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Competency in Numbers and Number Sense of Selected Senior High School Learners

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Abstract – *Number sense entails efficient strategies and the ability to think flexibly in numbers and number operations and flexible thinking ability, and the propensity to make sound mathematical judgments. This study aimed to look into learners' abilities to solve number sense problems. The responses and strategies of the learners were analyzed both qualitatively and quantitatively. First, the correctness of the participants' responses was determined. The researcher personally administered the Mathematics Competency Test in a public school for pilot testing to determine its reliability and validity. After which, the said test was simultaneously administered to 320 learners by General Mathematics teachers in selected public and private schools.*

Key Words**:** Competency, Number, Number Sense, Mathematics

Introduction

Mathematics teaches the mind to solve problems and make decisions logically and systematically. This discipline encourages meaningful learning and challenges the mind, and thus contributes to an individual's holistic development (Ministry of Education, 2004). Parallel to this school of thought, many mathematics educators have proposed that the process of mathematics learning and instruction should be centered on student understanding of numbers. Students should be able to understand why and how computations or algorithms are computed in this context (Munirah Ghazali, 2001).

With the continuous unfolding of developments in the Philippine educational system as a result of the application of the K to 12 Basic Education Curriculum, the country is left with no choice but to embrace these changes while ensuring that it not only caters to the needs of students but also to the demands of academic sectors from a global perspective. Along with these new content areas, one of the major transformations under the K to 12 programs is adopting the spiral curriculum from Grades 1-10, in which concepts and skills are taught in increasing complexity and sophistication for better mastery.

This remarkable reform in the Philippine educational system poses a significant challenge to the academic community. This new curriculum design will address the graduates' pressing needs to be globally competitive. This study's specific goal is to describe the mathematics competency of Grade 11 students in number and number sense. According to the findings, students have a solid foundation in the topics of numbers and number sense. Number sense is a comprehensive concept that refers to the ability to comprehend quantities, numbers, operations, and the connections between them in order to make a mathematical judgment in an efficient and flexible manner (Yang, 2010).

Literature

Mathematical competency is defined as the ability to understand, judge, perform, and apply mathematics in a wide range of intra- and extra-mathematical contexts and situations in which mathematics plays or could play a role. Many factual knowledge and technical skills are required but not sufficient pre-requisites for mathematical competence, just as vocabulary, orthography, and grammar are required but not sufficient pre-requisites for literacy. A mathematical competency is a distinct and easily identifiable component of mathematical competence (Niss, 2003).

At the most general level, mathematical competency is defined in terms of both content (what mathematics students should know) and process (how students should go about doing and understanding mathematics). This distinction is reflected in the structure of the document Principles and Standards for School Mathematics (National Council of Teachers of Mathematics (NCTM) 2000), which includes both content standards and process standards for K-12 mathematics students. The standards are based on research and have undergone extensive development and revision (the original version, Curriculum and Evaluation Standards for School Mathematics, was released in 1989). The content standards are as follows: (a) numbers and operations, (b) algebra, (c) geometry and measurement, and (d) data analysis and probability; and the process standards are as follows: (a) problem solving, (b) reasoning and proof, (c) communications, (d) connections, and (e) representation (Graf, 2009).

Methods

Using the Raosoft sample size calculator, a total of 320 Senior High School students were taken from a population of 1,893 Grade 11 students to compose the student-respondents. The samples consisted of students with different ability levels (above-average, average and below-average student) who were chosen by their respective mathematics teachers based on their grades.

An instrument description was used. It assessed the mathematics competency of the Grade 11 students on the three strands of Junior High School Mathematics which are Numbers and Number Sense, Patterns and Algebra, and Geometry. The items in the test were mapped to the competencies in the Grade 11 General Mathematics course against the pre-requisite competencies which should have been mastered in the Grades 7-10 Mathematics.

To describe the mathematics competency of the students, the test results were given description equivalent to the transmuted scores as stipulated in DepEd Order No. 8, s. 2015 as shown below:

Score Range	**Descriptor**
90 – 100	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

Result and Discussion

Table 1 shows the frequency and percentage of students for each level of competency in Numbers and Number Sense.

