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## Proficiency Level in Biology among Grade 9 Entrants in a Public Secondary School

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**Abstract.** In post-pandemic, schools are re-opening their doors to in-person classes to cater to students who were to distance learning modality for two years. To determine the learners' proficiency level in Biology, it is imperative to assess the most essential learning competencies (MELCs) to ascertain what competencies were missed so that teachers can come up with appropriate interventions. A descriptive-comparative research design was used to assess the proficiency level in MELCs in Biology of Grade 9 Entrants at a large rural secondary school in Central Negros Occidental, Philippines, during the S.Y. 2022-2023 when they were taken as a whole and grouped according to sex and family monthly income. Using a researcher-made Biology Proficiency Questionnaire based on MELCs, the study was conducted to 137 respondents who were identified through stratified random sampling. In data analyses, Mean, Standard Deviation, Kolmogorov-Smirnov, and Mann-Whitney U Test were employed. The overall result of the proficiency level in MELCs in Biology was low, and when grouped according to sex and family monthly income, the result was also low. Correspondingly, there was no significant difference in Biology proficiency level when grouped according to sex and family monthly income. With this, Strategic Intervention Materials (SIMs) were deemed relevant and timely to aid students in understanding the least learned MELCs.

**Keywords.** Science education, Biology, descriptive-comparative study, Central Philippines

### 1. Introduction

Biology is the study of life [1] and is an integral part of the Science curriculum at the secondary level in the Philippines [11]. The importance of biological education at school is increasing as it forms a scientific worldview among students [22]. [24] also added that through biological education, education goals could be achieved because it is an educational device to reach national education goals. Biological education significantly impacts society, describing the literacy of every individual in the community specific to scientific concepts, ideas, and principles [29].

The Department of Education (DepEd) Curriculum and Instruction strand, through the Bureau of Curriculum Development, has identified the Most Essential Learning Competencies (MELCs) in Biology for Junior High School as DepEd's commitment to ensure quality, relevant and liberating basic education for all through continuous curriculum refinement [18]. The identification of the MELCs is in collaboration with the Assessment Curriculum and

Technology Research Centre (ACTRC) as DepEd's key partner on the curriculum review in the middle of 2019 [28], which showed congestion and overlapping of competencies that resulted in students' achievement on national tests which are below proficiency [20]. Thus, DepEd needs to decongest the K to 12 Science Curriculum into MELCs.

As part of DepEd's Basic Education Learning Continuity Plan (BE-LCP) amid the coronavirus crisis, competencies in the K to 12 Science Curriculum have reduced to 187 most essential learning competencies with the removal of 34% [13]. These essential learning competencies in Biology exhibit "endurance," for they remain useful to every profession and applicable in everyday life [18]. To measure the achievement of competencies that determines proficiency level in Biology, DepEd has used an assessment scale of advanced, proficient, approaching proficiency, developing, and beginning, with corresponding mean percentage score for each proficiency level [12].

In the school where the researcher is employed, the performances in Science, particularly in Biology, based on the result of the Quarterly Assessment from S.Y. 2017-2018 to S.Y. 2019-2020, were 68.11, 69.34, and 72.60, respectively, which was a low proficiency level. The teaching of Biology had not optimized students learning experiences because Science is best learned through hands-on activities [5], which led to learners not mastering the competencies in Biology.

Latest studies on proficiency level in Biology of students dug on students with low academic performance in middle school Science [19], least mastered competencies in biology [29], and acquisition of science process skills among senior secondary school students [17]. There were limited studies yet about the proficiency level in Biology of students after utilizing the MELCs. The researcher saw the need to establish the proficiency level of Grade 9 entrants in Biology, for they were the batch of learners who stepped on the junior secondary school level, taught using the MELCs, and underwent printed modular modality in learning.

Thus, this study mainly aimed to assess the proficiency level of Grade 9 entrants in terms of MELCs in Biology. The findings of the study served as a basis for the development of the Strategic Intervention Material (SIM).

## **2. Framework of the Study**

This study theorized that the level of proficiency in Biology varies in terms of sex and family monthly income of Grade 9 entrants.

