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Development and Validation of *Onhan* Supplementary Learning Module on Four Basic Operations on Integers

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ABSTRACT

Mathematics has been proven to be a difficult subject for students. At Ferrol National High School, the student proficiency in quarterly periodical test was 56.28% as against the 75% standards. This study developed an *Onhan* supplementary module on operations on integers to provide struggling learners the chance to learn operations on integers using the learners' first language as the medium which students under open high schools in other *Onhan*-speaking municipalities can also use. The developed material underwent validation from five content experts based from the DepEd's guidelines and processes for Learning Resource Management and Development System's predetermined criteria. The materials were further assessed by two *Onhan* language experts, selected intended users, and pilot tested to grade seven students. The result of the validation revealed that the developed *Onhan* supplementary learning module was very satisfactory (M=3.76). The comparison of pretest and posttest of students' scores after pilot testing showed a significant mean difference, with the post-test recording 9.6% points higher than the target of 75%. This implies that the developed supplementary module contributed to the improvement of the performance of the students in operations on integers, (t=-11.511, p=.000). Furthermore, the words and sentences used in the developed *Onhan* supplementary learning readability were found appropriate for Grade 9 and may be adjusted to fit the target users.

Keywords: *Onhan supplementary learning module, development, validation, operations on integers*

INTRODUCTION

Republic Act No. 10533, also known as the Enhanced Basic Education Act of 2013 mandates flexibility in the curriculum, enabling schools to contextualize, localize, and indigenize lessons across various subjects. The aim is to provide learners the chance to receive a globally competitive and internationally standardized quality education. The act was established to promote learner-centered education, addressing the unique needs, cognitive and cultural capacities, circumstances, and diversity of learners, schools, and communities. It emphasizes the use of suitable languages for teaching, including the mother tongue as classroom instructional material.

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Mathematics is one of the most difficult subjects in school. However, students have difficulty with negative numbers and performing operations that involve negative numbers (Alfarisi et al., 2020). Another factor that makes mathematics hard for students is the choice of teaching strategies and methods for delivering the subject (Langoban, 2020). An effective approach to address this issue involves creating learning materials tailored to the student's needs and comprehension levels.

Self-Learning modules are designed to let the students choose how they learn, what to learn, where to learn, and when to learn (Sequeira, 2012). The use of self-learning modules has been proven to help students enhance their quality of learning (Tohidi et. al., 2019). Aside from that, self-learning modules allow students to work at their own pace, promote parents' engagement in their child's learning, and suit schools and communities with poor learning resources (Cahapay et.al., 2023).

In the Philippines, instruction is conducted in English across all subjects, including mathematics. However, students face two significant challenges in learning math: the language barrier that exists between students and the subject matter, and the inherent

difficulty of understanding the content, as mathematics is widely regarded as one of the most complex subjects. This is in alignment with the study of Peng et. al. (2020), who found that using the correct language in retrieving mathematics skills is important for foundational mathematics, which further strengthens the linguistic thought processes for performing advanced mathematics tasks.

This study was conducted to address the underlying issue that involves implementing strategies such as adapting the medium of instruction for students who struggle with a slower pace to ensure that no one is left behind in mathematics discussions. The most essential learning competency, operations on integers, has been listed three school years in a row as one of the least mastered competencies in grade 7 of Ferrol National High School. The study followed Analysis, Design, Development, and Evaluation (ADDE) in developing the *Onhan* supplementary learning module on four basic operations on integers. The research objectives involved validation of the developed supplementary learning material in terms of content, format, presentation and organization, accuracy and up-to-date information, and language. Moreover, it involved testing the efficacy of the developed module on the students.

Furthermore, the study of Canilao (2018) revealed that English is the least preferred language of instruction for students learning mathematics because of the difficulty in understanding it. However, Norén (2008) found out that bilingual students who used English and their mother tongue in the instruction were able to learn more and felt secure with ways of language and learning mathematics. This was supported by Perez and Alieto (2018), who found that when students use their mother tongue when learning mathematics, their proficiency level is advanced. Furthermore, positive correlation between mathematics achievement and proficiency in the mother tongue has been established (Perez & Alieto, 2018).

A study conducted by Morales-Obod et. al. (2020) found that the use of mother tongue language is more effective than non-mother tongue language in teaching math. The study by Fernando (2020) revealed that those students who were taught several topics in mathematics such as operations on decimal numbers, operations on whole numbers, and laws of exponent using their mother tongue performed better than those students who were taught using English. This was supported by the study conducted by Pillos et. al. (2020) who found that the use of the mother tongue as a medium of instruction can improve the learners' knowledge comprehension and strategies for solving problems.

Another study conducted by Falguera (2022) showed that exposing pupils to their mother tongue can greatly influence them to improve their performance. This implies that the use of the mother tongue language or the local language of the learners in teaching mathematics is one of the factors that can help to elevate the learning of the students and attain higher proficiency in the subject matter.

