



# DEVELOPMENT AND VALIDATION OF SUPPLEMENTAL MATERIAL ON OPERATION ON INTEGERS

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## ABSTRACT

*This study aims to assess the level of validity and acceptability of the Developed Supplemental Material on Operation on Integers. Specifically, this study seeks to attain the following objectives: determine if the supplemental material on integer is acceptable in terms of objectives, content, presentation and evaluation; Assess the level of validity of the supplemental material on operation on integers in terms of: usability, consistency and curriculum alignment and; determine if there is a significant relationship between the parts of the supplemental material on operation on integers and extent of validation of its usability, consistency and curriculum alignment.*

*The respondents of the said study were selected thirty (30) Mathematics teachers of Majayjay District who evaluated the learning module. The supplemental materials compose of four (4) lessons were as follows: Addition of Integers Using Number Line and Algebra Tiles, Subtraction of Integers, Multiplication and Division of Integers, and Problems involving Integers. The researcher utilized the weighted mean and Pearson r as statistical treatment of the study.*

*The results are as follows: in terms of objectives, the respondents strongly agree on each indicated statement which gathered an average weighted mean of 4.13 (highly acceptable); as for content, the respondents strongly agree on the five statements, resulting to an average weighted mean of 3.99 (highly acceptable); as for presentation, the respondents strongly agree on each statement, resulting to an average weighted mean of 4.41 (highly acceptable); and for evaluation, the respondents strongly agree on each statement, having an average weighted mean of 4.09 (highly acceptable). In terms of the validity of the learning module: as for usability, the respondents strongly agree on the four indicated statements, garnering an average weighted mean of 4.21 (highly acceptable); when it comes to consistency, the respondents strongly agree on the four indicated statements, having an average weighted mean of 4.11 (highly acceptable); as for the curriculum alignment, the respondents strongly agree on the four statements, making up to a 4.24 (highly acceptable) average weighted mean. It is shown that the null hypothesis stating that "there is no significant relationship between or among the parts of the supplemental material on operation on integers and extent of validation" is rejected, it can be inferred that there is a "significant" relationship between them.*

*Based on the data gathered and its findings, the researcher further concludes that; the Supplemental Material on Operation on Integers could help explore student's knowledge and skills, which could therefore help them solve problems involving operation integers; that the supplemental material on Operation on Integers serve as an aid in enhancing learner's analytical skills, provides additional information, discussing the different rules to follow in computing integers, and that it adds a sense of challenge for students to perform well. Since the supplementary material is acceptable in terms of having specific, simple, attainable and measurable objectives and it captures the interest of learners in the lesson taught; it could be used independently, to serve as a tool for deepening learning. Since the supplemental material focuses on the main goal, it has relevant experiences for the students to grow which is set and aligned to the DepEd standards and competencies which must strictly follow.*



## INTRODUCTION

Mathematics among the academic subjects is being considered as challenging. In the Philippine schools, learners encounter difficulties in Mathematics especially when the COVID 19 pandemic experienced all over the globe. Distance learning was implemented as the Department Education mandated to reduce the spread of the COVID 19 among schools to protect children. Intensified by the global pandemic, supplemental materials have been more vital than before in order to aid the students as support to the distance learning be it modular, online or broadcast platforms. Mathematics is challenging and become more challenging because of the current situation. Learners are required to study on their own with the help teachers through messenger, facebook, google meet and other platform guided with learner's parent.

In line with this, additional resources on learning is needed; due to this fact, educational sector and other private institution such as publishing companies are offering various supplemental materials as additional learning resources aside from the provided materials prescribed by the department.

With this, it shows the significance of supplemental materials in the process of teaching and learning. This is further proven by the studies of Thakur (2015) which stated that supplemental materials help teachers produce learners who are able to go beyond the textbook into real life. Supplemental materials add to the information in the textbook and carefully follow the content.

Tracing back, Suba National High School Gagalog Annex students from school year 2009-2010 up to present has shown difficulties in the area of integers under number sense. After performing root cause analysis, the researcher finds out the summative and periodical test results were affected with integer involving problems. Learners encounter challenges with integers from Grade 7 until these student reach in college. Misconceptions on operation with integers affects the student's learning in solving a certain problems.

