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Development of Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem

Jenny A. Allonar[1], Monera A. Salic-Hairulla[1], Ronaldo R. Orbita[1], Joy B. Bagaloyos[1] and Liza A. Adamat[2]

[1] College of Education, Mindanao State University – Iligan Institute of Technology, Bonifacio Ave., Tibanga, Iligan City, 9200, Philippines
2 College of Science and Mathematics, Mindanao State University – Iligan Institute of Technology, Bonifacio Ave., Tibanga, Iligan City, 9200, Philippines
*Corresponding author email: enny.allonar@g.msuiit.edu.ph

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Abstract

This study aimed to develop Contextualized Strategic Intervention Materials (CSIMs) to enhance the conceptual understanding of Grade 7 students in Ecosystem. The developed CSIMs focused on the topics in Ecosystem for Grade 7 students, aligned with the Most Essential Learning Competencies of the K-12 Curriculum. The development of the contextualized SIM utilized the Research and Development (R&D) model of Borg and Gall (1983). The experts with a mean of 3.93 rated the developed Contextualized Strategic Intervention Materials (CSIMs) "Very Satisfactory". This indicated good quality in terms of content, format, presentation, organization, accuracy, and up-to-datedness.

Keywords: Contextualization, Ecosystem, SIM

1. Introduction

The Filipino students' poor performance on international and national assessments for a number of years exemplifies the deplorable state of basic science education in the country (Ulla et al., 2022). The Philippines obtained an average Scientific Literacy score of 357 points in PISA 2018, significantly lower than the average score of OECD, 489 points (DepEd, 2018). Aside from that, the 2019 edition of the Trends in International Mathematics and Science Study (TIMSS) gave the Philippines scores of 297 and 249 in mathematics and science, respectively, the lowest among the 58 countries involved in the study (CNN Philippines, 2020). In addition, students' performance in the Philippine National Achievement Test consistently shows that Science is the most difficult field of study in basic education (Bonitez, 2021).

The results are quite alarming, and there is an urgent need to improve the quality of education in public schools and recognize the importance of creating instructional and intervention resources in the teaching-learning process (Bello et al., 2023; Adonis, 2020).

In connection with that, DepEd Memorandum No. 117, s. 2005, conducted a "Training Workshop on Strategic Interventions for Successful Learning" in its continuing effort to improve the Philippines' quality of education, pursuant to the DepEd Order No. 39, s. 2012, which stated that remediation programs and interventions have to be systematized in order to address learning gaps (DepEd, 2005).

On the other hand, to achieve an effective enhanced basic education curriculum, the DepED shall adhere to the Curriculum Development Standards stipulated in the Republic Act 10533 or Enhanced Basic Education Act of 2013, which states that, "the curriculum shall be contextualized and global" and "the curriculum shall be flexible enough to enable and allow schools to localize, indigenize, and enhance (the curriculum) based on their respective educational and social contexts" (Official Gazette, 2013).

Moreover, ecological management and conservation of natural resources were perceived to be difficult by the students (Etobro and Fabinu, 2017). Thus, interventions were felt needed in order to help the teachers and students in enhancing the teaching and learning process.

Furthermore, while there was support for literature pointing to the positive results of the use of SIM in improving learning outcomes, only a few were anchored on contextualization. Therefore, this study aimed to develop Contextualized Strategic Intervention Materials (CSIMs) on Ecosystem to enhance the conceptual understanding of Grade 7 students.

The main objective of this study was to develop Contextualized Strategic Intervention Materials (CSIMs) on the topics of Ecosystem for Grade 7 students. To attain the general objective, this study aimed to; (1) Identify the needs assessment of the teachers and school administrator on Contextualized Strategic Intervention Materials (CSIMs) in the topic Ecosystem for Grade 7 students, (2) Develop Contextualized Strategic Intervention Materials (CSIMs) on the topic of Ecosystem, and (3) Validate the developed Contextualized Strategic Intervention Material (CSIMs).

2. Method

The development of the Contextualized Strategic Intervention Materials (CSIMs) utilized the Research and Development (R & D) model proposed by Borg and Gall (1983). The R&D Model is used in the development and validation of educational products (Borg and Gall, 1983). It is also concerned with the development of product-oriented research for use in education and the improvement of education quality as it relates to the education assessment program (Gall et al., 2007).

2.1 Development of the Needs Assessment Questionnaire

The researcher adapted and modified a needs assessment survey questionnaire from the study of Jumawan et al. (2022) in press to assess the need for contextualization of the Strategic Intervention Materials (SIMs). In addition, it was validated by 3 experts who have Master's or Doctorate degrees in professional education. Meanwhile, the questionnaires were administered to the school principal and science teachers of the participating school. There were different sets of questions for the school principal and the science teachers who were the key informants of this study. Moreover, their responses, comments, and suggestions were used as input in developing the contextualized SIMs. Lastly, the evaluated needs assessment survey was administered to the school administrator and five (5) science teachers of Hinaplanon National High School.

