Development and Validation of Interactive Learning Material in Mathematics 8

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Abstract: *This study aimed to develop and validate the researcher-made interactive learning material in Mathematics 8. The research method used in the study is descriptive design. Respondents of the study were 62 teachers from Urdaneta City. To validate the output, the researcher tapped experts to check the validity of the interactive learning material in terms of:(a) Appropriateness of print materials to the planned course,(b)readability of text,(c)suitability of vocabulary, and (d)content validity. And to measure the readability of the text, the researcher used the Flesch Reading Ease Formula. The following are the results of the study:(a) the performance level of the Grade 8 students using the prescribed activity sheets is under the Low Mastery Level; (b) the interactive learning material is in compliance with the K-12 Curriculum Guide under the Most Essential Learning Competencies (MELCs) and has the best features; (c) the respondents gave the highest regard on the quality of the interactive learning material in terms of the following: appropriateness of the print material to the planned course; suitability of vocabulary used in the instrument; and content validity and in terms of readability, the interactive learning material is appropriate for the Grade 8 level.*

Keywords: Validate; Interactive; Appropriateness; Vocabulary; Readability; Validity

1. Introduction

In today's scenario, COVID-19 brought changes in academic settings, especially in the mode of instruction. And considering the mushrooming cases in the Philippines, the state opted to close schools temporarily. DepEd let the schools decide what instructional delivery method fit them best based on several factors. Since many students from public schools do not have gadgets to support the other learning delivery modality, they preferred Modular Distance Learning instead, where learners use self-learning modules (SLMs). These SLMs can be in the form of print or digital format/electronic copy and other learning resources like learner's materials, textbooks, activity sheets, study guides, and other study materials. Therefore, the current situation calls for varied learning materials that enable learners to do independent learning without worrying about their maximum engagement to finish the tasks.

In preparation for School Year 2021-2022, the Department of Education (DepEd) provided Self-Learning Modules (SLMs) with the modular(print) and blended learning delivery modality. DepEd believes that integrating SLMs with the alternative learning delivery modalities like modular, television-based, radio-based instruction, blended, and online will help them ensure that all learners have access to quality primary education with face-to-face classes still prohibited due to the public health situation. These SLMs are delivered in printed format to schools and can also be accessed online or offline through the DepEd Commons. DepEd has also provided a set of SLMs for each region for contextualization. These were printed and distributed nationwide, prioritizing the remote areas with no access to the internet and where students have no gadgets.

Under DepEd Order No. 12 s. 2020 on the Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 in Light of the COVID-19 Public Health Emergency, Schools Division Office of Urdaneta City initiated the development of Self-Learning Modules. The SLMs aim to provide appropriate and quality learning material across all grade levels as advised in Division Memorandum No. 069 s.2020. For continuity of learning, the Urdaneta City Division issued Division Memorandum No. 107 s. 2020 announced all public schools of Urdaneta City Division to download the copies of Activity Sheets and print/reproduce to provide a reproduction of the material for the students to utilize for School Year 2020-2021. The recorded students' scores from the materials showed that their performance, specifically in Mathematics, remains low.

DepEd Central Office of Region 1 also published additional learning activity sheets (LAS) for this school year. Trained Mathematics teachers across the region developed these. They attended several trainings and workshops to prepare them to be equipped and oriented on utilizing LAS. Likewise, DepEd Region 1 also conducted several evaluations to ensure that the material was ready for distribution. Unfortunately, the distributed number of LAS for the preceding quarter was not proportionate to the total population of students per school. Hence, the school applied the 1:3 ratio in the distribution of available activity sheets provided by DepEd Region 1 this school year.

To cope with the changes brought by the pandemic, educators are seeking ways to incorporate better teaching and learning strategies in Mathematics during the pandemic. With this, teachers of the 21st century should keep in mind that Math doesn't have to be boring or abstract. There are several innovative ideas for activating students' interest in Mathematics class. Teachers just have to be creative and imaginative. Emphasis on these can hurdle all the challenges brought by this pandemic. Therefore, the preparation of the lesson; delivery of the lesson; up until assessment of learning; must be carefully considered to meet the desired learning outcomes from the students.

Thus, choosing an appropriate assessment tool is one of the most important things teachers need to provide. Not only

that, but assessment is also primarily considered as an aid to enhance the students' learning. The result becomes a benchmark of which aspect will both the teacher and learner focus. Teachers have the sole responsibility of reporting student learning accurately and fairly, based on evidence obtained from various contexts and applications.