Attempting to address this mentioned problem, this study aim to develop a supplemental material on Operation in Integers.

## RESEARCH METHODOLOGY

The study is about the development and validation of supplemental material on operation on integers of Grade 7 students. The population consists of selected Mathematics teacher who are experts in evaluating instructional material from different public schools in the district of Majayjay.

### Sampling Techniques

The researcher has used purposive sampling technique by purposely selecting the Mathematics teachers in Majayjay district as evaluators and respondents of the study.

### Data Gathering Procedure

A letter of request will be submitted to the Schools Division Superintendent, through the Division Education Program Secondary to seek permission to conduct the study. Immediately after the approval, with permission of School Principals, schedules in distributing the questionnaires to the Mathematics Teachers in District of Majayjay are arrange. Data are going to tabulate, analyze and compute applying the needed statistical treatment.

### Research Procedure

A permit is secured from the office of the Schools Division Superintendent before the conduct of the study. The proponent will undergo the difficult stages and then monitored the development until the completion of the study.

### Research Instrument

The data for the study are going to gather by means of a questionnaire. A researcher-made questionnaire is also employed as a part of the instrument in gathering the data.

The questionnaire aims to generate assessment among the Mathematics teacher. It has two parts. The first part is composed of the parts of supplemental material in terms of objectives, content, presentation and evaluation.

The last part is dedicated to the criteria to be evaluated by the respondents: usability, consistency, and curriculum alignment.

### Ranges of Statistical Treatment

Table 2. presents various ranges in the statistical treatment.



Rating	Range	Verbal Interpretation
5	4.20-5.00	Highly Acceptable
4	3.60-4.19	Acceptable
3	2.40-3.59	Moderately Acceptable
2	1.80-2.39	Slightly Acceptable
1	1.00-1.79	Not Acceptable

### Validation

In the process, the questionnaire undergoes the process of validation to determine the degree of its effectiveness to which set of survey instrument accurately measure what it should intend to measure as well as its capability to achieve the specific objectives of the study.

Content validity is the measure that going to undertake. It is the analysis of the extent to which set of variables/concepts expressed in each item is going to make. Consultation with experts and adviser will going to undertake to assure that no items will overlap and that all items reflect the sub topic with much clarity and understanding.

### Statistical Treatment

Once the measuring instruments have been retrieved, the researcher processed the raw data into quantitative forms. Data processing involves input, this involves the responses to the measuring instrument of the subjects of the study.

To reveal the level of acceptability and validity of Supplemental Material on Operation on Integers, the weighted mean was used. The formula is:

$$WM = \frac{4f + 3f + 2f + f}{N}$$

Wherein:

WM = Weighted mean value  
f = frequency of responses  
N = total number of cases

To reveal the relationship between or among the parts of the supplemental material on operation on integers and extent of validation, the Spearman rho was used. The formula is:

$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Wherein:

d = difference in ranks  
n = number of pairs of data  
 $\sum$  = Sigma = sum of  
 $\rho^2$  = Spearman's Rank Correlation Coefficient

## RESULTS AND DISCUSSIONS

The researcher utilized the computed mean, standard deviation, and weighted mean in determining whether the acceptability and validity of Supplemental Material on Operation on Integers are in accordance to objective, content, presentation and evaluation. A four-point Likert scale was employed to verbally interpret the computed mean and weighted mean.

On the other hand, to determine its relationship, the researcher has utilized Pearson r as treatment.

**Supplemental Material on Operation on Integers****Table 1. Level of acceptability of the Supplemental Material in terms of Objectives**

<i>The Developed Supplemental Material is...</i>	Mean	SD	Verbal Interpretation
specific and detailed	4.23	0.73	Strongly Agree
measurable so it can be objectively assessed	4.23	0.68	Strongly Agree
attainable and time bounded	4.03	0.72	Agree
realistic	4.00	0.64	Agree
in line with most essential learning competencies	4.13	0.63	Agree
<b>Overall Mean = 4.13</b>			
<b>Standard Deviation = 0.629</b>			
<b>Verbal Interpretation = Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

The teacher perceived that the developed supplemental material with regards to as specific, detailed and measurable and can be objectively assessed got a descriptive rating of *strongly agree* with the *mean of 4.23 and standard deviation of 0.73*. The other statements, *the developmental material is in line with most essential learning competencies*, *it is measurable so it can be objectively assessed*, and *realistic* achieved the results of (M=4.13, SD=0.63), (M=4.03, SD=0.72), and (M=4.00, SD=0.64), respectively.

