Construction of the "Mission poCELLble" -Cellular Structure and Function: A Strategic Intervention Material (SIM) for Grade 7 Biology

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ABSTRACT: This study aimed to address the persistent challenges of low student mastery in Grade 7 Biology by constructing and validating a Strategic Intervention Material (SIM) titled "Mission poCELLble" – Cellular Structure and Function. The development process was driven by the urgency to provide targeted support for students struggling with key concepts in cellular biology. A Strategic Intervention Material (SIM) for grade seven biology was the main objective of this study. The SIM was meticulously crafted based on the identified least mastered skills and the Department of Education's standard criteria for SIM construction. This research followed the input-process-output model of developing instructional material, utilizing two sets of questionnaires: one set for five identified experts and one for teacher and student users, each containing 19 statements tailored to their respective roles. Data analysis informed the construction of the SIMs, including identifying least mastered skills, assessing student-teacher agreement with the Kappa Measure, and measuring expert and readability levels with Cronbach's alpha and Flesh-Kincaid Reading Ease.The results revealed that the SIM content, pedagogical and technical aspects were "very evident" as rated by the experts. The internal consistency between responses are rated as "good". These findings suggest the potential of the "Mission poCELLble" SIM as a valuable tool for intervention purposes in Grade 7 Biology classrooms. Further research is recommended to assess the SIM's effectiveness in improving student learning outcomes.

Keywords: Strategic Intervention Material (SIM), Grade 7 Biology, Cellular Structure and Function

INTRODUCTION

Every educational system in the world has always aimed to produce learners who are able to think critically, absorb the information they have gained and apply these learning effectively in to their day to day life. Several issues and problems have befallen the Philippine educational system during the last several decades. There are various reforms that has been made to be more relevant to the contemporary demands of the nation in lined with the global standard. Some of these are, by reflecting the existing vision of the content, classroom management, teaching approaches, methods, strategies and techniques and assistance needed to provide students with a high-quality scientific education [1].

The K to 12 Curriculum, the largest reform in Philippine education, aims to promote holistic development and 21st-century skills. However, studies show many Filipino learners struggle with 21st-century skills, particularly in science. The World Bank's Strategy 2020 promotes country-level reforms to achieve "learning for all," leading to increased interest in large-scale learning assessments at regional, national, and international levels [2]

The Philippines ranks low in the Second International Science Study (SISS), Third International Mathematics and Science Study (TIMSS), and National Achievement Tests (NAT). The country's average mean percentage score in Grade 10 NAT is 37.44, the weakest in the DepEd's history. In the Programmed for International Student Assessment (PISA) 2022, only 23% of the Filipino learners reached Level 2 or higher, which is the minimum level of proficiency in Science Literacy, placing the country's rank 77th out of 81 participating countries. Low expenditure per student and students' lack of readiness for computer-based tests could contribute to the poor performance [3].

Filipino students' low performance in science is attributed to a lack of science culture, deficiencies in school curriculum, teaching, and learning processes, large class sizes, restricted facilities, and lack of hands-on activities [4]. The pandemic has further exacerbated these issues, with remote learning causing disparities across schools, particularly in poorer areas, impacting over 1.7 billion students [5, 6].

The enactment of R.A. 10533, the Enhanced Basic Education Curriculum popularly known as K-12 Curriculum, the need for instructional materials doubled as the learners stay in school for two additional years [5]. The use of instructional materials to improve the performance of students, wherein they found that these materials used in teaching physics were effective in improving the academic performance of students [8]. Instructional materials are key to the academic performance of students. It implies that schools with adequate instructional materials are likely to perform high [9]. The learning materials are vital to the success of student achievement. These materials can support student learning and intensify success of students [10].

As teachers now called as facilitators and distributors of learning, the demand to practice effective facilitation techniques and skills in the implementation of K-12 curriculum is inevitable. Teachers must see to it that students have acquired creative and critical thinking abilities ready to face the realities of life [11]. Central to acquiring creative and critical thinking abilities is the ability of teachers to design teaching sequences that develop among their students the abilities to respond to situations that make their learning meaningful [12]. Teachers must provide instructional materials that suit and satisfy the learners' hunger for wisdom. It is in this context that the researcher embarked on the construction of Strategic intervention Materials (SIMs).

This study seeks to develop and validate a Strategic Intervention Material in Grade 7 Biology. Specifically, it aims to: determine the least mastered competencies of the grade seven students in biology; develop Strategic Intervention Materials (SIM) based on least mastered competencies in Grade seven biology; validate the SIMs on its content, pedagogical and technical aspect; and revise the Strategic Intervention Materials (SIM) based in the pilot tests and evaluation for the final output.