2.2 Development of the Contextualized Strategic Intervention Materials in Ecosystem

Before the development of contextualized SIMs, the researcher identified first which topics should be included in the CSIMs. The Most Essential Learning Competencies (MELCs) were considered in designing and conceptualizing the contextualized SIM on Ecosystem. The topics included in the development of SIM were biotic from abiotic components of an ecosystem, the level of organizations in an ecosystem, ecological relationships, energy transfer in the ecosystem, and the effect of changes in abiotic factors on the ecosystem. Moreover, the needs assessment for the key informants were also used as the bases for the development of the contextualized SIMs.

Afterward, the chosen topics and activities included in the study were mapped onto the learning competencies from DepEd's MELCs. Also, the researcher adapted the steps in developing a SIM from DepEd (2009). There were seven (7) elements in developing a SIM. These are (1) Title Card, (2) Guide Card, (3) Activity Card, (4) Assessment Card, (5) Enrichment Card, (6) Reference Card, and (7) Answer Card. This kind of intervention material aimed to develop the conceptual understanding of the student on the least learned competency of a certain subject or area.

Furthermore, the developed contextualized Strategic Intervention Materials on the topics in Ecosystem were evaluated by the adviser and the panel members. The comments and suggestions of the adviser and the panel members were considered for the enhancement of the developed contextualized Strategic Intervention Materials on the topics in Ecosystem.

Lastly, the contextualized SIMs were evaluated by five (5) in-service public school science teachers. The criteria for selecting evaluators were considered. These were: (1) the evaluator must be a Biology major, and (2) an evaluator must be knowledgeable about contextualization. It utilized the adapted standardized criteria from DepEd (2015) to evaluate the developed contextualized SIMs. Before utilizing the developed CSIMs, the ratings, comments, and suggestions of the evaluators were considered for the improvement of the developed contextualized SIMs on the topics in Ecosystem.

2.3 Data Gathering: Needs Assessment

Prior to the implementation, the respondents were given consent and assent forms to ask for their voluntary participation in the study. Their responses were treated with the utmost confidentiality. To ensure the security of all the data obtained prior to the conduct of the study, the ethical standards were met. This study utilized codes to protect the identity and maintain the confidentiality of the responses and the raters themselves. In addition, the respondents for the needs assessment were the school principal and five (5) science teachers of Hinaplanon National High School. Then, the survey was administered to the school administrator and science teachers using the developed and evaluated needs assessment questionnaires. Afterward, the results of the needs assessment survey were tabulated and thematically analyzed.

2.4 Data Analysis

Mean was used to analyze the ratings in the needs assessment questionnaire, and the developed contextualized SIMs on the Ecosystem. Standard deviation was used to identify how dispersed the data is in relation to the mean. In addition, thematic analysis was used to generate themes on the responses of science teachers and the school principal on the needs assessment, and the comments and suggestions of experts to improve the needs assessment questionnaires and the Contextualized Strategic Intervention Materials (CSIMs). The mean score will be interpreted as follows: 1.00-1.79 label as Needs improvement, 1.80-2.39 label as Fair, 2.40-3.19 label as Satisfactory, 3.20-4.19 label as Very Satisfactory, and 4.20-5.00 label as Outstanding

3. Results and Discussions

The development of the contextualized SIM utilized the Research and Development (R&D) model of Borg and Gall (1983).

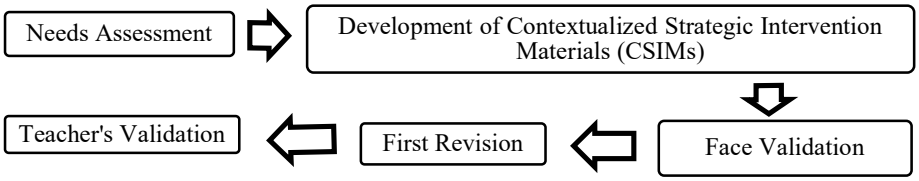


Figure 1. Steps in the Development of Contextualized STEM Module on Biodiversity

3.1 Needs Assessment

The participants for the needs assessment were the school administrators and 5 science teachers of Hinaplanon National High School. In developing a needs assessment questionnaire, there are six (6) steps: (1) developing a needs assessment survey questionnaire; (2) face validation; (3) first revision; (4) teacher's validation; (5) second revision; and (6) implementation.