Many supplementary learning modules have been constructed over time. When the pandemic hit the world, there was shift a in education delivery modes from face-to-face to distance education or modular education. Mamun et al. (2020) highlighted the use of the model Predict, Observe, Explain, and Observe (POEE) in their study, wherein they focused on teaching children through scaffolding learners through online learning modules. In the module developed by Bandala et. al. (2023), sample activities, exercises, and pre-assessment and post-assessment were the highlights of their self-learning modules while the best feature of the said module according to their pupils were representations and connection to real life. Funa and Talaue (2021) affirmed that the module should be under the philosophy of constructivism. On the other hand, Wulandari et. al. (2016) developed a module incorporating a discovery learning approach and proved to be effective according to the evaluation of experts and students.

This study aimed to produce a developed *Onhan* supplementary learning module that will help struggling students and those in the open high school program to understand better operations on integers using their mother tongue. The supplementary learning module is written in the first language of the target students and features contextualized situations in the examples and word problems. Moreover, it has been simplified and each topic was made up of five parts. First is the *Usyan,* wherein the topic objectives are written. Second, *Dapat Usyan Nimo Ya* which gives a simplified overview of the topic. Third, *I-Try Naton* wherein the examples were provided with discussions on the side. Fourth, *Ikaw Ron,* which gives the learners the opportunity to work on their own using the acquired knowledge. Lastly, *Kaya Ron Nako* gives the students the chance to answer the worded problem.

The study provides evidence that the use of the mother tongue in supplementary modules helps improve the performance of the students in classroom instruction. This is for the curriculum planners to include the mother tongue as an option to deliver lessons in the classroom.

METHODOLOGY

The research followed a descriptive-developmental approach which was composed of two phases. Phase 1 was the development of the supplementary learning material according to the learning needs of the students in terms of content encompassing analysis, design, and development, while Phase 2 focused on the evaluation of the developed module. Before the module development process began,

the researcher analyzed the gaps and problems in teaching operations of integers.

Figure 1 shows the *Onhan* supplementary learning module development process. First, the researcher analyzed the learning needs of the students in terms of language and content. The researcher utilized the consolidated reports submitted by the math teacher to assess the difficulties of the students in terms of content. Secondly, the researcher came up with the assessed needs of learners. Lastly, the researcher used the assessed needs in developing the *Onhan* supplementary learning material using the Analyze, Design, Develop and Evaluate (ADDE) process. The developed learning material was validated by content experts, language experts, and student participants for feedback. After the validation process, the developed learning module was tested for its efficacy by administering it to the group of students using the pre-test and post-test scores.

To assess the validity of the *Onhan* supplementary learning material, the researcher utilized the evaluation tool adopted from the Department of Education Guidelines and Processes for Learning Resources Management and Development System (LRMDS) dated March 2009. The tool was also used in a master's thesis about the development and evaluation of instructional modules for special programs in journalism (Yongco & Del Valle, 2022). As for the tool used in validating the language used in the supplementary learning module, the researcher adopted the evaluation tool used by Altares (2024) in his study about the development and validation of a supplemental learning resource in chemistry in conversational Filipino.

The pre-test and post-test were administered to test the effectiveness of the developed *Onhan* supplementary module. In developing the test material used, the researcher adhered to the procedure in developing test materials. The researcher used Kuder-Richardson (KR21) to test the reliability through its internal consistency. The resulting reliability of the developed pre-test and post-test was .71, assuring that it is good for a classroom test. Hence, yielding a reliable test result.

The study's participants consisted of content and language experts in mathematics. Expert teachers as defined by Anderson and Tanner (2023) have well-developed pedagogical knowledge. With these, to identify these experts, a set of criteria such as scholastic achievements in the teaching-learning process in mathematics, contributed greatly to the field of mathematics, and long tenure as a teacher was established to validate the developed learning material in terms of content and language. The content experts were composed of two Master Teachers, a Head Teacher, an Education Program Supervisor in Mathematics, and a faculty member from the College of Education from Romblon State University. Moreover, the language experts were the director of *Sentro ng Wika at Kultura* of Romblon State University specializing in literature and Romblon languages, and an English teacher who served as a back translator from Ferrol National High School. Due to the limited number of language experts in the Division of Romblon, the researcher came up with only two language experts.