RESEARCH METHODS
Research Design
This research study employs a descriptive-evaluative research design, as described by Cliff [13]. This design is characterized by its systematic approach to designing, developing, and evaluating instructional programs, such as the Strategic Intervention Materials (SIMs) developed in this research. These materials must meet criteria that include reliability and validity, which will be evaluated by experts in the field. The development and validation of the SIMs includes three stages: 1. Preparation, 2. Development and 3. Validation.
Research Respondents
This study aimed to develop a material in Grade 7 biology for teachers and students at School X. The target population was the two sections of Grade 7, with a total of 67 students participating. For the pilot testing, 36 students from Class A participated in the first round, and 31 students from Class B participated in the second round.
Research Environment
All respondents that were included in the study are in School X, which is a public institution in the City of Santiago located at Purok 4, Naggasican, Santiago City, Isabela, as this is the hometown of the researcher and gathering necessary information will be smoother and faster specially in this time of pandemic.
Research Instrument
This study is founded by a checklist/assessment tool which was constructed to suit the objectives of this research. The first assessment tool is for students' & teachers' evaluation, it comprised of two parts: First part includes the opening letter and informed consent where the respondent gives his/ her permission in answering the assessment tool. Second part is a checklist in a 4-point Likert-type gauge. The checklist is composed of four criteria for evaluating the Strategic Intervention Materials namely; Objective and Content, Clarity, Presentation and Relevance of the SIM. Items are rated as follows: 4-strongly agree; 3-agree; 2-disagree; 1-strongly disagree.

To validate the developed Strategic Intervention Material (SIM), five (5) experts was chosen by purposive selection, as evaluating the material requires expertise and familiarity with the teaching of biological topics. The experts' qualifications are primarily determined by the area of expertise in which they are trained. The experts constitute of the following: (i.) one professor from Philippine Normal University and two professors at Isabela State University, teaching professional education courses and or biology subjects (for content and pedagogical aspect); (ii.) SDO Quality Assurance Personnel and

Quality Assurance Focal Personnel in NNHS (technical aspect. The checklist is composed of three indicators for evaluating the Strategic Intervention Materials namely; Content Aspect Indicator, Pedagogical Aspect Indicator and Technical Aspect Indicator. Items are rated as follows: 5-Very Evident; 4-Evident; 3-Moderately Evident; 2-Less Evident; 1-Least Evident.

Data Gathering Procedure

The flow chart below (Figure 1) shows the chronological order of the procedures that was done in the study. The development and validation of the SIMs includes three major stages: 1. Preparation, 2. Development and 3. Validation which are represented by the three boxes and. it shows the steps in each stage that are needed to be undertaken to fulfill the objectives of the research study.
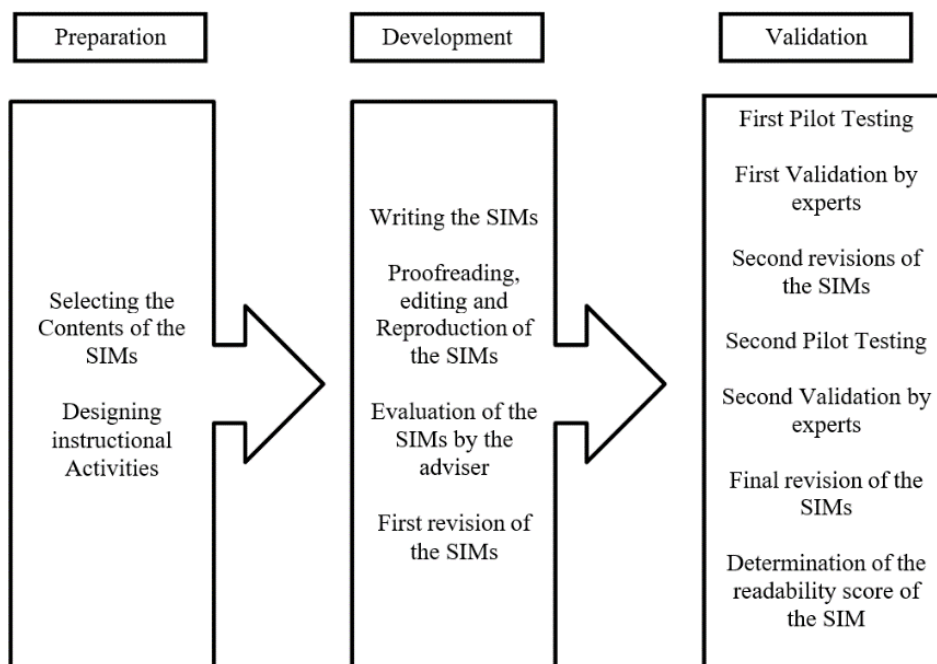