1.1 Objectives of the study

This study aimed to develop and validate the researcher-made interactive learning material in Mathematics 8. Specifically, the study sought to determine: a) the performance level of the Grade 8 students using the prescribed activity sheets in Mathematics 8; b) the learning material that can be developed based onMost Essential Learning Competencies (MELCs) and its best feature; c) the quality of the proposed interactive learning material along:appropriateness of print materials to the planned course, readability of text, suitability of vocabulary used, andcontent validity.

1.2 Limitations of the study

The study is delimited to the Public Secondary High School Mathematics teachers of Urdaneta City Division this SY 2021-2022. The researcher focused on the Public Secondary High School students who are taking Mathematics 8 as the target users of the interactive learning material since the coverage of the said ILM are the lessons under Mathematics 8. The researcher started to collect data during the months of January and February 2022. And due to unavailability of some JHS Math teachers, only sixty-two (62) were able to validate the output. Moreover, the quality of the proposed interactive learning material includes only in the following aspects: a) appropriateness of print materials to the planned course, b) readability of text, c) suitability of vocabulary used, and d) content validity.

2. Materials and Methods

2.1 Research Design

The study adopted the Descriptive-Developmental Design to develop and validate the proposed interactive learning material in Mathematics 8. A descriptive study is one in which information is collected where nothing is manipulated. The research design is deemed appropriate in the study since it aimed to develop and validate the interactive learning material proposed by the researcher.

2.2 Population and Locale of the Study

The study's respondents were the 47 purposively selected math teachers from the different schools in Urdaneta City Division, Urdaneta City, Pangasinan during the academic year 2021-2022. Respondents also came from the 12 elected MATARI Club officers. Lastly, three respondents were instructors from the Higher Education Institution (HEI) experts in Mathematics. There were 62 respondents from the public high school teachers, MATARI Club officers, and HEI.

2.3 Data Collection Instrument

The study utilized a questionnaire checklist that was administered to the respondents. To check the face validity of the proposed interactive material, it adopted the validation instrument of the Urdaneta City Division. The data-gathering instruments are enumerated for the different purposes needed in understanding the study.

2.4 Treatment of Data

In order to treat the numerical results on the specific problem in this study, statistical tools such as frequency count, weighted average, and Flesch Reading Ease Formula were used.

3. Results and Discussion

3.1 Performance Level of the Grade 8 Students Using the Prescribed Activity Sheets

Table 1: Performance Level of the Grade 8 Students Using the Prescribed Activity Sheets
n=206

Grade Level	Total no. of students	Highest possible score	Mean	Median	Standard Deviation	Mean Percentage Score	Skewness
Grade 8	206	50	27.42	27.92	6.32	54.83	--0.0442
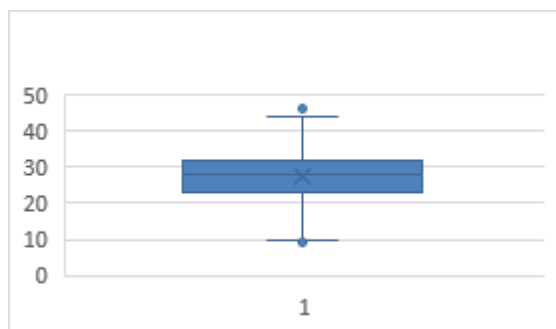
The first quarter performance level of the Grade 8 students is shown in Table 1 above. Data on the performance level of the Grade 8 students revealed that the students, indeed, have been performing low in Mathematics. Out of 50 items, the mean score obtained from the students is 27.42. The computed mean shows that the students hardly reach at least 38 or 75% of the total scores. A mean percentage score (MPS) of 75 is the goal of DepEd in any tests (Benito, 2010). The number for the overall MPS for the first quarter of the school year 2021-2022 showed that the goal of 75% seems elusive at this point. Grade 8 posted a low MPS of 54.83. Using the Level of Mastery Index, the score falls

under Average Mastery, which further shows that students performed way below the acceptable MPS. Specifically, a mean score of 27.42 with a high standard deviation of 6.32 indicates that the scores are spread out over an extensive range of values close to 27.42. In terms of the median, it can be further stated that the students obtained scores below and above 27.92. Lastly, a skewness value of -0.0442 indicates that the distribution is symmetrical since the mean, median and mode are almost equal.

3.2 Development of an Interactive Learning Material in Mathematics 8

The researcher developed an interactive learning material that contains several approaches with text, images, and videos to provide several forms of activities that will encourage the students to utilize their skills in calculating, composing, drawing, analysis, and problem solving.