The pilot testing was conducted in a span of two days. On the first day, the researcher administered the pretest to the students and handed them out the developed *Onhan* supplementary learning material for the experimental group while DepEd's Self-Learning Module was in the control group. A continuation of the use of the developed *Onhan* supplementary learning

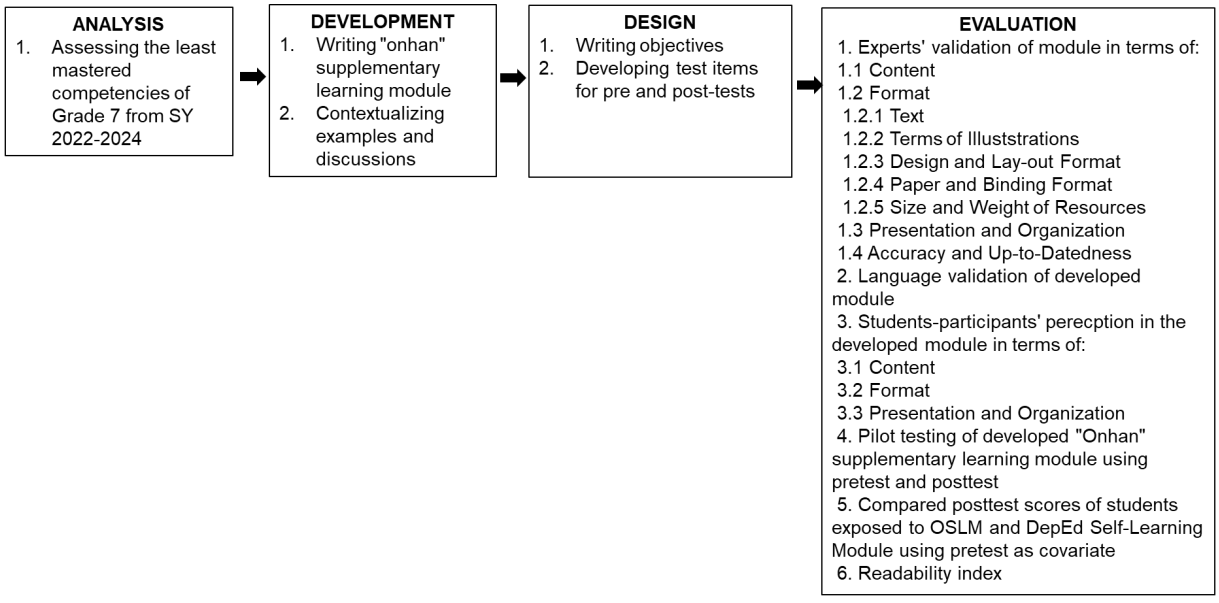

Figure 1. *Onhan* Supplementary Learning Module Development Process

module was done on the second day before administering the posttest. The researcher utilized Grade 7 *(Mapagmahal)* as the experimental group and Grade 7 *(Mapagpakumbaba)* as the control group in pilot testing and soliciting feedback about the developed *Onhan* supplementary learning material. Furthermore, the researcher utilized the pretest and posttest that were incorporated in the developed *Onhan* supplementary learning module.

RESULTS AND DISCUSSION

Analysis

In the analysis stage, the researcher analyzed and assessed the consolidated least mastered competencies for grade 7 for the past three years from 2022 to 2024. Based on this submitted report, the most frequent and least mastered competency for the past three years was about the operations of integers. This finding is consistent with that of Gabriel et al. (2022), wherein they listed performing operations on integers as one of the compromised most essential learning competencies. A prior study by Ereño and Benavides (2022) revealed that these are due to several factors that hamper the process of learning the competencies such as student-related factors, home-related factors, and subject-related factors which was supported by results found by the study conducted by Ganal and Guiab (2014) adding teachers' lack of creativity in adapting to the learners' capability.

Design

In the design stage, the researcher unpacked the least mastered competency and crafted the lesson objectives per subtopic based on the most essential learning competencies released from the Department of Education. The supplementary learning material was designed to enhance the skills of the students in the number sense and intensify the learning of the learners through contextualization and culture. Table 1 displays what the students will be able to do upon successful completion of the *Onhan* supplementary Module.

Development

In the development phase, the researcher crafted and structured the module meticulously. This supplementary learning module was specifically tailored to instruct students on the four fundamental operations of integers, employing *Onhan* as the instructional medium. It incorporated various contextualized examples to ensure that students could readily grasp and apply the lessons to real-life situations. Table 2 below exhibits the different contextualization across the four operations of integers.

Table 1. Lesson objectives per topic

Topic	Objectives
Addition of Integers	• model addition of integers using a number line • add two positive or negative integers • add two integers with one is positive and the other is negative • solve real-world problems that involve addition of integers
Subtraction of Integers	• state the rules for subtracting integers • subtract integers using the rules • solve real-world problems that involve subtraction of integers
Multiplication of Integers	• state the rules in multiplying integers • multiply integers using the rules • solve real-world problems that involve multiplication of integers
Division of Integers	• state the rules in division of integers • divide integers using the rules • solve real-world problems that involve division of integers

Table 2. Contextualization across four topics on operation on integers

Topic	Contextualized Examples
Addition of Integers	• The concept of "*kwarta*" as positive integer and "*utang*" as negative integer. • Used addition of integers to integrate financial literacy on the students.
Subtraction of Integers	• marketplace setting in worded problem • rules in addition of integers
Multiplication of Integers	• financial literacy for a student using daily allowance • business math
Division of Integers	• finance and banking • rules of multiplication

Evaluation

According to Sidek & Jamaluddin (2015) as cited by Abdelmohsen (2020), module development encompasses validation by experts and students. The module was evaluated by five content experts and one *Onhan* language expert who is qualified and with appropriate expertise in content and *Onhan* language. A checklist was adapted from the evaluation tool prescribed by the Learning Resources Management and Development System (LRMDS) manual to test the content validity of the module. As to language validity, the researcher adapted a checklist with a five-point Likert scale from 1 (to no extent) and 5 (to a very large extent).

