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# **EVALUATING THE EFFECTIVENESS OF CHESS-BASED INSTRUCTIONAL MATERIALS IN IMPROVING STUDENTS' UNDERSTANDING OF SPECIES DIVERSITY: A QUANTITATIVE STUDY**

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# ABSTRACT

This study deals with the integration of chess-based instructional material since it helps the learner and teachers to make learning more interesting, practical, realistic, and appealing. This study aimed to quantitatively evaluate the effectiveness of chess-based instructional materials in improving Grade 8 students' understanding of species diversity in Libertad National High School, Libertad Sta. Monica, Surigao del Norte. The researchers used a quasi-experimental design to determine the effectiveness of the chess-based instructional materials. A pre-test and post-test design were used for comparison. The students got low scores during the pre-test while in the post-test, their scores significantly increased. It was hypothesized that there is no significant difference between the mean score of the pre-test and the mean score of the post-test since there is a substantial increase between the mean score of both pre-test and post-test. It further indicates that the P-value = P < 0.05 using a paired sample t-test. The Pearson Correlation of 74.24% explains the relationship between pre-test and post-test. This implies a significant increase in student performance with the integration of chessbased instructional material since the students enhanced their conceptual understanding of the topic. Science teachers may use this innovation in teaching for their low-achieving students. Thus, this may be discussed in the LAC sessions and in-service training for faculty.

Keywords: Teaching innovation, Board game, enhanced learning outcomes, Instructional Materials, Science literacy

# 1. INTRODUCTION

Filipino students' performance in global assessments of science literacy has always been low, and this was confirmed again in the PISA 2018, where Filipino learners' average science literacy scores ranked second to last among 78 countries (Bernardo A.B et.al, 2023). Results from international assessments like the Programmed for International Student Assessment (PISA) show the real problem of education in the Philippines. The data reported by these international assessments awaken us that science education is still a major concern that experts and policymakers need attention (Von Lorenz A. C. et.al, 2024). Science proficiency among Filipino students is still at lower levels PISA 2024 results in the Philippines placing in the bottom four among 64 countries meaning they lack critical thinking skills and problem solving which is an important skill among 21st-century learners.

The low achievement in Science of Filipino students is not a new trend in Philippine education. Local studies have long documented this science education dilemma (Orleans, 2007). Jamalsco (2017) stated that the lack of science education facilities reflected the poor quality of basic science as seen by low achievement test scores of Filipino students on various tests. Facilities and instructional material in science could affect and motivate the learners to engage in the classroom. Motivation has a significant influence on student's learning and performance (Pintrich, P.R et.al 2002). Yet studies have shown that there is a decline in student motivation toward science learning going from elementary to secondary school (Osborne, J. 2003).

Considering the educational problem presented above is enough evidence that the Philippine educational system should change to a new trend of education in terms of teaching teaching-learning process. Teachers should adopt the use of improvised instructional materials as a method of teaching science since it is found most effective (Affiah, D. et.al, 2022). Specifically, in game-based instructional material, learning in the form of a game is one of the oldest and most useful pedagogical ideas that has been applied throughout the history of mankind (Ferreira, S.M. et.al, 2016).

Incorporating the chess game principle into explaining the concept of science specifically species diversity can significantly improve the performance of the students by blending educational content with interactive learning. Gamified and immersive educational interventions have proven to be powerful motivators to encourage participation in unattractive activities (Yuan, Q. et.al 2024). Chess game activities ensure the effective development of cognitive and intellectual abilities of students, motivation to study science and mathematics, and productive development of its problem areas (Dvoryatkina, S. N et.al 2021). By simulating diverse ecosystems through game mechanics, students can explore the roles of various species, their interactions, and the impact of diversity on ecosystem stability. This approach

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not only makes the concept more engaging but also helps students grasp complex ecological relationships through practical, hands-on experience.

Thus, this study aimed to quantitatively evaluate the effectiveness of chess-based instructional materials in improving students' understanding of species diversity in Libertad National High School, Libertad Sta. Monica, Surigao del Norte. The study will determine whether integrating chess into the learning process leads to a significant improvement in students' understanding of ecological concepts compared to traditional instructional methods.

### 2. METHODOLOGY

This chapter presents the research design, research respondents, instrument, data gathering procedure, and data analysis. **Research Design** 

The researcher employed a quasi-experimental design to evaluate the effectiveness of chess-based instructional materials in improving students' understanding of species diversity. In this design, there is only one group and all of them were in the experimental condition. Before the proper class instruction, a pre-test was administered, followed by a treatment, and then a post-test.



Figure1: Quasi-experimental Design specifically Pre-test and Post-test Design

#### Participants

The participants of the study were the 50 Grade 8 students of Libertad National High School – Libertad, Sta. Monica, Surigao del Norte, S.Y. 2024-2025.