This is hinged on Vygotsky's Sociocultural Theory of Cognitive Development, which views that social interaction plays a fundamental role in the development of cognition. One of the central tenets of Vygotsky's Sociocultural Theory of Cognitive Development is the Zone of Proximal Development (ZPD) which is the distance between the child's actual development and level of potential development where learning is possible under a teacher's guidance or through interaction with advanced and competent peers that can provide support to the learner's developing knowledge [30].

The Sociocultural Theory of Cognitive Development investigates individual progress after exposure to the world. Social learning comes before individual development. The latter is the result of the interactions made by the learner with someone who has a higher level of knowledge or is a more skilled learner. In school, learners interact with peers, teachers, parents, canteen personnel, and society in general, which may influence how they process knowledge through the information they get from their encounters with them. This learning theory, therefore, explains the interrelated relationships of learning, social interaction, and individual

development, where learning depends on social interaction and individual development depends on learning.

The Zone of Proximal Development (ZPD) is central to Vygotsky's Sociocultural Theory of Cognitive Development. It is often defined as the difference between a learner's current level of knowledge, where he is capable of learning alone, and a potential level of knowledge, where he needs guidance and support through interaction with the teacher or a competent peer as they co-construct knowledge. Thus, ZPD has three important components: the learner's potential development, the role of interaction, and the wise somebody, where learners reach their learning potential through interactions with their teachers and advanced classmates.

Contrary to what is stated, the level of proficiency in Biology had no difference in terms of sex and family monthly income, indicating that it did not follow the Sociocultural Theory of Cognitive Development set forth by Vygotsky, specifically the principle of Zone of Proximal Development (ZPD). Other factors, such as the content of the competency, resource materials used, degree of difficulty of the terms used, the readiness of the students, and absence of teachers, contributed to the students' low Biology proficiency. Furthermore, social interactions between sexes and high and low-family-income students did not aid learners to learn in Biology and had not contributed to their development in the subject.

### **3. Methodology**

This study made use of descriptive-comparative design. Descriptive-comparative research design is a non-experimental, quantitative research design [10].

The researcher employed the descriptive-comparative design since the study aimed to assess the proficiency level in Biology of Grade 9 entrants of a large rural secondary school in Central Negros, Philippines, for the school year 2022-2023, in terms of the MELCs in relation to students' sex and family monthly income.

A researcher-made Biology Proficiency Questionnaire based on MELCs was used in gathering the data.

The basis of the development of the 55-item test questionnaire was the MELCs in Biology 8, the Budget Outlay for utilizing MELCs, and the Table of Specifications. There were eleven most essential learning competencies; each had an equal duration of the number of weeks of learning as reflected on the Budget Outlay. Thus, each competency contributed five items to come up with a 55-item multiple-type of test with four options for the respondents to select from. In constructing the table of specifications, a one-way grid table of the specification was used. Items of the test were distributed to three instructional domains: knowledge, comprehension, and analysis.

It was composed of two parts. The first part consisted of the demographic profile of the respondents, such as sex and family monthly income. The second part was the proficiency test in Biology based on MELCs.

Fifteen (15) experts in Science Education ascertained the validation using Lawshe's content validity ratio (CVR). Lawshe's CVR is widely used to quantify the instrument's content validity [21]. The jury validation showed a very high degree of validity with a content validity index value of 0.81.

After validation, the instrument was administered for pilot testing to 30 students in another school within the Schools Division to determine its reliability. The research instrument obtained a very high degree of reliability result of 0.90 using Cronbach's Alpha.

#### 4. Results and Discussions

##### Profile of the Respondents

Table 1 shows the demographic profile of the respondents. When grouped according to sex, 44.5% of the respondents were male (n=61), while 55.5% were female (n=76). It showed that the respondents were female-dominated. Meanwhile, when grouped according to monthly family income, 71.5% belong to lower monthly family income (n=98), while 28.5% to higher monthly family income (n=39). It conveyed that most of the respondents were from low monthly family income and a few from high family monthly income. Overall, this study utilized a total of 137 respondents.