Table 3 shows the overall validity of the *Onhan* supplementary learning module in four basic operations on integers. The mean score obtained as regards content was 3.63 with adjectival description very satisfactory. Moreover, as regards format, it obtained a mean score of 3.60 with an adjectival description of very satisfactory. The mean score obtained as regards presentation and organization was 3.80 with adjectival description of very satisfactory. As regards accuracy and up-to-date, the supplementary learning module obtained a mean

Table 3. Overall validity of *Onhan* supplementary learning module in four basic operations of integers

Factor		Mean	DI
1.	Content	3.63	VS
2.	Format	3.60	VS
3.	Presentation and Organization	3.80	VS
4.	Accuracy and Up-to-Datedness of Information	4.00	VS
Overall Mean		3.76	VS

Table 4. Summary of students' perceptions on *Onhan* supplementary learning module

Factor	Mean	DI
1. Content	3.66	VS
2. Format	3.78	VS
3. Presentation and Organization	3.76	VS
Overall Mean	3.73	VS

Table 5. Content validity of the *Onhan* supplementary learning module

Content Indicator		Mean	DI
1.	Content is suitable to the students' level of development.	4.00	VS
2.	Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	4.00	VS
3.	Material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem-solving, etc.	3.20	S
4.	Material is free of ideological, cultural, religious, racial, and gender biases, and prejudices.	3.80	VS
5.	Material enhances the development of desirable values and traits.	3.20	S
6.	Material has the potential to arouse the interest of the target reader.	3.80	VS
7.	Adequate warning/symbols are provided in topics and activities where safety and health are concern.	3.40	S
Overall Mean		3.63	VS

Legend for Descriptive Interpretation (DI):
3.6-4 Very Satisfactory (VS); 2.6-3.5: Satisfactory (S); 1.6-2.5 Fair (F); 1-1.5 Poor (P)

score of 4.00 with a description very satisfactory. The overall validity of the *Onhan* supplementary learning module is 3.76 with a description, very satisfactory. One of the content validators expressed "I do not see any incorrect content about the material. The material is good." This means that the supplementary module passed all the criteria and was deemed valid. This supports the claim of Samuel (2009) that through validated instructional materials, the learning of the students becomes meaningful.

After the validation from content experts and language experts, the supplementary module samples were administered to the students to get their feedback regarding the developed supplementary module using the same evaluation tool, and revisions were made according to the students' feedback.

The student's perception of the developed *Onhan* supplementary learning module exhibited in Table 4 revealed that the module passed the three factors: content, format, presentation, and organization with mean of 3.66, 3.78, and 3.76 respectively. The overall perception of the students in the developed module is 3.73 with an adjectival rating of Very Satisfactory. This implies that the module passed according to the student's perception.

It can be observed in Table 5 that content indicators 1 and 2 obtained the highest mean 4.00 with adjectival description very satisfactory, indicators 4 & 6 obtained 3.80 with adjectival description very satisfactory, indicator 7 obtained 3.40 with adjectival

Table 6. Language validation of *Onhan* supplementary learning module

Criteria		Mean	DI
1.	Instructions to students are clear, unambiguous, and easy to follow.	4.5	To a large extent
2.	The words, grammar, and mechanics are correct and accurate.	4	To a large extent
3.	The vocabulary used is suitable to the reading and understanding level of students to whom the learning resource is intended.	4.5	To a large extent
4.	The vocabulary and grammar used in the learning resource are contextualized.	5	To a very large extent
5.	The use of mathematical terms and jargon are appropriately retained in the learning resource.	5	To a very large extent
6.	The learning resource uses a great and accurate command of language (Onhan) and native to the intended users.	4.5	To a large extent
7.	The language used in the learning resource is truly a reflection of a conversational type of discussion.	4.5	To a large extent
Overall Mean		4.57	To a large extent

description satisfactory, and lastly, indicators 3 and 5 obtained the lowest mean 3.20 with adjectival description satisfactory. This means that as regards content the supplementary learning module can be of help in honing the higher order thinking skills, appropriate to students' development stage, free of biases, and has the potential to arouse the interest of the students. This is to support the claim of Hassan et.al. (2023), wherein they claimed that teachers need modules to develop the higher-order thinking skills of the students.

In the aspect of language validation of the developed *Onhan* supplementary learning module as shown in Table 6, indicator 2 obtained a mean of 4 with an adjectival rating of "To a large extent", indicators 1, 3, 6, & 7 obtained a mean of 4.5 with an adjectival rating of "To a large extent", and indicators 4 & 5 obtained a mean of 5 with an adjectival rating of "To a very large extent". The overall mean score is 4.57 with an adjectival rating of "To a large extent". This means that the vocabulary and grammar used are contextualized, mathematical terms and jargon are retained in the learning resource, the module uses a conversational type of language, and instructions are clear, unambiguous, and easy to follow. Hence, the module passed the criteria in terms of language.