#### Instrument

This study used a researchers-made test questionnaire. Fifty (50) items of multiple types of tests were deployed and administered in the pre-test and the post-test. Two master teachers from different schools validated the content of the questionnaire with the table of specifications. The items were divided based on the level of Bloom's taxonomy.

The researchers Administered the Pilot testing at Alegria National High School, Alegria Sta. Monica, Surigao del Norte to test the validity and the reliability of the test questionnaire. The correlation was computed using Pearson Product Moment Coefficient of Correlation, to get the reliability index of the research instrument. The obtained value is 0.76 which means that it has a high relationship, thus the result of the reliability coefficient is good for the classroom test.

#### **Data Gathering Procedure and Ethical Consideration**

The researchers write a letter of request to the school principal of Libertad National High School asking for approval to conduct a study. Another letter of request was sent to the experts asking for their expertise to validate the table of specifications and the researchers made test questionnaire. After approval of the request, the researchers administered the pre-test. After the pre-test, the researcher starts the class instruction with the integration of chess-based instructional material to understand species diversity. Each topic had an allotted time of one hour. The assessment and evaluation were given to the students after the end of the lesson to determine whether the students understood the lesson about species diversity.

Administration of the Post-test. The post-test will be conducted after the treatment being applied in the same manner as the pre-test.

| THIRD QUARTER | LIVING THINGS AND THEIR ENVIRONMENT      |
|---------------|--|
| Module 1      | Introduction to species diversity        |
| Lesson 1      | Factors affecting species diversity      |
| Lesson 2      | Measuring species diversity              |
| Lesson 3      | Ecosystem Examples and Species Diversity |

Table 1. Lesson Coverage

After the administration of the pre-test and post-test, the researcher checked the papers. The results were recorded and tabulated.

#### **Data Analysis and Statistical Tool**

The statistical tools used in the interpretation of the data were as follows:

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|--------------------|--|-----------------------|
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| editor@ijprems.com | Vol. 04, Issue 12, December 2024, pp : 2079-2084                           | 7.001                 |

Frequency Count and Percentage Computation. These will be used to describe the profile of the participants.

Arithmetic Mean and Standard Deviation. These will be used to determine the pre-test and post-test mean scores.

**T-test.** used to determine the significant difference between the mean gain scores of the experimental group and the control group.

# 3. RESULT AND DISCUSSION

The integration of chess into education is increasingly recognized for its potential to enhance student learning outcomes and foster critical thinking skills (Chitiyo et.al 2024). Incorporating the Chess principle in teaching Species Diversity could enhance the understanding by integrating interactive learning. Using the principle of chess to species diversity would create a game-based approach where the students would engage in an activity that reflects ecological interactions. The goal of this innovation is to build and maintain a balanced ecosystem by managing species diversity, and interactions and maintaining optimal biodiversity levels or to solve specific ecological challenges. Chess has a great potential for forming personal qualities and developing the creativity and abilities of a high school student who faces the challenges of modern life, analyzes, synthesizes, summarizes, thinks critically, and initiates (Dallakyan et.al 2024). This approach transforms the concept not just more engaging but also helps students to cop with complex ecological relationships through practical, hands-on experience



Figure 2: Chess-Based Instructional Material

#### **Profile of the Students**

The data presented in table 2 provides valuable insights into the demographic profile of the students, highlighting significant trends regarding sex, age, number of siblings, and parental educational attainment, all of which have profound implications for the students' educational experiences and outcomes. Notably, the predominance of female respondents (62%) compared to males (38%) may reflect broader societal trends or cultural factors influencing educational enrollment. This gender imbalance raises questions about whether it persists at higher educational levels and its potential impact on future career opportunities. Additionally, the fact that 56% of the students are 14 years old suggests they are in a critical developmental stage, typically associated with increased independence and identity formation, which can affect their academic engagement and aspirations. The statistic indicating that 48% of families have between 1-3 siblings points to relatively small family sizes, which may allow for more individualized parental attention and support for each child. However, sibling dynamics can also play a role in educational outcomes, as older siblings may serve as role models or sources of support for younger ones. Moreover, the educational attainment of parents is crucial in influencing children's success; with 36% of fathers and 46% of mothers having only completed high school, this level of education often correlates with socioeconomic status and affects parents' ability to provide academic support or resources. Parents with higher educational levels are typically more equipped to assist with homework and foster a conducive learning environment at home. The findings suggest a potential correlation between parental education levels and the ability to afford educational opportunities for their children. If most parents have only achieved a high school education, it raises concerns about their capacity to navigate higher education systems or advocate effectively for their children's needs, potentially leading to a cycle of limited educational attainment within families and perpetuating socioeconomic disparities.