FIGURE 1. Material Development and Validation Flow Chart

Treatment of Data
1. Preparation:
   - Analyze student test results (e.g., grade 7 biology, 2021-2022) to identify least mastered competencies.
   - Design SIM content based on the identified skills.
2. Development:
   - Develop SIM materials based on the designed content.
   - Validate the materials with experts.
   - Use Cronbach's alpha to assess the internal consistency of expert responses.
3. Validation:
   - First pilot testing:
     - Compare student and teacher ratings on the SIMs.
     - Use Kappa measure to assess agreement between student and teacher responses.
     - Use Pearson's correlation coefficient to analyze relationships between student responses.
   - Readability assessment:
     - Use Flesch-Kincaid Reading Ease score to determine the reading difficulty of the SIMs.

RESULT AND DISCUSSION
A. The Least Mastered Competencies of the Grade Seven Student in Biology
The nature of the learners and past experiences of the researcher on how the students learn in grade seven biology were the preliminary considerations in conceptualizing the SIM. The topic in the material was based on the least mastered competencies of grade seven students in biology second periodical test in the school year 2021-2022.

TABLE 1. Mastery Level of the Least Mastered Competencies

Learning Competencies	Mastery Level	Verbal Description
1. differentiate plant andanimal cells accordingto presence and absence of certain organelles	73%	Beginner
2. differentiate cell as the basic structural and functional unit of all organisms	74%	Beginner

Table 1 shows the least mastered competencies were; 1.) differentiate plant and animal cells according to presence and absence of certain organelles; 2. differentiate cell as the basic structural and functional unit of all organisms. These are the least mastered competencies because students gained below the mastery level which is 75%. The students were all described as "beginner" on said competencies because they do not develop the required skills on these competencies during the quarter.

B. The Use of the Strategic Intervention Material

The use of Strategic Intervention Material (SIM) as prescribed by the Department of Education is one of the treatments to improve student's achievement and reduce least mastered skills in science subjects. In drafting the SIM, the following parts were included; guide card, activity card, assessment card, enrichment card and reference card. According to Limbago [14] to maximize the impact of the developed SIMs, schools are encouraged to consider adopting them as supplementary resources for Grade 7 Biology instruction. Additionally, integrating the SIMs into existing lesson plans and curriculum materials would further enhance their effectiveness [14]. To ensure the effective utilization of the developed SIMs, schools must prioritize providing teachers with adequate training and support. This aligns with the findings of Casinillo [15], who emphasizes the crucial role of teacher training in maximizing the impact of SIMs. At the individual level, teachers can leverage the SIMs to target identified learning gaps and address specific student needs. Adapting and modifying the SIMs to fit their teaching style and classroom context further personalizes the learning experience. Finally, continuous monitoring of student progress and adjustments to instructional strategies as needed allow teachers to optimize the use of the SIMs for improved student outcomes [15].

C. Establishing Validity of the Strategic Intervention Material (SIM)

Table 2 presents the validation of the experts on the content of the SIM for two (2) try outs. Experts reviewed the parts of the SIM based from the guidelines set by the Department of Education [16].

1. Experts Validation

TABLE 2. Summary of Experts' Validation on the SIM Content

Criteria	Mean Rating	Verbal Description	Mean for Criterion
A. Guide Card			
First Pilot Test	4.87	Very Evident	4.93
Second Pilot Test	5	Very Evident	
B. Activity Card			
First Pilot Test	4.88	Very Evident	4.94
Second Pilot Test	5	Very Evident	
C. Assessment Card			
First Pilot Test	5	Very Evident	5
Second Pilot Test	5	Very Evident	
D. Enrichment Card			
First Pilot Test	5	Very Evident	5
Second pilot Test	5	Very Evident	
E. Reference Card			
First Pilot Test	5	Very Evident	5
Second Pilot Test	5	Very Evident	
Grand Mean			4.97

Table 2 shows that the assessment card, enrichment card and reference card has the highest weighted mean of 5, indicating strong agreement among experts that these cards effectively provide activities, tests, additional applications, and clear resources for further learning. Emphasizing the importance of these elements in supporting student learning [17, 18].