Table 7.1 shows the validity of the *Onhan* supplementary learning module as regards format. It revealed that indicator 1 obtained the highest mean of 3.85 with a description of very satisfactory, indicators 4 & 5 obtained 3.6 with a description of very satisfactory, indicator 2 obtained 3.57 with a description of very satisfactory, indicator 3 obtained 3.4 with a description satisfactory, and overall mean 3.60 and description very satisfactory as regard to format. This means that the material passed the criterion.

Table 7.2 shows the validity of the text format of the supplementary learning module. The data revealed that indicator 3 obtained a mean of 4.00 with a description very satisfactory, and indicators 1, 2, & 4 obtained a mean score of 3.80 with a description very satisfactory. The overall validity of the text format is 3.85 with description, very satisfactory. This indicates that the typeface is readable, the printing is of high quality, the letter sizes are suitable for the intended user, and the gaps between words and letters make reading easier.

The results of the validation of the supplementary learning module in terms of illustration format, as shown in Table 7.3, revealed that indicator 1 obtained a mean of 4 with description very satisfactory, indicator 2 obtained a mean of 3.80 with description very satisfactory, indicator 6 obtained a mean of 3.60 with description very satisfactory, indicators 3 & 4 obtained a mean of 3.40 with description satisfactory, and indicator 5 obtained a mean of 3.20 with description

Table 7.1. Validity of the *Onhan* supplementary learning module in terms of format

Format Criteria	Mean	DI
1. Text	3.85	VS
2. Illustration	3.57	VS
3. Design and lay-out	3.4	S
4. Paper and Binding	3.6	VS
5. Size and weight of resources	3.6	VS
Overall Mean	**3.60**	**VS**

Table 7.2. Validity of the *Onhan* supplementary learning module in terms of text format

Criteria	M	DI
1. Size of letters is appropriate to the intended user.	3.80	VS
2. Spaces between letters and words facilitate reading	3.80	VS
3. Font is easy to read	4.00	VS
4. Printing is of good quality	3.80	VS
Overall Mean	**3.85**	**VS**

Table 7.3. Validity of the *Onhan* supplementary learning module in terms of illustrations format

Criteria	Mean	DI
1. Simple and easy recognizable	4.00	VS
2. Clarify and supplement the text	3.80	VS
3. Properly labelled or captioned (if applicable)	3.40	S
4. Realistic / appropriate colors	3.40	S
5. Attractive and appealing	3.20	S
6. Culturally relevant	3.60	VS
Overall Mean	**3.57**	**VS**

Table 7.4. Validity of the *Onhan* supplementary learning module in terms of design and lay-out format

Criteria	Mean	DI
1. Attractive and pleasing to look at	3.40	S
2. Simple (i.e. does not distract the attention of the reader)	3.60	VS
3. Adequate illustration in relation to text	3.20	S
4. Harmonious blending of elements (e.g. illustrations and text)	3.40	S
Overall Mean	**3.40**	**S**

Table 7.5. Validity of the *Onhan* supplementary learning module in terms of paper and binding format

Criteria	Mean	DI
1. Paper used contributes to easy reading	3.60	VS
2. Durable binding to withstand frequent use	3.60	VS
Overall Mean Score	**3.60**	**VS**

Table 7.6. Validity of the *Onhan* supplementary learning module in terms of size and weight of resources format

Criteria	Mean	DI
1. Easy to handle	3.60	VS
2. Relatively light	3.60	VS
Overall Mean	**3.60**	**VS**

Legend for Descriptive Interpretation (DI):
3.6-4 Very Satisfactory (VS); 2.6-3.5: Satisfactory (S); 1.6-2.5 Fair (F); 1-1.5 Poor (P)

satisfactory. The overall validity of the illustration format is 3.57 with description, very satisfactory. This means that the illustrations in the supplementary module are simple and easily recognizable, properly labeled, realistic, attractive and appealing, culturally relevant, and able to supplement the text. Hence, passing the criterion.

Further, Table 7.4 shows the validity of the *Onhan* supplementary learning module in terms of design and layout. It revealed that indicator 2 obtained a mean of 3.60 with a description very satisfactory, indicators 1 and 4 obtained a mean of 3.40 with a description satisfactory, and indicator 3 obtained a mean of 3.20 with a description satisfactory. The overall design and layout validity is 3.40, with a satisfactory description, thus passing the criterion.

Likewise, Table 7.5 shows the paper and binding validity of the developed supplementary learning module. Data revealed that indicators 1 and 2 obtained a mean of 3.60 with a description of very satisfactory. The overall paper and binding validity are 3.60 with the description very satisfactory. This means that the developed supplementary learning module has a durable binding to withstand frequent use, and the paper used contributes to easy reading. Hence, it passed this criterion.