Table 1

Mathematics Competency of Grade 11 Students (Numbers and Number Sense)

Competency Level	Public n = 97		Private n = 223		Both Public and Private n = 320	
	F	%	F	%	f	%
Outstanding (90 – 100)	57	58.76%	85	38.12%	142	44.38%
Very Satisfactory (85 – 89)	6	6.19%	7	3.14%	13	4.06%
Satisfactory (80 – 84)	15	15.46%	18	8.07%	33	10.31%
Fairly Satisfactory (75 – 79)	5	5.15%	12	5.38%	17	5.31%
Did Not Meet Expectations (Below 75)	14	14.43%	101	45.29%	115	35.94%

It shows that though almost 50% of the students got an **Outstanding** level of competency, there were also almost 40% who fell under the level of **Did Not Meet Expectations.** Data show that the public schools have registered a much higher percentage in the Outstanding level and much lower under Did Not Meet Expectations as compared to the private schools. A minimal percentage is distributed from **Fairly Satisfactory** to **Very Satisfactory**. It is evident that the public school students have a better competency level in Numbers and Number Sense as compared to the private school students. Number sense involves rational, creative, effective and flexible thinking, and thus with sufficient number sense ability students can solve problems in a creative, analytical and flexible manner (Butuner, 2017). Number sense is part of the core knowledge of the individual. Bruer, (1997) also summarizes that research since the 1970s has produced evidence of a number sense component in children

Table 2 shows the frequency and percentage of students who got the correct answers on items in Numbers and Number Sense.

Table 2

Frequency and Percentage of Students who Got the Correct Answers on Items in Numbers and Number Sense

		Public n = 97		Private n = 223		Both Public and Private n = 320	
Item No.	Content	f	Percentage	f	Percentage	f	Percentage
1	Concept of Rational Numbers	84	86.60%	174	78.03%	258	80.63%
2	Concept of Rational Numbers	56	57.73%	130	58.30%	186	58.13%
3	Arranging Rational Numbers	59	60.82%	122	54.71%	181	56.56%
4	Changing Fraction to Decimal	83	85.57%	160	71.75%	243	75.94%
5	Changing Decimal to Fraction	80	82.47%	161	72.20%	241	75.31%
6	Changing Percent to Fraction	75	77.32%	153	68.61%	228	71.25%
7	Concept of Percent	68	70.10%	141	63.23%	209	65.31%
8	Expressing Fraction in Lowest Term	72	74.23%	125	56.05%	197	61.56%
9	Concept of Proper Fraction	73	75.26%	148	66.37%	221	69.06%
10	Changing a Mixed Number into an Improper Fraction	58	59.79%	152	68.16%	210	65.63%
11	Operations on Rational Numbers	65	67.01%	142	63.68%	207	64.69%
12	Similar Fractions	73	75.26%	143	64.13%	216	67.50%
13	Equivalent Fractions	80	82.47%	135	60.54%	215	67.19%
14	Concept of Percent	79	81.44%	150	67.26%	229	71.56%
15	Finding the LCD	66	68.04%	114	51.12%	180	56.25%
16	Operations on Fractions	68	70.10%	105	47.09%	173	54.06%
17	Operations on Fractions	59	60.82%	108	48.43%	167	52.19%
18	Operations on Rational Numbers	59	60.82%	136	60.99%	195	60.94%
19	Operations on Rational Numbers	70	72.16%	132	59.19%	202	63.13%
20	Operations on Rational Numbers	63	64.95%	139	62.33%	202	63.13%

Concepts involving simple recall of the definition of a rational number, changing fraction to decimal form and vice versa, changing percent to fraction, and finding a certain percentage of a given number were answered correctly by 70%-81% of the respondents. This is consistent with the study of Cramer et al. (2002) where many students could apply the identical numerator strategy. The ability of calculation includes complex aspects of human cognition abilities, namely linguistic, spatial, memory, body knowledge and executive function abilities (Ardilla, 1998).

On the other hand, 50%-70% were able to answer correctly the items which deal with identifying a rational number from a given set of numbers, arranging a set of rational numbers in increasing order, finding the least common denominator of the given fractions, proper and improper fractions, similar fractions, equivalent fractions, mixed numbers, and operations on rational numbers. However, it may be significant to note that two of the items (16 and 17) deal with the procedure, stated in words, on how to add/subtract and divide fractions yet these two have the lowest percentage of correct answers which implies that though students were able to perform operations on fractions, they still have difficulty in verbalizing on how to do so. Generally, it can be said that students have strong foundation on the topics under Numbers and Number Sense since all questions were answered correctly by majority of the respondents.

Conclusion and Recommendations

Students' mathematics competency along the three strands of Junior High School Mathematics ranged from Did Not Meet Expectations to Outstanding. In Numbers and Number Sense, 44.38% got Outstanding, 4.06% got Very Satisfactory, 10.31% got Satisfactory, 5.31% got Fairly Satisfactory and 35.94% got Did Not Meet Expectations. Junior High School Mathematics teachers are encouraged to continue to engage learners in number and number sense and to see that all the topics prescribed in the curriculum guide are well-taught since these serve as building blocks for higher mathematics.

Mathematics department heads may consider monitoring the teachers through regular checking of daily lesson logs and classroom observations to verify whether the lessons are being taught within the specified time frame.

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