The level of acceptability of the supplementary material in terms of objectives was disclosed with the overall mean of 4.13 and the standard deviation of 0.629. This means that the activities involved in achieving the goal of the developed supplemental material is met. The specific actions and measurable outcome are achieved.

This is to address the claim of Shields (2010) that learning objectives are the heart of every lesson since it these serves as foundations for lesson planning. The mentioned researcher inculcate that objectives provide the criteria for evaluating students' achievement.

**Table 2. Level of acceptability of the Supplemental Material in terms of Content**

<i>The Developed Supplemental Material is...</i>	Mean	SD	Verbal Interpretation
interesting and suitable to learners	4.13	0.63	Agree
contributing to the acquisition of concepts and theories	4.07	0.69	Agree
achievable in a given time frame	4.00	0.69	Agree
addresses the needs of the learners	4.00	0.83	Agree
engaging and consistent with the activities	3.73	0.64	Agree
<b>Overall Mean = 3.99</b>			
<b>Standard Deviation = 0.640</b>			
<b>Verbal Interpretation = Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

The data presented above reveal that the supplemental material are interesting and suitable to learners with the highest rating of (M=4.13, SD=0.63). The respondents were satisfied with the supplemental material that, *it is contributing to the acquisition of concepts and theories* on Operation on Integers (M=4.07, SD=0.69).



The overall mean of 3.99, standard deviation of 0.640 indicated the level of acceptability of the Supplemental Material in terms of Content is acceptable. This means that the content of the supplementary material is aligned to the students' needs and interest.

The results on this table is essential as stated to the study of Liboon (2011), the content of the learning packages is the answer to the needs of the developing country like the Philippines for the curricular motivation of the educational system.

**Table 3. Level of acceptability of the Supplemental Material in terms of Presentation**

<i>The Developed Supplemental Material is...</i>	Mean	SD	Verbal Interpretation
simple yet detailed	4.60	0.50	Strongly Agree
readable and easy to understand	4.60	0.50	Strongly Agree
making the photographs simple and clear	4.40	0.67	Strongly Agree
motivates/captures the interest of the learners	4.23	0.68	Strongly Agree
giving positive attitude towards operation on integers	4.20	0.61	Strongly Agree
<b>Overall Mean = 4.41</b>			
<b>Standard Deviation = 0.610</b>			
<b>Verbal Interpretation = Highly Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

As shown in table 3, the respondents agreed that the supplemental material is simple yet detailed, readable and easy to understand. This statement has the highest rating of M=4.60, SD=0.50. Also, the respondents rated the statement *making the photographs simple and clear* with M=4.40, SD=0.67.

The overall mean of 4.41 and the standard deviation of 0.610 indicated the level of acceptability of the Supplemental Material in terms of Presentation is highly acceptable. This means that the demonstrations or the information conveys can be adapted.

This is further proven by the study of Gunaydin & Karamete, (2016) which describes that great presentation can help the learner visualize a certain object by providing them supporting images from the materials developed by teachers. The images should follow certain criteria such as "pleasing to the eye and reflecting visual integrity".

**Table 4. Level of acceptability of the Supplemental Material in terms of Evaluation**

<i>The Developed Supplemental Material is</i>	Mean	SD	Verbal Interpretation
Assesses what is stated in the learning objectives	4.27	0.69	Strongly Agree
Evaluation should motivate the student to learn	4.07	0.74	Agree
Practical and realistic	4.00	0.64	Agree
It provides feedback that stimulates learning	3.93	0.69	Agree
Different versions of an exam must be at the same level	4.17	0.70	Agree
<b>Overall Mean = 4.09</b>			
<b>Standard Deviation = 0.699</b>			
<b>Verbal Interpretation = Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable



The data above reveal that the developed supplemental material in terms of assessing what is stated in the learning objectives and has a different versions of exam that must be in the same level garnered the result of (M=4.27, SD= 0.69) and (M=4.17, SD=0.70) respectively.