**Table 1. Demographic Profile of the Respondents**

Variable	f	%
Sex		
Male	61	44.5
Female	76	55.5
Monthly Family Income		
Lower (Less than Php6,849)	98	71.5
Higher (Php6,849 and above)	39	28.5
<b>Total</b>	<b>137</b>	<b>100.0</b>

Note: Average income=Php6,849

##### Proficiency Level in Biology of Grade 9 Entrants

Generally, the proficiency level in Biology of Grade 9 entrants was "low," as shown in Table 2 (M=33.38, SD=8.83). The mean of 33.38 indicated that Grade 9 entrants were at the "beginning level" of their proficiency in MELCs in Biology.

The student at this level encounters challenges with his knowledge, prerequisite, fundamental knowledge, and skills in Biology that have yet to be achieved or acquired sufficiently for understanding [12].

In the study of [9] on the scientific literacy of Grade 9 (K-12 Curriculum) and Fourth year students (RBEC) based on learning competencies in basic Biology, results revealed that both graders have low proficiency levels in their fundamental and derived scientific literacy in Biology. There were gaps in the learning competencies of Grade 9 and Fourth-year students primarily due to the transition to a new curriculum.

Generally, the proficiency level in Biology of students in Kano, State Nigeria is low, the declining performance is disappointing, and there should be innovations in teaching strategies to improve the learning of Biology [4].

Meanwhile, Biology competencies for seventh and eighth graders were the least mastered by learners recommending those science teachers employ inquiry-based and hands-on learning activities to enhance students' proficiency in Biology [29].

Regarding the MELCs, the Biology proficiency of Grade 9 entrants in most of the competencies was low (M=25-49), except for the two competencies where respondents were not proficient (M=0-25).

The low proficiency means were obtained in the following MELCs: suggest ways to minimize human impact on the environment (M=40.15, SD=26.29), compare mitosis and meiosis, and their role in the cell-division cycle (M=40.00, SD=19.85), explains the advantage of high biodiversity in maintaining the stability of an ecosystem (M=40.00, SD=25.32), explain

how materials cycle in an ecosystem ( $M=37.08$ ,  $SD=20.80$ ), explains the significance of meiosis in maintaining the chromosome number ( $M=34.31$ ,  $SD=18.78$ ), explain ingestion, absorption, assimilation, and excretion ( $M=34.01$ ,  $SD=20.20$ ), describe the transfer of energy through the trophic levels ( $M=33.14$ ,  $SD=20.93$ ), explains the concept of a species ( $M=31.53$ ,  $SD=22.72$ ), and classify organisms using the hierarchical taxonomic system ( $M=28.61$ ,  $SD=19.07$ ).

The not proficient means were acquired in the following MELCs: predict phenotypic expressions of traits following simple patterns of inheritance ( $M=23.80$ ,  $SD=17.07$ ) and analyze the roles of organisms in the cycling of materials ( $M=24.38$ ,  $SD=16.22$ ).

This means that most of the competencies were least learned by Grade 9 entrants. However, two competencies were unlearned. The unlearned competencies became the subject of the intervention material, which was the Strategic Intervention Materials.

According to [29], the reasons for low proficiency include the lack of interest in the topics, learners' short retention span, low conceptual comprehension, lack of fundamental ideas on the topic, and teacher factor. Consequently, there was negative feedback coming from students that they find Biology learning as boring, tiresome, and burdensome [16]; thus, they would likely get low performances in both academic and conceptual reasoning skills.

In terms of demographics, according to sex, the Biology proficiency of females ( $M=33.92$ ,  $SD=9.26$ ) indicated slightly higher proficiency than males ( $M=32.70$ ,  $SD=8.29$ ); nonetheless, both sexes were low.

This means that female respondents learn better than males in biological concepts. Females prefer Biology more than males. It showed female respondents like Biology compared to males. Notwithstanding, the finding revealed that regardless of sex, Biology proficiency was low. Females had a higher preference for biology and astronomy, while males were inclined toward physics and chemistry [27], [29].