This interactive learning material contains one activity per competency prescribed in the Most Essential Learning Competencies (MELCs). Each page consists of the following: a. competency to be achieved; b. subject matter to learn; c. references for guidance; d. about the lesson or a short outline of the lesson learned from the learner's material (LM); and others----activities with varying forms and degree of complexity that elicit the learners' excitement and interest. The best features of the ILM are the following: puzzles, domino, maze, cut & glue, color & match, coordinates, plot & draw.

3.3. Quality of the Proposed Interactive Learning Material in Mathematics 8

The quality of the developed interactive learning material in terms of the appropriateness of the print materials to the planned course; readability of text; suitability of vocabulary used; and content validity are presented below.

Appropriateness of Print Materials to the Planned Course

The distribution of the mean per statement under this is shown in table 2. The overall score on the appropriateness of print materials to the planned course garnered an overall weighted mean of 4.55, which is described as Very High. This result indicates that the teacher-respondents gave the highest regard to the print materials regarding their appropriateness to the planned course.

Table 2: Appropriateness of Print Materials to the Planned Course

Indicators	WM	DE
1. The learning material reflects a learning competency indicated in the Curriculum Guide with corresponding objectives.	4.65	VH
2. The objectives are unpacked in accordance with the Most Essential Learning Competencies (MELCs).	4.60	VH
3. The learning material creates activities that are short, but varied, and more importantly, congruent with the objectives.	4.66	VH
4. The activities are consistent with stated objectives.	4.58	VH
5. The overall form of the material is interactive, engaging and challenging.	4.55	VH
6. The content is appropriate for intended audience.	4.50	VH
7. The material has activities that cater to the learning style of the target learners.	4.50	VH
8. The lesson proper is concise and error-free.	4.35	H
9. The graphics and illustrations are suited to grade level and topic presented.	4.58	VH
10. The learning material presents appropriate and useful examples before the activity proper.	4.48	H
Overall Weighted Mean	**4.55**	**VH**

Legend:

Range	Descriptive Equivalent
4.50-5.00	Very High (VH)
3.50-4.49	High (H)
2.50-3.49	Moderately High (MH)
1.50-2.49	Slightly High (SH)
1.00-1.49	Not High (NH)

In compliance with the K-12 Curriculum Guide, 50 most essential learning competencies are included under Grade 8 level. The competencies were divided into the four quarters of the school year with the following quantity each quarter: Quarter 1 has 16 competencies, Quarter 2 has 16 competencies, Quarter 3 has eight competencies, and Quarter 4 has ten competencies.

It was interesting to note the commonality of individual responses. They indicated that the learning material is indeed appropriate to the planned course based on the results. Indicators were rated by the respondents ranging from 4.50 to 4.66 as 'Very Highly Valid' are the following: the content is appropriate for the intended audience; it has activities that cater to the learning style of the target learners; the overall form of the material is interactive, engaging and challenging; activities are consistent with stated objectives; graphics and illustrations are suited to grade level and topic presented; objectives are unpacked following the Most Essential Learning Competencies (MELCs); the learning material reflects a learning competency indicated in the Curriculum Guide with corresponding objectives; and the learning material creates activities that are short, but varied, and more importantly, congruent with the objectives. On the other hand, indicators "The lesson proper is concise and error-free" and "The learning material presents appropriate and useful examples before the activity proper" were described as Highly Valid.

Likewise, the statements "Learning material reflects a learning competency indicated in the Curriculum Guide with corresponding objectives," and the "Learning material creates activities that are short, but varied, and more importantly, congruent with the objectives" gained the highest weighted mean of 4.65 and 4.66, respectively. It is safe to conclude that the instrument met the planned course objectives since the researcher aligned the competencies from the K-12 curriculum guide.

Readability of the Text

In terms of the readability of the text of the interactive learning material, the Flesch Reading Ease Formula was used. The data on Table 3 below shows that the text scored a Flesch Reading Ease score of 68.1, which is described as appropriate for Grade Levels 8-9 with a standard description style, 147 syllables per 100 words, and an average sentence

length of 17. This figure can further be interpreted that the text can be easily read by Grade Level 8 students. Therefore, this implies that the material is readable enough for them when they read it alone.

Table 3: Readability of Text

Readability Formula	Score	Grade Level	Description Style	Syllables per 100 Words	Average Sentence Length
Flesch Reading Ease	68.1	8-9	Standard	147	17

Legend:

Reading Ease	Grade Level	Description of Style	Syllables per 100 Words	Average Sentence Length
90-100	5	Very easy	123	8
80-90	6	Easy	131	11
70-80	7	Fairly easy	139	14
60-70	8-9	Standard	147	17
50-60	10-12	Fairly difficult	155	21
30-50	College	Difficult	167	25
0-30	College graduate	Very Difficult	192	29

Suitability of Vocabulary Used in the Interactive Material in Mathematics 8

Table 4 elucidates the result of the data on the suitability of vocabulary used in the interactive learning material in Mathematics 8. The recorded high to very high weighted mean (WM) ranging from 4.44 to 4.66 are strong indications that the vocabulary used is suitable to the grade 8 students who will use the material. The learning material uses audience-appropriate language, which is simple and easily understood by the learners.