Furthermore, Table 7.6 shows the validity of the *Onhan* supplementary learning module concerning the size and weight of resources. Data revealed that indicators 1 & 3 obtained a mean of 3.60 with a description of very satisfactory. The overall size and weight of resources validity is 3.60 with a description of very satisfactory. This means that the developed supplementary module is easy to handle and relatively light. Hence, the material passed the criterion.

The data in Tables 7.1-7.6 are comparable to the research of De Guia & Reyes (2015) in terms of the assessment approach that was used in validating printed instructional material. This method was utilized to gauge the module's validity.

Additionally, Table 8 shows the validity of the developed supplementary learning module concerning presentation and organization. Data revealed that indicator 4 obtained a mean of 4.0 with a description of very satisfactory, indicators 1, 2 and 3 obtained a mean of 3.80 with a description of very satisfactory, and indicator 5 obtained a mean of 3.60 with a description of very satisfactory. The overall presentation and organization validity is 3.80, with a very satisfactory description. This means that the developed learning material is logical and has a smooth flow, the presentation is engaging, the vocabulary level is tailored to the comprehension level of the target reader, the length of sentences is appropriate, and the sentences and paragraph structures are intriguing and varied.

Hence, the developed supplementary material passed the criterion. Selga (2011) asserts that a worktext's well-designed and ordered structure aids in the development of higher cognitive skills and helps students meet the subject's specific objectives.

Also, Table 9 exhibits the validity of the *Onhan* supplementary learning module in terms of accuracy and up-to-dateness. Results revealed that indicators 1, 2, 3, 4, 5, and 6 obtained a perfect mean of 4.00 with a description of very satisfactory. The overall accuracy and up-to-date validity of the developed supplementary learning module is 4.00 with a description of very satisfactory. This means that the material has minor to no conceptual errors, factual errors, grammatical errors, computational errors, and typographical errors. Hence, the material passed the criterion.

Likewise, Table 10 shows the perception of student participants in the content of the developed supplementary learning module. Results revealed that indicators 1, 2, 3, 4, and 7 obtained the highest mean score of 3.80 with an adjectival rating of very Satisfactory. In addition, indicator 6 obtained a mean score of Very Satisfactory while indicator 5 obtained a mean score of 3 with an adjectival rating of Satisfactory. The overall mean score of the content factor is 3.66 with an adjectival rating of Very Satisfactory.

Moreover, Table 11 shows the perception of the student participants in terms of the format of the developed *Onhan* supplementary learning module. It revealed that indicator 5 obtained the highest mean score of 3.90 with an adjectival rating of very Satisfactory. Indicators 2, 3, and 4 obtained an adjectival rating of Very Satisfactory with mean scores of 3.83, 3.85, and 3.70, respectively. The lowest mean score of 3.60 was obtained by indicator 1 with an adjectival rating of Very Satisfactory. To sum it up, the overall mean score obtained in terms of format is 3.78 with an adjectival rating of Very Satisfactory. Hence, the developed supplementary learning module passed in terms of the format and perception of the student participants.

The validation of the supplementary learning module in terms of presentation and organization exhibited in Table 12 data revealed that indicators 1, 3, 4, and 5 obtained the same mean score of 3.80 and adjectival rating of Very Satisfactory. Meanwhile, indicator 2 obtained a mean score of 3.60 with an adjectival rating of Very Satisfactory. The overall perception of participants in the developed *Onhan* supplementary learning module in terms of presentation and organization is 3.76, Very Satisfactory. Hence, the developed supplementary learning module passed in terms of presentation and organization in the perception of the student participants.

Following the pilot testing of the developed supplementary learning module, Table 13 presents the Descriptive Statistics of Pre-test Mean Scores of Grade

Table 8. Presentation and organization validity of the *Onhan* supplementary learning module

Criteria		Mean	DI
1.	Presentation is engaging, interesting, and understandable.	3.80	VS
2.	There is logical and smooth flow of ideas	3.80	VS
3.	Vocabulary level is adapted to target reader's likely experience and level of understanding	3.80	VS
4.	Length of sentences is suited to the comprehension level of the target reader	4.0	VS
5.	Sentences and paragraphs structures are varied and interesting to the target reader	3.60	VS
Overall Mean		**3.80**	**VS**

Table 9. Accuracy and up-to-datedness of information validity of *Onhan* supplementary learning module

Factor		Mean	DI
1.	Conceptual errors	4.00	VS
2.	Factual errors	4.00	VS
3.	Grammatical errors	4.00	VS
4.	Computational errors	4.00	VS
5.	Obsolete information	4.00	VS
6.	Typographical and other minor errors (e.g. inappropriate or unclear illustrations, missing, labels, wrong captions, etc)	4.00	VS
Overall Mean		**4.0**	**VS**

Table 10. Students-participants perception in content factor of the developed *Onhan* supplementary learning module