The remaining statements, evaluation should motivate the student to learn, practical and realistic, and it provides feedback that stimulates learning acquired M=4.07, SD=0.74, M=4.00, SD= 0.64 and M=3.93, SD=0.69 respectively.

The overall mean of 4.09 standard deviation of 0.699 indicated the level of acceptability of the Supplemental Material in terms of Evaluation is acceptable. This means that the judgement or the assessment about the materials is worthy and significant using criteria governed by a set of standards.

The obtained data is needed for evaluation plays a significant role in providing useful and relevant information towards the improvement of teaching (Salandanan, 2001). An evaluation of a learning material can be a way to heighten effectiveness of teaching and learning process.

**Table 5. Level of validity of the Supplemental Material in terms of Usability**

<i>The Developed Supplemental Material is helpful since it...</i>	Mean	SD	Verbal Interpretation
can be used independently	4.43	0.50	Strongly Agree
offers various activities that learner helps to grow.	4.33	0.55	Strongly Agree
uses terms that can be understood easily	4.10	0.31	Agree
could be a substitute for modules	4.03	0.67	Agree
serves as a supplemental tool for understanding math	4.17	0.65	Agree
<b>Overall Mean = 4.21</b>			
<b>Standard Deviation = 0.648</b>			
<b>Verbal Interpretation = Highly Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

The statement, *the developed supplemental material is helpful since it can be used independently and offers various activities that learner helps to grow* obtained the result of (M=4.43, SD=0.50) and (M=4.33, SD=0.55), respectively.

The respondents also agreed in the statements, *the supplemental material is helpful since it serves as a supplemental tool for understanding math, it uses terms that can be understood easily, and it could be a substitute for modules* acquired the results of (M=4.33, SD=0.55), (M=4.10, SD=0.31), and (M=4.03, SD=0.67), respectively.

The overall mean of 4.21, standard deviation of 0.648 indicated the level of validity of the Supplemental Material on operation on integers in terms of Usability is highly acceptable. This means that the context or design achieved a defined goal effectively, efficiently and satisfactorily.

This data in the table answers to the claims of Alafareet et al., (2009) in which usability is the effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment. In essence, a system with good usability is easy to use and effective.

**Table 6. Level of validity of the Supplemental Material in terms of Consistency**

<i>The Developed Supplemental Material is Consistent because...</i>	Mean	SD	Verbal Interpretation
it follows the prescribed curriculum set by DepEd	4.33	0.66	Strongly Agree
the activities are connected to the curricular standard	4.27	0.64	Strongly Agree
the performance standards are strictly followed	4.13	0.57	Agree
the competencies are thoroughly followed	4.20	0.66	Strongly Agree
the learning is achieved.	3.63	0.56	Agree
<b>Overall Mean = 4.11</b>			
<b>Standard Deviation = 0.556</b>			
<b>Verbal Interpretation = Acceptable</b>			



Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

Table 6 shows that the teachers agreed on the first statement that the developed supplemental material is consistent because it follows the prescribed curriculum set by DepEd ( $M=4.33$ ,  $SD=0.66$ ) and the activities are connected to the curricular standard ( $M=4.27$ ,  $SD=0.64$ ).

The table also shows the remaining statements which are: the developed material is consistent because the competencies are thoroughly followed, the performance standards are strictly followed, and the learning is achieved that gained the results of ( $M=4.20$ ,  $SD=0.66$ ), ( $M=4.13$ ,  $SD=0.57$ ), and ( $M=3.63$ ,  $SD=0.56$ ), respectively.

The overall mean of 4.11, standard deviation of 0.556 indicated the level of validity of the Supplemental Material on operation on integers in terms of Consistency is acceptable. This means that the condition of the quality is cohering or holding together and retaining firmness.

In the study of Granger (2008) consistency is the reliability or uniformity in the quality of being consistent. It is the agreement within the data or content of the material.