Guide card received the lowest weighted mean (4.87) initially, with experts suggesting improvements like incorporating a brief and engaging introduction to the topic. After revisions addressing these suggestions, the mean score increased to 5.0, demonstrating significant improvement.

Activity card scored a weighted mean of 4.88, indicating that the tasks were generally considered competency-oriented and effective in providing practice for students. Further revisions based on expert feedback, such as ensuring simple directions and opportunities for discovery learning, further enhanced the card's effectiveness.

TABLE 3. Summary of Experts' Validation on the SIM Pedagogy

Criteria	Mean Rating	Verbal Description	Mean for Criterion
A. Instructional Planning			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
B. Active Student Learning			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
C. Assessment of Learning			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
Grand Mean			5

Table 3 shows the summary of experts' Validation on the SIM Pedagogy. Expert evaluation confirmed the effectiveness of a Strategic Intervention Material (SIM) across various pedagogical aspects. Both initial and revised versions received high ratings (mean = 5) for instructional planning, demonstrating clear objectives, alignment with activities and assessments, logical concept presentation, and suitability for remediation or enrichment.

Similarly, experts consistently rated the SIM highly (mean = 5) for promoting active student learning, indicating opportunities for developing higher-order thinking skills. This aligns with research on fostering student engagement and independent learning.

TABLE 4. Summary of Experts' Validation on the SIM Technical Aspect

Criteria	Mean Rating	Verbal Description	Mean for Criterion
1. Illustration/graphics stimulate student's interest			4.6
First Pilot Test	4.4	Very Evident	
Second Pilot Test	4.8	Very Evident	
2. Language is within the comprehension of the learners			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
3. Texts are Readable			4.8
First Pilot Test	4.6	Very Evident	
Second Pilot Test	5	Very Evident	
4. Illustrations are appropriate			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
5. The activities are self-directing			5
First Pilot Test	5	Very Evident	
Second Pilot Test	5	Very Evident	
Grand Mean			4.88

Finally, the SIM received strong validation (mean = 5) for its assessment of learning, with experts commending the alignment with objectives, utilization of results for targeted interventions, and inclusion of self-assessment and reflection prompts. This finding underscores the material's ability to effectively evaluate student learning outcomes.

Table 4 shows the summary of experts' validation on the SIM technical aspect. Expert evaluation confirmed the technical strengths of a Strategic Intervention Material (SIM). The overall weighted mean (5.0) indicated strong agreement on several aspects:

Clarity and comprehensibility: Experts commended the clear and simple language, making the material easy to read and understand for the target learners.

Appropriate illustrations: Visuals were deemed effective in enhancing understanding, with clear layouts and details encouraging concept comprehension.

Self-directed activities: Instructions were considered easy to follow, enabling students to perform activities independently.

While illustrations received a slightly lower mean (4.6), they were still recognized as stimulating student interest and complementing the learning experience.

Emphasizing the importance of clear language, effective visuals, and self-directed activities in promoting efficient learning. Overall, the SIM demonstrates strong technical qualities that contribute to a positive learning environment for students [19].

TABLE 5. Summary of Evaluators' Internal Consistency

	Cronbach Alpha Coefficient	Verbal Interpretation
First Pilot Test	0.983	Excellent
Second Pilot Test	0.998	Excellent

Cronbach's alpha coefficients ranging from .983 to .998 indicate "excellent" internal consistency among expert evaluations of the SIM. This suggests strong agreement on the material's alignment with Department of Education criteria, further supported by positive expert comments and high weighted means across assessment categories. These findings demonstrate the SIM's effectiveness in meeting established standards for educational materials.

D. Students and Teachers Evaluation on the SIM

Table 6 and 7 show the students and teachers evaluation on the developed SIM. It also show the levels of agreement of the teachers and students during first and second try outs and the relationship of the two try outs.

TABLE 6. Levels of Agreement of the Teachers and Students during the first and second try out

Pilot Test	Kappa Measure of Agreement	Verbal Interpretation
First Pilot Test	0.692	Good Agreement
Second Pilot Test	0.444	Moderate Agreement

Student and teacher feedback plays a crucial role in SIM validation. Their unique perspectives contribute valuable insights into knowledge gain, comprehension, and motivation [20]. Teachers' observations during and after implementation provide additional context for evaluating the material's effectiveness as an intervention tool.

Cohen's Kappa coefficients were used to assess agreement between student and teacher ratings during the first and second tryouts. The initial tryout yielded a "good" agreement (kappa = 0.692), indicating consensus on content, clarity, presentation, and relevance. Both groups appreciated the structured framework facilitating efficient use.

