.

Ezeaku S. N. (2019). Creative Quality of Educational Managers in functional Education as a panacea to Achieving Sustainable Development in Anambra State, Nigeria. *Journal of Education, Society and Behavioral Science* Vol. 31 (issued) (Pg. 1-9).

Ezeaku, S. N. (2019). Dividends of Security in Managing Education for the Attainment of Sustainable Development Goals in Anambra State. *International Journal of Education, Culture and Society*, *4*(4), 60-64.

Ezeaku, S. N. Appraisal of Strategies Towards Upgrading Staff Personnel Management in Public Secondary Schools: Implications for Policy Makers in Anambra State, Nigeria.

Fayombo, G. A. (2012). Active learning strategies and student learning outcomes among some university students in Barbados. *Journal of Educational and Social Research, Special Issue,* 2(9), 79–90.

Fleischner, T. L., Espinoza, R. E., Gerrish, G. A., Greene, H. W., Kimmerer, R. W., Lacey, E. A., & Zander, L. (2019). Teaching biology in the field: Importance, challenges, and solutions. *Bio Science Journal,* 67(6), 558–567. https://doi.org/10.1093/biosci/bix036

Freeman, S., Quillin, K., Allison, L., Black, M., Podgorski, G., Taylor, E., & Carmichael, J. (2019). *Biological Science (6th ed.)*. Hoboken, N.J.: Pearson. Pp. 1–18. ISBN 978-0321976499.

Khalil, M., Lazarowitz, R., & HertzLazarowitz, R. (2019). Biology high school science curricula for the 21st century. *Creative Education Journal*, 5(16), 1464–1478. https://doi.org/10.4236/ce.2014.516164

Khesht-Masjedi, M., Shokrgozar, S., Abdollahi, E., Habibi, B., Asghari, T., Ofoghi, R., & Pazhooman, S. (2019). The relationship between genders, age, anxiety, depression, andacademic achievement among teenagers. *Journal of Family Medicine and Primary Care*, 8 (3), 799–804. https://doi.org/10.4103/jfmpc.jfmpc_103_18

Kubiatko, M. (2019). Effect of active learning on perception of and performance in. *Journal of Experimental Biology Education,* 16(4), 444–445.

Mohammed, A. O., & Jimoh A, S. (2024). Predictive role of active learning strategies on learning outcomes in economics among public secondary school students in lagos state, Nigeria. *Journal of Arts and Social Science Education,* 19(10), 19-31.

Ng'ang'a, M. W., Mwaura, P. A. M., & Dinga, J. N. (2018). Relationship between achievement goal orientation and academic achievement among form three students in Kiambu County, Kenya. *International Journal of Education and Research,* 6(4), 1-12.

Novick, L. R., & Catley, K. M. (2020). Fostering 21st-century evolutionary reasoning: teaching tree thinking to introductory biology students. *CBE Life Sciences Education,* 15(4), 1–12. https://doi.org/10.1187/cbe.15-06-0127.

Nwafor. S. C., Eke A. j & Ibe F. N. (2023). Correlation between test anxiety and students' chemistry achievement. *International Journal of Research Publication and Reviews*, 3(6), 3670-3685.

Nwankwo, I. N. (2014). Students' Participation in Decision Making and Its Implications for Educational Leadership. *Journal of Emerging Trends in Educational Research and Policy Studies* (JETERAPS) 5(3):362-367.

Nwankwo, I. N. (2024). Management Of Science and Technology Education for National Development: A Case of Secondary Schools in South East of Nigeria. *African Journal of Educational Management, Teaching and Entrepreneurship Studies*, *12*(2), 14-29.

Nworgu, B.G. (2015). *Educational Research: Basic issues and methodology (2nd ed), Nsukka*: University Trust publishers.

Ojimba, C. C. (2024). Effect Of National Industrial Court and Industrial Arbitration Panel in Resolution of Corporate Dispute. *African Journal of Educational Management, Teaching and Entrepreneurship Studies, 13*(2).

Okaforcha, C. C. and Okeke I. N (2018). Extent of Principals fund management practices for effective implementation of entrepreneurial studies in secondary schools in Awka Education Zone. *Journal of Emerging Trends in Educational Research and Polity Study (JETERAPS) vol. 10 (2).*

Okaforcha, C. C. and Okeke, N. I. (2020) School Leadership as a correlation of teachers' job satisfaction in public secondary schools in Awka Education zone of Anambra State. *Unizik Journal of Educational Research and Policy Studies (UNIJERPS)* January- June 2020 Vol. 1.NO. 1 Pg. 1-7.

Okeke Ifediorah, N. and Okaforcha, C. C. (2018). Extent of principals' classroom instructional supervision for effective teaching in secondary schools in Anambra State. *Journal of Emerging Trends in Educational Research and polity study (JETERAPS)* vol. 10 (2).

Okoye, A. C. (2016). Professional competencies required of secretaries in modern automated offices in tertiary institutions in Anambra State of Nigeria. Online Journal of Arts, Management and Social Sciences (OJAMSS), 1(1), 89-97. http://www.gojamss.net/journal/index.php/OJAMSS/article/view/89

Okoye, A. C. (2017). Strategies considered effective by business educators for teaching entrepreneurship education in tertiary institutions in Anambra State. International Journal of Social Sciences and Humanities Reviews, 7(1), 65 – 71

Okoye, A. C. (2021). Strategies for developing sustainable business education for economic development. *International Journal of Management Studies and Social Science Research, 3*(2), 76-81.

Paulo, N.V., Adelinda, A., Candeias , A. S., Neto , M. D. Glória, S Fo, Madalena Melo . (2017). Academic achievement in physics-chemistry: the predictive effect of attitudes and reasoning abilities. *British Journal of Education,* 6(3), 1-9.

Sayan, H., & Mertoğlu, H. (2020). Equipment use in biology teaching. *Journal of Educational Issues*, 6(1), 357-361. https://doi.org/10.5296/jei.v6i1.17042

Shahzad, A., Naveed, S., & Sadia, J. (2022). Students' attitude towards biology and academic achievement in biology at secondary level, in islamabad, Pakistan. *American Journal of Educational Research*, 10(5), 268–275. https://doi.org/10.12691/education-10-5-1

Sibomana, A., Karegeya, C., & Sentongo, J. (2021). Factors affecting secondary school students' academic achievements in chemistry. *International Journal of Learning, Teaching and Educational Research,* 20(12), 114–126.

Soltanzadeh, L., Hashemi, S. R. N., & Shahi, S. (2023). The effect of active learning on academic achievement motivation in high schools' students. *Archives of Applied Science Research,* 5(6), 127-131.

Sudarisman, S. (2021). Memahami hakikat dan karakteristik pembelajaran biologi dalam upaya menjawab tantangan abad 21 serta optimalisasi implementasi kurikulum 2013. *Florea Journal of Biology and Learning, 2(1), 29–35.* https://doi.org/10.25273/florea.v2i1.403

Urry, L., Cain, M., Wasserman, S., Minorsky, P., & Reece, J (2020). *Evolution, the themes of biology, and scientific inquiry. Campbell Biology (11th ed.).* New York: Pearson. Pp. 2–26. ISBN 978-0134093413.