**Table 7. Level of validity of the Supplemental Material in terms of Curriculum Alignment**

<i>The Developed Supplemental Material is Aligned to the Curriculum because...</i>	Mean	SD	Verbal Interpretation
it adhere to the curriculum prescribed by DepEd	4.57	0.57	Strongly Agree
the most essential learning competencies are aligned	4.50	0.51	Strongly Agree
the performance standards are strictly implemented	4.30	0.53	Strongly Agree
the activities are connected to the curricular standard	4.20	0.61	Strongly Agree
the learning is attained.	3.63	0.49	Agree
<b>Overall Mean = 4.24</b>			
<b>Standard Deviation = 0.490</b>			
<b>Verbal Interpretation = Highly Acceptable</b>			

Legend:

Range	Verbal Interpretation
4.20-5.00	Highly Acceptable
3.40-4.19	Acceptable
2.60-3.39	Moderately Acceptable
1.80-2.59	Less Acceptable
1.00-1.79	Not Acceptable

As shown in table 7, the developed supplemental material is aligned to the Curriculum because it adheres to the curriculum prescribed by DepEd garnered the highest result of ( $M=4.57$ ,  $SD=0.57$ ) and followed by the statement, *most essential learning competencies are aligned* with the result of ( $M=4.50$ ,  $SD=0.51$ ).

The overall mean of 4.24, standard deviation of 0.490 indicated the level of validity of the Supplemental Material on operation on integers in terms of Curriculum Alignment is highly acceptable. This means that the process in which the developed materials address the changing needs of students.

In the book entitled "*Pathways to Results: Curriculum Alignment Module*" by Mordica, J., & Nicholson-Tosh, K. (2013), it noted the importance of connections between curricular alignment and improved student achievement.

**Table 8. Relationship between or among the parts of the supplemental material on operation on integers and extent of validation.**

	r value	p value	Degree of Correlation	Analysis
Content and Objective	0.852	0.000	Very Strong	Significant
Presentation and Content	0.395	0.031	Weak	Significant
Presentation and Objective	0.372	0.043	Weak	Significant
Evaluation and Objective	0.820	0.000	Very Strong	Significant
Evaluation and Content	0.869	0.000	Very Strong	Significant
Evaluation and Presentation	0.464	0.010	Moderate	Significant
Consistency and Usability	0.644	0.000	Strong	Significant
Curriculum Alignment and Usability	0.366	0.047	Weak	Significant
Curriculum Alignment and Consistency	0.474	0.008	Moderate	Significant

**Legend****Correlation Coefficient (r value)**

± 0.8 to ±1.0  
 ± 0.6 to ±0.79  
 ± 0.4 to ±0.59  
 ± 0.2 to ±0.39  
 ± 0.1 to ±0.19

**Indication**

Very Strong  
 Strong  
 Moderate  
 Weak  
 Very Weak

Table 8 presents the relationship between or among the parts of the supplemental material on operation on integers and extent of validation.

The content and objective, presentation and content, presentation and objective, evaluation and objective, evaluation and content, evaluation and presentation, consistency and usability, curriculum alignment and usability, and curriculum alignment and consistency shows a relationship have a verbal interpretation of significant at 0.05 level of significance. This means that between or among the parts of the supplemental material on operation on integers and extent of validation has a direct relationship.

Based on the data, it shows that the null hypothesis stating that “there is no significant relationship between or among the parts of the supplemental material on operation on integers and extent of validation” is rejected, it can inferred that there is a “significant” relationship between them.

**CONCLUSION**

In view of the aforementioned findings, the study has drawn the following conclusions:

1. The Supplemental Material on Operation on Integers based on the data result shows that the study output is highly acceptable.
2. Since the supplementary material is acceptable in terms of having specific, simple, attainable and measurable objectives and it captures the interest of learners in the lesson taught; it could be used independently, to serve as a tool for deepening learning.
3. Since the supplemental material focuses on the main goal, it has relevant experiences for the students to grow which is set and aligned to the DepEd standards and competencies which must strictly follow.

**RECOMMENDATIONS**

Based on the findings and the conclusions, the following are the recommendations are offered:

1. The teachers and students may use the supplementary materials for the purpose of continuity in learning during pandemic times;
2. Provide more differentiated activities so students could have more opportunities to learn new experiences;
3. It is recommended to test the supplemental material’s reliability and effectiveness.
4. It is recommended that the researcher submit a proposal to the District Mathematics Principal Coordinator to adapt the module for district implementation.

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