3.1.1 Expert's Ratings of the Developed Needs Assessment Questionnaires

After the needs assessment questionnaires were revised according to the comments and suggestions of the thesis adviser and panel members, minor revisions were done to improve the needs assessment questionnaires. Then, a panel of evaluators validated the needs assessment questionnaire. The criteria for selecting an evaluator for this instrument were the following (1) the evaluator must be an expert on the topics in biology; (2) the evaluator must be an expert in contextualization and localization; (3) the evaluator must have earned a master's or doctorate degree. In line with that, the needs assessment questionnaire for key informants was evaluated based on the adapted rubric from Bontilao et al. (2021) in press.

Table 1. Expert's Rating of the Developed Needs Assessment Questionnaire

Components	Mean	Description
Content and Development	3.44	Very Satisfactory
Format, Organization, and Structure	3.67	Very Satisfactory
Grammar	3.56	Very Satisfactory
Overall Average	3.56	Very Satisfactory

Table 1 shows the results of the teacher evaluators' rating of the developed needs assessment questionnaires. The rubric was composed of different components such as content and development, format, organization, structure, and grammar. The needs assessment questionnaires were rated very satisfactory in all areas. Hence, this indicated that the questionnaires were valid and can be used as an instrument in the study. Furthermore, the needs assessment questionnaires proposed no changes to the questions highlighted during the validation of teacher evaluators. This meant that the questions did not need to be revised; thus, the researcher proceeded to the next step, which was the implementation.

3.1.2 Implementation of the Developed Needs Assessment Questionnaires

The needs assessment questionnaires were administered to the school administrator and five (5) science teachers from Hinaplanon National High School at Hinaplanon, Iligan

City, and their responses were treated with the utmost confidentiality. Aside from that, the participants voluntarily participated and signed the consent forms provided by the researcher. Furthermore, safety and health protocols were followed during the conduct of the needs assessment survey.

3.1.3 Summary of the Results of the Needs Assessment for the School Administrator and Science Teachers

During the implementation of the needs assessment questionnaires for the key informants through interviews, it was found that there is a need to develop Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem. It was because it could be observed from the teacher's responses that they were having difficulties in teaching the topics in Biology, especially in the learning competency, predicting the effect of changes in abiotic factors on the ecosystem (S7LT-IIj-12).

With regard to familiarity with contextualized teaching, all the key informants, the school principal, and five (5) science teachers were familiar with this approach because it was introduced by the Department of Education. However, only the school principal had attended a seminar or webinar about the contextualization of lessons. While all five (5) science teachers have not attended a seminar or webinar about contextualizing the lessons or activities.

Another section of the interview was about Strategic Intervention Material (SIM). Based on the responses of the key informants, the school principal, as well as one (1) science teacher, were familiar with SIM as material used for remediation purposes. While two (2) science teachers were also familiar with SIM being used as instructional material integrated into a regular class. However, one (1) science teacher was not familiar with SIM.

To sum it up, the needs of the teachers should be considered in developing Contextualized Strategic Intervention Materials (CSIMs) since they are the facilitator of learning and much aware of the needs of the students. With the responses of the key informants, it was clear that the teacher's familiarity and exposure to the different approaches can enhance the teaching and learning process.

3.2 Development of Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem

3.2.1 Selection of Topics in MELCs from DepEd

After the needs assessment, the next step was to develop a contextualized SIM on the topics in Ecosystem.

Table 2 shows the content standard, learning competencies, duration, and K to 12 CG code used in the study. Aside from the results of the needs assessment from the key informants, the most essential learning competencies (MELCs) were also used as the basis for developing the Contextualized Strategic Intervention Materials (CSIMs).

Table 2. Selection of Topics in Most Essential Learning Competencies (MELCs) from DepEd

Quarter	Content Standard *The learners demonstrate understanding of...*	Performance Standard *The learners should be able to...*	Most Essential Learning Competencies	Duration	K to 12 CG Code
2nd	organisms interacting with each other and with their environment to survive	employ appropriate techniques using the compound microscope to gather data about very small objects	Differentiate biotic from abiotic components of an ecosystem	Week 6	S7LT - IIh - 9
			Predict the effect of changes in abiotic factors on the ecosystem	Week 7	S7LT -IIj - 12

3.2.2 Learning Competency Mapping in Contextualized Strategic Intervention Materials (CSIMs)

The learning competency was the basis for the construction of subtasks used in the lessons and activities. There were 5 topics included Biotic and Abiotic, Ecological Level of Organizations, Ecological Relationships, Energy Transfer in the Ecosystems, and the Effect of Changes in abiotic factors on the ecosystem. The topics included were also based on the results of the needs assessment of the key informants. Likewise, the activities included in the CSIMs utilized the local resources and the local community which the students can relate to and are familiar with.