In summary, the profile of these students underscores interconnected trends that shape their educational experiences. Addressing these issues requires a multifaceted approach that includes community support programs, targeted interventions for families with lower educational attainment, and policies aimed at increasing access to quality education for all children.



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| Table 2. Profile of the Students |                        |                |  |  |
|----------------------------------|------------------------|----------------|--|--|
| Profile of the Students          | No. of Students (n=50) | Percentage (%) |  |  |
| Sex                              |                        |                |  |  |
| Male                             | 19                     | 38%            |  |  |
| Female                           | 31                     | 62%            |  |  |
| Age                              | 3                      |                |  |  |
| 13                               | 28                     | 6.%            |  |  |
| 14                               | 17                     | 56%            |  |  |
| 15                               | 2                      | 34%            |  |  |
| 16                               |                        | 4%             |  |  |
| Number of Siblings               |                        |                |  |  |
| 1-3                              | 24                     |                |  |  |
| 4-6                              | 20                     | 48%            |  |  |
| 7-9                              | 5                      | 40%            |  |  |
| 10-12                            | 1                      | 10%            |  |  |
| Educational Attainment of        | 3                      | 2.0%           |  |  |
| Father                           | 2                      | 6%             |  |  |
| Elementary Level                 | 18                     | 4%             |  |  |
| Elementary Graduate              | 11                     | 36%            |  |  |
| High School Level                | 10                     | 22%            |  |  |
| High School Graduate             | 6                      | 20%            |  |  |
| College Level                    | 0                      | 12%            |  |  |
| College Graduate                 |                        | 0%             |  |  |
| With MA units                    |                        | 2%             |  |  |
| Mother                           | 1                      | 2%             |  |  |
| Elementary Level                 | 1                      | 16%            |  |  |
| Elementary Graduate              | 8                      | 46%            |  |  |
| High School Level                | 23                     | 18%            |  |  |

Pre-test and Post-test of Grade 8 Students of Libertad National High School

Table 3 shows the pre-test and post-test scores of participants.

High School Graduate

College Level

College Graduate

With MA units

Table 3. The Pre-test and Post-test Scores of the participants

9

8

0

| PRE-TEST |      |      |          | POST-TEST |      |
|----------|------|------|----------|-----------|------|
| Mean     | VI   | SD   | Mean     | VI        | SD   |
| 18.28    | Fair | 4.96 | 28.04    | Good      | 5.91 |
|          | •    |      | <u>.</u> | •         |      |

Parameter:

| i didilicitei. |   |             |
|----------------|---|-------------|
| 0-10           | - | Poor        |
| 11-20          | - | Fair        |
| 21-30          | - | Good        |
| 31-40          | - | Very Good   |
| 41-50          | - | Outstanding |
|                |   |             |

16%

0%

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As shown in Table 3, the pre-test has a mean of 18.28 with a standard deviation of 4.96 and the post-test has a mean of 28.04 with a standard deviation of 5.91. the value of the standard deviation of the pre-test which is 4.96 implies that the scores of the students are closer to each other and this means that the subject matter was not yet taught, majority of the students have less prior knowledge about the topic. In the post-test, the value of standard deviation of 5.91 shows that the scores of the students are more scattered which implies that after the intervention of chess-based instructional material in understanding species diversity, most of the students understood the lesson being discussed and got higher scores compared to the pre-test.

The students got a mean score in their pre-test of 18.28 with a standard deviation of 4.96. This showed that although the lesson was not yet familiar and the intervention was not yet applied, they were able to show that they had a piece of prior knowledge about the subject matter. The difference is evident by looking at the post means score of 28.04 with a standard deviation of 5.91. This means that the group showed improvement in their performance. Chess-based instructional materials are essential since they help the teacher and learners avoid overemphasis on recitation and rote learning that can easily dominate a lesson. Resource materials allow learners to have practical experiences which help them to develop skills and concepts and to work in a variety of ways (Tuimur, H. N. E. et.al 2015). This innovation would bring life to learning by stimulating students to learn. It has the potential to help the teacher explain new concepts clearly which would result in a better understanding of the concepts being taught.

#### Significant Difference between the Mean score of the Pre-test and Post-test.

Table 4, Shows the significant difference between the mean score of the pre-test and the post-test.

| Table 4. Significant Difference between the intent score of the Fre-test and Fost-test. |       |    |      |        |                     |           |
|---|-------|----|------|--------|---------------------|-----------|
|   | М     | VI | SD   | Pvalue | Remarks             | Decision  |
| Pre-test  | 18.28 | F  | 4.96 | P<0.05 | Highly Significant  | Deject He |
| Post-test   | 28.04 | G  | 5.91 |        | ringing Significant | Кејест П  |

 Table 4. Significant Difference between the Mean score of the Pre-test and Post-test.