However, the second tryout showed a "moderate" agreement (kappa = 0.444), suggesting potential revisions or differing interpretations. This could be attributed to using different student and teacher groups in each phase.

Overall, while perfect agreement is uncommon, these findings highlight the importance of incorporating student and teacher perspectives throughout the SIM development and validation process.

Teacher and student ratings on SIM content, clarity, presentation, and relevance were analyzed using Cohen's Kappa and Pearson's correlation coefficient. In Initial tryout "Good" agreement (kappa = 0.692), indicating consensus on the material's qualities. However, Second tryout: "Moderate" agreement (kappa = 0.444), suggesting potential variations in interpretation. There is a strong positive correlations (r>0.8) for content/objectives and clarity, indicating significant relationships between student and

teacher ratings. While moderate positive correlation (r = 0.503) for relevance, suggesting some variation in perspectives. The results shown on table 7 denote that the responses of the students on the criterion for the objective and content, clarity, presentation and relevance of the SIM have a general significant relationship. It means that the responses are correlated with each other.

TABLE 7. Relationships of the results in the First Pilot Test and Second Pilot Test *Significant at 99 % level of confidence*

	2nd Pilot Test Objectives and Content	2nd Pilot Test Clarity	2nd Pilot Test Presentation	2nd Pilot Test Relevance of the SIM
1st Pilot Test Objectives and Content	.844	.246	.383	.391
1st Pilot Test Clarity	.249	.837	.184	.321
1st Pilot Test Presentation	.240	.280	.944	-0.24
1st Pilot Test Relevance of the SIM	-.020	-.024	-.076	.503

E. Determining the Flesch Reading Ease Score

The validated SIM was subjected to Microsoft readability statistics to determine the Flesch Reading Ease Score designed by Rudolph Flesch. It assumes that high readability score means the passage is easier to comprehend. It means that the higher the readability score, the easier the SIM is to be understood.

TABLE 8. Summary of Results of Microsoft Readability Statistics

Criteria	Results
A. Counts	
Words	2,150
Characters	12,197
Paragraphs	773
Sentences	166
B. Averages	
Sentences per Paragraph	144
Words per Sentence	3.0
Characters per Word	4.5
C. Readability	
Flesch Reading Ease	70.0
Flesch-Kincaid Grade Level	4.2

Table 8 shows the summary of the Microsoft readability statistics of the SIM which includes the quantity of words, characters, paragraphs and sentences used in SIM. It also presents the number of sentences per paragraph, words per sentences and characters per word. The readability scores include the percentage for the passive sentences used, the Flesch Reading Ease which is needed in the study and the Flesch Kincaid grade level.

TABLE 9. Flesch Reading Ease Interpretation

	Flesch Reading Score	Verbal Interpretation
Mission poCELLble SIM	70.0	Fairly Easy

The Flesch Reading Ease score that identifies the readability of the SIM was used to determine whether the material is readable and easy to comprehend by the level of students. Table 8 shows that the SIM obtain a 70.0 flesch reading ease score, which is described as fairly easy. It indicates that the contexts are easy to read because the words used are simple and short and it can be comprehended by a 13-year-old.

CONCLUSION

The Development and Validation of the Strategic Intervention Material (SIM) in this study offer a promising solution for addressing the gaps in Grade 7 Biology. Firstly, it was identified that

competencies with mastery levels below 75% were the key areas requiring intervention. This finding served as the foundation for developing the SIMs. Secondly, the developed SIMs were validated to ensure alignment with DepEd standards. This validation process involved two rounds of testing, confirming the materials' effectiveness for intervention purposes in Grade 7 Biology. Thirdly, the SIMs demonstrated strong consistency in the feedback received from experts regarding content, pedagogy, and technical aspects. This level of consistency suggests that the materials are well-suited for student use. Furthermore, a kappa measurement indicated high agreement between students and teachers on the effectiveness of the SIMs in terms of content, clarity, presentation, and relevance. This agreement further strengthens the evidence of the materials' positive impact on learning. Finally, the Flesch reading score confirmed the easy readability of the SIMs, ensuring comprehension within the reading level of seventh-grade students. This characteristic is crucial for effective learning and independent engagement with the materials.

In conclusion, the findings of this study support the claim that the developed and validated "Mission poCELLble" -Cellular Structure and Function: A Strategic Intervention Material (SIM) for Grade 7 Biology hold significant potential for improving student learning outcomes in Grade 7 Biology.

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