On the contrary, the effects of gender on the academic performance of biology students who attended extra-mural classes in public senior secondary schools revealed that male students were performing well compared to their female counterparts [14]. In addition, [8] agreed that the academic performance in Biology in terms of gender showed a high percentage of females who failed compared to the male, which means that male students performed better in Biology than female students.

Correspondingly, as to family monthly income, the Biology proficiency of high-income respondents ( $M=35.62$ ,  $SD=10.21$ ) was higher than low-income respondents ( $32.49$ ,  $SD=8.11$ ), although their Biology proficiency was low.

This means that respondents from high family monthly income were more proficient in grasping concepts in Biology compared to low family monthly income respondents. High-income respondents excel in Biology more than low income. Respondents of high income learn Biology well than low income. However, the biology proficiency was also low regardless of the family's monthly income.

According to [25], the family income had little connection with students' performance as factors like teachers' quality, school accountability, and school choice exhibited higher impacts on students' Biology achievement.

Meanwhile, [26] cited that the socioeconomic status of parents, particularly financial support, is a determinant factor in learners' education as it influences their performance in Biology. Similarly, a significant difference in Biology was found between students' achievement and parents' socioeconomic status, where students from high socioeconomic backgrounds achieve higher in Biology than those from low socioeconomic backgrounds [2].

**Table 2. Proficiency Level in Biology of Grade 9 Entrants (in %)**  
**Difference in the Proficiency Level in Biology of Grade 9 Entrants according to**

Variable	Sex						Monthly Family Income						Whole		
	Male		Female			Lower			Higher			M	SD	Int	
	M	SD	Int	M	SD	Int	M	SD	Int	M	SD				Int
1. Explain ingestion, absorption, assimilation and excretion	33.11	19.62	LP	34.74	20.75	LP	33.06	20.73	LP	36.41	18.85	LP	34.01	20.20	LP
2. Compare mitosis and meiosis, and their role in the cell-division cycle	34.75	18.22	LP	44.21	20.22	LP	41.22	19.65	LP	36.92	20.28	LP	40.00	19.85	LP
3. Explain the significance of meiosis in maintaining the chromosome number	35.41	18.76	LP	33.42	18.87	LP	31.84	17.67	LP	40.51	20.25	LP	34.31	18.78	LP
4. Predict phenotypic expressions of traits following simple patterns of inheritance	22.30	16.77	NP	25.00	17.32	LP	23.67	16.83	NP	24.10	17.88	NP	23.80	17.07	NP
5. Explain the concept of a species	35.08	22.99	LP	28.68	22.23	LP	29.39	21.34	LP	36.92	25.36	LP	31.53	22.72	LP
6. Classify organisms using the hierarchical taxonomic system	25.25	18.22	LP	31.32	19.41	LP	29.59	18.88	LP	26.15	19.55	LP	28.61	19.07	LP
7. Explain the advantage of high biodiversity in maintaining the stability of an ecosystem	39.02	25.93	LP	40.79	24.97	LP	37.35	24.14	LP	46.67	27.27	LP	40.00	25.32	LP
8. Describe the transfer of energy through the trophic levels	33.11	20.29	LP	33.16	21.55	LP	31.43	18.61	LP	37.44	25.62	LP	33.14	20.93	LP
9. Analyse the roles of organisms in the cycling of materials	24.59	16.08	NP	24.21	16.43	NP	25.10	16.82	LP	22.56	14.64	NP	24.38	16.22	NP
10. Explain how materials cycle in an ecosystem	35.08	21.18	LP	38.68	20.48	LP	36.94	20.98	LP	37.44	20.61	LP	37.08	20.80	LP
11. Suggest ways to minimize human impact on the environment	41.97	28.68	LP	38.68	24.29	LP	37.76	25.99	LP	46.15	26.42	LP	40.15	26.29	LP
<b>Proficiency</b>	<b>32.70</b>	<b>8.29</b>	<b>LP</b>	<b>33.92</b>	<b>9.26</b>	<b>LP</b>	<b>32.49</b>	<b>8.11</b>	<b>LP</b>	<b>35.62</b>	<b>10.21</b>	<b>LP</b>	<b>33.38</b>	<b>8.83</b>	<b>LP</b>

Note: 0-25=Not Proficient (NP), 25-49=Low Proficiency (LP)

### Sex

Table 3 presented that there was no significant difference in the proficiency level in Biology of Grade 9 Entrants when they were grouped according to sex [U=2119.5, p=0.389].