Content Indicators		Mean	DI
1.	Content is suitable to the students' level of development.	3.8	VS
2.	Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	3.8	VS
3.	Material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	3.8	VS
4.	Material is free of ideological, cultural, religious, racial, and gender biases, and prejudices.	3.8	VS
5.	Material enhances the development of desirable values and traits.	3	S
6.	Material has potential to arouse interest of target reader.	3.6	VS
7.	Adequate warning/symbols are provided in topics and activities where safety and health are concern.	3.8	VS
Overall Mean		**3.66**	**VS**

Table 11. Students-participants perception in format factor of the developed *Onhan* supplementary learning module

Factor Indicators		Mean	DI
1.	Text	3.60	VS
2.	Illustrations	3.83	VS
3.	Design and Lay-out	3.85	VS
4.	Paper and Binding	3.70	VS
5.	Size and Weight of Resources	3.90	VS
Overall Mean		**3.78**	**VS**

Legend for Descriptive Interpretation (DI):
3.6-4 Very Satisfactory (VS); 2.6-3.5: Satisfactory (S); 1.6-2.5 Fair (F); 1-1.5 Poor (P)

7 learners exposed to *Onhan* Supplementary Learning Module (Experimental) and DepEd Self-Learning Module (Control). Results revealed the pre-test mean scores of Grade 7 learners exposed to *Onhan* Supplementary Learning Module and DepEd Self-Learning Module in Four Operations on Integers. The OSLM group (M = 6.96, SD = 2.32) comprised 26 learners, while the Control group (M = 3.50, SD = 1.58) comprised 26 learners. The total sample size was 52 learners, with an overall mean pretest score of 5.23 (SD = 1.95) across both groups. These results suggest a slight difference in mean pretest scores between the two groups, with the OSLM group showing a slightly higher mean score. However, the variability in scores within each group indicates that individual learner performance varied.

While this difference in mean scores may not be statistically significant, further analysis is needed to determine the practical significance of these findings. Consequently, considering Tohidi et. al. (2019) claim that the use of learning modules has been proven to help students enhance their quality of learning, exploring the integration of mother tongue in crafting a supplementary module appears to be encouraging based on the observed mean score differences and principles of contextualization.

Furthermore, Table 14 presents descriptive statistics for the post-test mean scores of Grade 7 learners exposed to *Onhan* Supplementary Learning Module and DepEd Self-Learning Module in Four Basic Operations on Integers. The OSLM group had a mean post-test score of 12.69 with a standard deviation of 2.04, based on a sample of 26 learners. In comparison, the control group had a lower mean score of 6.88 with a standard deviation of 3.65, based on a sample of 26 learners. The total mean posttest score across both groups was 9.79, with a standard deviation of 2.85, based on a total sample size of 52 learners. The mean percentage score (MPS) of the OSLM group is 84.6%. This is almost 10% percentage points higher than the

Table 12. Students-participants perception in presentation and organization factor of the developed *Onhan* supplementary learning module

Presentation and Organization Indicators		Mean	DI
1.	Presentation is engaging, interesting, and understandable.	3.80	VS
2.	There are logical and smooth flows of ideas	3.60	VS
3.	Vocabulary level is adapted to target reader's likely experience and level of understanding	3.80	VS
4.	Length of sentences is suited to the comprehension level of the target reader.	3.80	VS
5.	Sentences and paragraphs structures are varied and interesting to the target reader	3.80	VS
Overall Mean		3.76	VS

Legend for Descriptive Interpretation (DI):
3.6-4 Very Satisfactory (VS); 2.6-3.5: Satisfactory (S); 1.6-2.5 Fair (F); 1-1.5 Poor (P)

Table 13. Descriptive statistics of pretest mean scores of grade 7 learners exposed to *Onhan* supplementary learning module (OSLM) and deped self-learning module (Control) in four basic operations on integers

Group	Mean	Std. Deviation	Minimum	Maximum	N
OSLM	6.96	2.323	2	12	26
Control	3.50	1.581	0	6	26
Total	5.23	1.952			52

Table 14. Descriptive statistics of post-test mean scores of grade 7 learners exposed to *Onhan* supplementary learning module (OSLM) and DepEd self-learning module in four basic operations on integers (Control)

Group	Mean	Std. Deviation	Minimum	Maximum	N
OSLM	12.69	2.04	8	15	26
Control	6.88	3.65	1	13	26
Total	9.79	2.85			52

Table 15. Comparison of pretest and posttest scores of students-participants on developed *Onhan* supplementary learning module

	Paired Differences		t	df	Sig (2-tailed)
	Mean	Std. Deviation			
Pretest-Posttest	-5.731	2.539	-11.511	25	.000*

*significant at ρ<.05

Table 16. Test of significant difference between posttest mean scores of grade 7 learners exposed to OSLM and Control group using pretest mean scores as covariates

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Era Squared
Corrected Model	449.574[a]	2	224.787	25.911	.000	.514
Intercept	547.212	1	547.212	63.076	.000	.563
Pre	11.093	1	11.093	1.279	.264	.025
Var00002	49.639	1	49.639	5.691	.021	.104
Error	425.100	49	8.676			
Total	5857.000	52				
Corrected Total	874.673	51				

Table 17. Readability index of the *Onhan* supplementary learning module

Number of words	Number of Sentences	Flesch Reading Ease Level	Flesch-Kincaid Grade Level
2 164	168	44.1	9

target of 75%. These findings suggest a notable difference in mean post-test scores between the two groups, with the OSLM group showing a higher mean score. However, as indicated by the standard deviations, there was variability in scores within each group, indicating differing levels of individual student performance.