Table 4: Appropriateness of Vocabulary Used in the Instructional Materials in Mathematics 8

Indicators	WM	DE
1) The material uses no/minimal jargon.	4.44	H
2) It matches the tone to the audience.	4.44	H
3) The learning material uses audience-appropriate language.	4.66	VH
4) The language used is simple and easily understood.	4.66	VH
5) The mathematical terms are correctly applied in the lesson and activity proper.	4.60	VH
6) The words are appropriately worded to meet the required competency level of the students.	4.66	VH
Overall Weighted Mean	4.58	VH

Legend:

Range	Descriptive Equivalent
4.50-5.00	Very High (VH)
3.50-4.49	High (H)
2.50-3.49	Moderately High (MH)
1.50-2.49	Slightly High (SH)
1.00-1.49	Not High (NH)

Content Validity of the Instrument

According to Middleton (2019), validity refers to how accurately a method measures what it intends to measure. If research has high validity, it produces results corresponding to fundamental properties, characteristics, and variations in the physical or social world.

Table 5: Content Validity of the Interactive Learning Material

Indicators	WM	Interpretation
The lesson objectives of the instructional material are:		
1. relevant to the objectives/topics.	4.58	VH
2. specific and clearly stated.	4.53	VH
3. measurable.	4.60	VH
4. attainable.	4.44	H
5. result-oriented.	4.47	H
6. time bound.	4.40	H
The lesson inputs of the instructional material:		
7. give insights and ideas of what the activity is all about.	4.55	VH
8. provide background of concepts and information about the topic.	4.44	H
9. attract students' attention.	4.29	H
10. arouse the students' interest.	4.34	H
The lesson application of the instructional material is:		
11. in consonance with the course objectives.	4.56	VH
12. relevant to the lesson objective/s.	4.65	VH
13. properly sequenced.	4.56	VH
14. can be accomplished according to schedule.	4.39	H
15. is interesting.	4.48	H
16. adequate to develop students' mathematical knowledge and skills.	4.47	H
17. appropriate to students' abilities.	4.39	H
18. sufficient enough to determine the mastery level of students.	4.37	H
19. adopted to the students' level of comprehension.	4.35	H
20. well-constructed.	4.53	VH
Overall Weighted Mean	4.47	H

Legend:

Range	Descriptive Equivalent
4.50-5.00	Very High (VH)
3.50-4.49	High (H)
2.50-3.49	Moderately High (MH)
1.50-2.49	Slightly High (SH)
1.00-1.49	Not High (NH)

Description of the data was made similarly with essentially the same results as shown in Table 5 using the scale on the next page. Various responses only fall under Valid and Highly Valid, which strongly indicates that the tool passed its content validity. The instrument generally garnered an overall average weighted mean (AWM) of 4.47, interpreted as Highly Valid.

As expected, some differences in the indicators under content validity were found; but these tended to be minor, with only 0.05-0.36 %. Table 5 also shows that the indicator The lesson application of the instructional material is relevant to the lesson objective/s' reached the highest mean of 4.65, which attests that the developed activities from the interactive learning material are following the lesson objectives. On the other hand, the part with the lowest weighted mean (WM=4.29) falls under the indicator The lesson inputs of the interactive material attract students' interest, which is high. Still, the figure must be given importance for improving the material.

Summary Table on the Quality of the Proposed Interactive Learning Material
Table 6 below presents the overall quality of the proposed interactive material along with appropriateness of print materials (4.55, VH); readability of text (17 sentence length, standard description style); suitability of vocabulary (4.58, VH); and content validity (4.47, H). A general weighted average mean of 4.53 is interpreted as Very High. Thus, the overall quality of the developed interactive material is very highly appropriate, readable, and valid.