Sex does not influence the proficiency level in MELCs in Biology of Grade 9 Entrants. Male and female entrants exhibit the same proficiency level in MELCs in Biology. There is no significant difference in the proficiency level in Biology of Grade 9 entrants when grouped according to sex.

Relatedly, [6] investigated the relationship between gender and academic performances of students in Biology in Malaysia. Based on the results, no significant differences were recorded between male and female students in Biology academic performance. This implies that gender is not correlated with the scores in Biology examinations of the students.

On the other hand, there were significant differences in the students' least mastered competencies in grades 7 and 10 Biology according to sex at  $p < 0.05$  value, indicating female respondents have a higher mastery compared to male respondents in grades 7 and 10 Biology competencies while no significant differences for Grades 8 and 9 Biology competencies in relation to sex, maybe because of small sample size taken or the large error of measurement [29].

### Difference in the Proficiency Level in Biology of Grade 9 Entrants according to Family Monthly Income

Also, Table 3 showed that family monthly income has no significant difference in the proficiency level in Biology of Grade 9 Entrants [U=1539.5, p=0.076].

This means that the proficiency level in MELCs in Biology of Grade 9 Entrants is not affected by monthly family income. Clearly, the result shows that the proficiency level in MELCs in Biology of Grade 9 Entrants is not particular to family monthly income.

In the study of [23], students from high-income families are most likely to perform better in Biology than their counterparts.

Furthermore, parental income significantly influences the academic performance of students in Biology in Nigeria. Thus, parental empowerment is recommended for parents of low socioeconomic status to enhance students' academic performance in Biology [3]. Likewise, [15] also revealed that parents' annual income significantly differs when grouped according to monthly income.

Contrary to this, socioeconomic status has no statistically significant difference with academic performance in biology [7]. Performances of high, middle, and low-class students were evidently no difference.

**Table 3. Difference in the Proficiency Level in Biology of Grade 9 Entrants (in %)**

Variable	U	z	p
Sex	2119.500	-0.862	0.389
Monthly Family Income	1539.500	-1.776	0.076

*Note: the difference is significant when  $p \leq 0.05$*

The Sociocultural theory of Cognitive Development and its central idea, the Zone of Proximal Development (ZPD), fall short of backing up the findings of this study. Sex and family monthly income did not significantly differ in the Biology proficiency of Grade 9 entrants. Social interactions of opposite sexes and high and low family monthly income were unable to make learning happen, and no individual development was manifested, resulting in mean scores in MELCs in Biology, which were low proficiency. Therefore, Biology proficiency is not dependent on sex and family monthly income; moreover, factors such as the content of the competency, degree of difficulty of terms used, resource materials used, the readiness of the students, and absence of teachers may contribute to the low Biology proficiency.

### 5. Conclusion

The findings of this study imply that most of the MELCs were least learned by learners and that they were at the beginning level of their Biology proficiency. Relatedly, sex and family monthly income had no impact on the Biology proficiency of students; the absence of teachers, content, degree of difficulty of competency, and learning resources can be attributed to the low result. Furthermore, the modular distance learning modality falls short of assisting students in learning the MELCs in Biology. With this, SIMs were deemed necessary to aid students in learning the competencies.

### 6. Recommendations

Based on the findings of the study, it is recommended that school administrators may design seminars and workshops to capacitate teachers in teaching Science, where Biology is one of the components to update their content knowledge and pedagogy in the subject. The teacher may employ activities to explore a prior understanding of students in science concepts to correct misconceptions. Likewise, the SIMs can be used to decrease students' difficulty in learning science concepts. For future researchers, they may investigate the Biology proficiency of other grade levels as competencies in science follow a spiral progression. Furthermore, the developed SIMs may need additional inputs or revisions to better facilitate learning which future research may look into.

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