Parameter:

| 0-10  | - | Poor        |
|-------|---|-------------|
| 11-20 | - | Fair        |
| 21-30 | - | Good        |
| 31-40 | - | Very Good   |
| 41-50 | - | Outstanding |

It was hypothesized that there is no significant difference between the mean score of the pre-test and the mean score of the post-test. Table 4, however, shows the substantial increase between the mean score of both pre-test and post-test. It further indicates that the P-value = P < 0.05 using a paired sample t-test. The Pearson Correlation of 74.24% explains the relationship between pre-test and post-test.

This implies that there is a significant increase in student performance with the integration of chess-based instructional material within the lesson since the students understand more the topic being discussed.

Based on the result, it denotes that the use of chess-based instructional material in understanding species diversity is effective in delivering the lesson. Salili (2005) mentioned that learning materials should be available in the classroom for they help teachers clarify vague points and facilitate better understanding among students. Moreover, Sibayan (1998), cited by Salili (2005) and Gravino (2010), in his article stressed that not only the parental background and teacher factor play important roles in the educative process of the learners, but also the school facilitates and instructional materials count to enhance the learning experience of the learners.

#### 4. FINDINGS

After a thorough analysis of the data, the following are the major findings of the study.

- 1. Most of the respondents are females (31 or 62%) and there are fewer males (19 or 38%); as to age, it shows that most of the students were 14 years old which covers 56%; as to the number of siblings, the table shows that the bracket of 1-3 siblings in the family is dominant, 24 or 48%; as to educational attainment of father, most fathers are high school level, 18 or 36%; and as to educational attainment of the mother, mostly of the mother are High School graduate, 23 or 46%.
- 2. The mean score of the pre-test was 18.28 (SD=4.96)
- 3. The mean score of the post-test was 28.04 (SD=5.91)
- 4. There is a significant difference between the score of pre-test and post-test. The computed t-test correlated sample got Pvalue=P=0.05 and Pearson Correlation of 74.24.

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## 5. CONCLUSION

Based on the result of the study, it was concluded that Chess-Based Instructional Material in Understanding Species Diversity has a significant improvement in the student's performance. Considering their mean scores, students performed low in the beginning but after the intervention gained a satisfactory performance in species diversity. Therefore, the use of Chess-Based Instructional Material in teaching could increase the learning outcomes of students in science.

### 6. REFERENCES

- [1] Bernardo, A. B., Cordel, M. O., Calleja, M. O., Teves, J. M. M., Yap, S. A., & Chua, U. C. (2023). Profiling low-proficiency science students in the Philippines using machine learning. Humanities and Social Sciences Communications, 10(1), 1-12.
- [2] Von Lorenz, A. C. (2024). Exploring Latent Class Profiles of Mathematics Performance among Filipino Students: Insights from PISA 2022 Using Growth Mindset Indicators and Group Comparison Analysis.
- [3] Orleans, A. (2007). The condition of secondary school physics education in the Philippines: recent developments and remaining challenges for substantive improvements. Australian Educational Researcher, 34/1, 33-54.
- [4] Jamlsco N. (2017). Science education Realities. The manila Times Pintrich, P.R.; Zusho, A. (2002) The Development of Academic Self-Regulation: The Role of Cognitive and Motivational Factors. In Development of Achievement Motivation; Educational Psychology; Wigfield, A., Eccles, J.S., Eds.; Academic Press: San Diego, CA, USA, 2002; pp. 249–284.
- [5] Osborne, J.; Simon, S.; Collins, S. (2003). Attitudes towards Science: A Review of the Literature and Its Implications. Int. J. Sci. Educ. 2003, 25, 1049–1079.
- [6] Affiah, D., Okore, G., Uchegbu, R., Omerekpe, G., & Isemede, A (2022). Perceived Impact of Using Improvised Instructional Materials on Teaching and Learning: A Case Study of Chemistry Students and Teachers in Southeast, Nigeria.
- [7] Ferreira, S.M., Gouin-Vallerand, C., Hotte, R. (2016). Game based learning: a case study on designing an educational game for children in developing countries. In 2016 8th Inter national Conference on Games and Virtual Worlds for Serious Applications (VS GAMES). IEEE, pp. 1-8.
- [8] Yuan, Q., Chen, K., Yang, Q., Pan, Z., Xu, J., & Yao, Z. (2024). Exploring intuitive visuo-tactile interaction design for culture education: A Chinese-chess-based case study. International Journal of Human–Computer Interaction, 40(8), 2099-2119.
- [9] Gravino, J. (2010) Metacognitive Strategies in Achieving Comprehension in Biology among the 2<sup>nd</sup> year students of San Isidro National High School, Saint Paul University, Surigao City, Philippines