Table 6: Summary Table on the Quality of the Proposed Interactive Material

Indicators	OWM	DE
1. Appropriateness of print materials	4.55	VH
2. Readability of text	17 (Sentence Length)	Standard (Description Style)
3. Suitability of vocabulary	4.58	VH
4. Content validity	4.47	H
Grand Weighted Mean	4.53	VH

Legend:

Range	Descriptive Equivalent
4.50-5.00	Very High (VH)
3.50-4.49	High (H)
2.50-3.49	Moderately High (MH)
1.50-2.49	Slightly High (SH)
1.00-1.49	Not High (NH)

4. Conclusions

Based on the salient findings, the following conclusions were drawn: (a) the performance level of the Grade 8 students in Mathematics 8 using the prescribed activity sheets is under the Low Mastery Level; (b) the interactive learning material is in compliance with the K-12 Curriculum Guide in terms of its alignment to the competencies and sequence of lesson objectives under the Most Essential Learning Competencies (MELCs) and has the best features; (c) the respondents gave the highest regard on the quality of the interactive learning material in terms of the following: appropriateness of the print material to the planned course; suitability of vocabulary used in the instrument; and content validity and in terms of readability, the interactive learning material is appropriate for the Grade 8 level.

5. Recommendations

Through a review of the findings and conclusions, the following recommendations are presented: (a) this study could be redesigned to incorporate additional profile variables and other statistical design methodology to examine differences across the profile and in terms of methodology, there is also a great need to increase the number of respondents tohave more substantial results; (b) to check the effectiveness of the developed and validated interactive learning material in Mathematics 8, the researcher also recommends the students to be part of the respondents using the experimental research design; (c) teachers must devise various learning resources that will invite interaction among the students to enrich the teaching-learning process and must attend annual workshops and seminars on the different teaching strategies and instructional materials to enforce the new trends in teaching; (d) the researcher recommends that the developed interactive learning material be endorsed to the division office, as a supplement to the existing activity sheets; and (e) future researchers are recommended to conduct further studies related to the current research to reinforce the development and validation of interactive learning materials in Mathematics.

References

[1] Ally (2020). Six Learning Theories accessed from https://iamlearning.pressbooks.com/chapter/six-learning- theories/
[2] "A talent for every child: The eight types of intelligence" accessed from https://www.iberostar.com/en/inspiration-guide/wellness/eight-types-of-intelligence/ dated January 2022.
[3] M K Abadi et al (2017). Development of Teaching Materials Based Interactive Scientific Approach towards the Concept of Social Arithmetic for Junior High School Student
[4] Benavente, Kathy C. (2010). "Development and Validation of a Work Text in College Algebra". Unpublished Thesis. Urdaneta City University.
[5] Brownlow, J. & Johnson, F. (2005). Choosing Appropriate Assessment Tools as an Aid to the Enhancement of Adult Students' Learning
[6] Bucholska, R. A. (2019). Interactive Learning Materials for Engagement. Accessed from https://elearningindustry.com/interactive-learning-materials-engagement
[7] DepEd website. https://www.deped.gov.ph/k-to-12/. Accessed on 2021

[8] Dimasuay&Aguna (2015). Interactive Learning Materials (ILMs) as Supplement for Teaching High School Students in the Philippines, 17.1-17.5

[9] Earl, L. & Katz, S. (2006). Rethinking Classroom Assessment with Purpose in Mind: Assessment for Learning, Assessment as Learning, Assessment of Learning, 55-65

[10] Flesch Reading Ease and the Flesch Kincaid Grade Level accessed from https://readable.com/readability/flesch-reading-ease-flesch-kincaid-grade-level/ dated June 2021

[11] Kaplar, et al. (2021). The Influence of Interactive Learning Materials on Solving Tasks That Require Different Types of Mathematical Reasoning accessed from https://link.springer.com/article/10.1007/s10763-021-10151-8 dated February 2022

[12] Kendra, Cherry (2021). Gardner's Theory of Multiple Intelligences" accessed from https://www.verywellmind.com/gardners-theory-of-multiple-intelligences-2795161 dated January 2022

[13] Li, Shengru (2018). The Influence of Interactive Learning Materials on Self-Regulated Learning and Learning Satisfaction of Primary School Teachers in Mongolia. accessed from https://www.researchgate.net/publication/324229745_The_Influence_of_Interactive_Learning_Materials_on_Self_Regulated_Learning_and_Learning_Satisfaction_of_Primary_School_Teachers_in_Mongolia/link/5ac6fe760f7e9bcd51932e98/download dated May 2021

[14] Linn, R. & Gronlund, N. (2009). Measurement and Assessment in Teaching

[15] Lorna, E. (2006). Rethinking Classroom Assessment with Purpose in Mind accessed from https://curriculum.gov.mt/en/Assessment/Assessment-of Learning/Documents/assessment_of_learning.pdf

[16] Middleton, F. (2019). Reliability vs Validity in Research | Differences, Types and Examples accessed from https://www.scribbr.com/methodology/reliability-vs-validity/ dated January 2022

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