This suggests a notable difference in mean post-test scores after implementing OSLM, the treatment group, showed a higher mean score. These findings support the effectiveness of the use of the mother tongue in learning mathematics, as highlighted in Perez and Alieto's study (2018). Moreover, this was supported by Pillos et. al. (2020) who highlighted that the use of the mother tongue as a medium of instruction improves the learners' comprehension and strategies for solving problems.

In addition, Table 15 presents the comparison of the pretest and posttest scores of students-participants in the developed *Onhan* supplementary learning module. Using a paired sample t-test, the comparison between the pretest and posttest is displayed in the table. According to the data, the mean posttest is higher than the mean pretest. This suggests that students' exposure to the specially designed *Onhan* supplemental learning module improved their understanding of the four fundamental operations on integers. This is consistent with Ricablanca's (2014) results that learning mathematics in one's mother tongue facilitates easier and better learning. Moreover, Englis and Boholano (2021) corroborated these results by stating that using the learners' mother tongue during mathematics instruction enhances their performance and memory abilities. The findings of Villaruz and Perez (2020) support these results by stating that the use of learner's mother tongue greatly influences their performance in mathematics. The module is, hence, efficient.

Also, Table 16 presents the results of a test of significant difference between the post-test mean scores of Grade 7 students exposed to OSLM and the Control group, using pre-test mean scores as covariates. The focus is on the significance value and the partial eta squared as an effect size measure.

The analysis reveals that the corrected model, which includes the factors being tested, is statistically significant ($F(2, 49) = 25.911$, $p = .000$). This indicates that there is a significant difference in post-test mean scores between the OSLM and Control groups when controlling for pretest scores.

The partial eta squared value of .514 indicates a medium effect size. This suggests that approximately 51.4% of the variance in posttest scores can be explained by the difference between the OSLM and Control groups, after controlling for pretest scores.

The findings suggest that the OSLM group has a statistically significant effect on the post-test mean scores of Grade 7 learners in four basic operations on integers compared to the Control group, even when controlling for pre-test scores. The medium effect size indicates that the OSLM has a meaningful impact on learners' performance. These results highlight the potential effectiveness of using the mother tongue in enhancing learner's learning outcomes in Mathematics and support the continued use and development of the program in educational settings. This supports the findings of Perez and Alieto (2018) that the student's proficiency level is more advanced when exposed to instruction using their mother tongue. Furthermore, this supports the claim of Morales-Obod et. al. (2020) that the use of mother tongue language is more effective than non-mother tongue language in teaching mathematics.

Lastly, table 17 shows the readability index of the developed *Onhan* supplementary learning module. The data revealed that the material has 2,164 words, 168 sentences, 44.1 Flesch reading ease score which means that the developed learning material is easy for the adult to read and 9 at Flesch-Kincaid grade level. This means that the developed supplementary learning material is suitable for grade 9 students, two grades higher than the target readers. However, a study by Solnyshkina et. al. (2017) states that cohesion components of text and complexity of texts do not correlate with the Flesch-Kincaid Grade Level score.

CONCLUSION

The study was intended to develop and validate *Onhan* supplementary learning module in four basic operations on integers. The developed *Onhan* supplementary learning module was validated by five content experts as very satisfactory in overall content, format, presentation and organization, and accuracy, and up-to-date information. This implied that the *Onhan* supplementary learning module is valid. The noteworthy improvement observed in the pretest and posttest results of the students after their exposure to the *Onhan* supplementary learning module suggests that the developed supplementary learning module resulted in some degree of improvement in their understanding of the four fundamental operations on integers. Therefore, the developed *Onhan* supplementary learning module is a valid instructional material that can effectively improve students' performance in four operations on integers.

In light of these findings, more supplementary learning modules are suggested to be made for other identified least mastered competencies. Also, to ensure the quality of the material, designers and developers of instructional materials should always adhere to a set of guidelines and procedures. Additionally, the developed *Onhan* supplementary learning module should be tried out more to establish its efficacy over time. Lastly, the words and sentences used in the developed *Onhan* supplementary learning module should be adapted to an appropriate Flesch-Kincaid Grade Level Score.

AUTHORS' CONTRIBUTIONS

S.R. is the lead researcher who conceptualized and led the study. B.S. is the researcher's adviser who helped and guided him throughout the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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