3.2.3 Designing Contextualized Strategic Intervention Materials (CSIMs)

In developing and designing Contextualized Strategic Intervention Materials (CSIMs), the elements in developing a SIM were adapted from DepEd (2009). The contents of the CSIMs were arranged in order as listed, to wit: (1) Title Page (2) Introduction (3) Table of Contents (4) Guide Card (5) Content (6) Activity Card (7) Assessment Card (8) Enrichment Card (9) Reference Card.

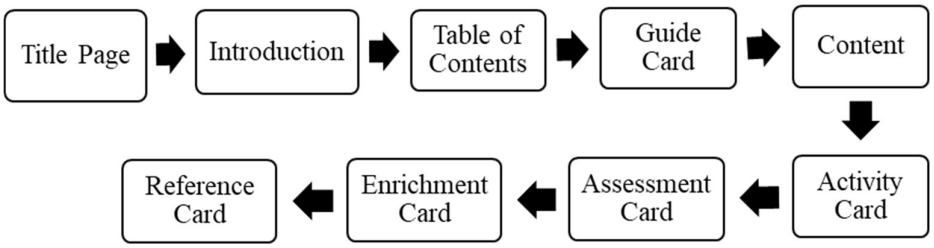


Figure 2. Nine Elements in Designing Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem.

Figure 2 shows the elements of developing and designing Contextualized Strategic Intervention Materials (CSIMs) adapted from DepEd (2009). The first element was the title page, which included the five (5) topics used in the developed Contextualized Strategic Intervention Materials (CSIMs). The second element was the introduction, which includes an overview of the topic and stimulates the interest of the students to learn from the SIM. The third element was the table of contents, where the contents, activities, assessment, enrichment, and reference card were organized for easy access for readers. The fourth element was the guide card, where the subtasks aligned to the learning competencies can be found. The fifth element was the content which provides information about the topic. In addition, the sixth element was the Activity Card, which includes at least 3 learning activities for each topic. The activities included in the CSIMs were mostly found in the local community, which was Mandulog River, Hinaplanon, Iligan City. Furthermore, the seventh element was the assessment card to test the conceptual understanding of the students for each topic. The eighth element was the enrichment card, which allows the students to enhance their learning on the topic. Lastly, the reference card includes a list of resources related to the topic that the students can browse or read for additional learning or information.

3.3 Face Validation

After the development of the Contextualized Strategic Intervention Materials (CSIMs) on the topics in Ecosystem, it was face validated by the thesis adviser and the panel members. The comments and suggestions of the thesis adviser and the panel members were considered for the enhancement of the developed Contextualized Strategic Intervention Materials (CSIMs).

Table 3. Comments and Suggestions of the Thesis Adviser and Panel Members on the Developed Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem

Comments and Suggestions	Parts of the CSIM
Remove the pictures of the animals that cannot be found in the local community	Title Page
Add a question about Viruses.	Enrichment Card
Rearrange the content of ecological relationships from positive to negative.	Content

Table 3 shows the comments and suggestions of the thesis adviser and panel members. Among the comments was that in developing Contextualized Strategic Intervention Materials (CSIMs), the pictures to be included in the background must be found in the local community because contextualization was the focus of the material. In addition, it was also suggested to indicate the table and figure number for each so that it was clear to students. Moreover, it was also suggested by the panel members to include one (1) question about viruses. Furthermore, a panel member suggested rearranging the ecological relationships from positive to negative for the second topic.

3.4 First Revision

After the face validation of the developed Contextualized Strategic Intervention Materials (CSIMs). The comments and suggestions of the thesis adviser and the panel members were considered for the enhancement of the developed CSIMs.

Table 4. Comments and Suggestions of the Thesis Adviser and Panel Members on the Title Page of the Developed Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem

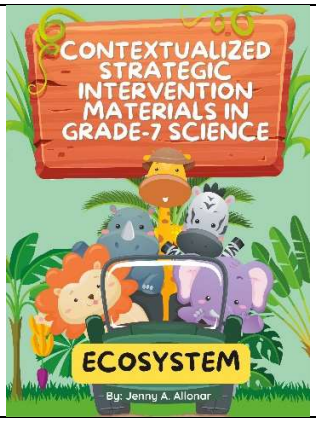
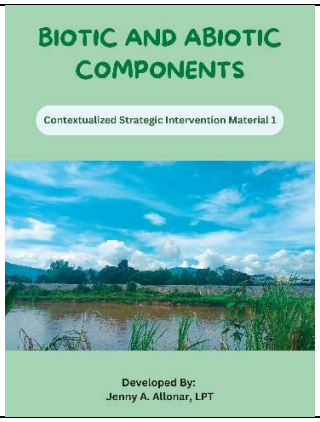
Comment/s	Before	After
1. Remove the pictures of the animals that cannot be found in the local community. **2.** Remove the word "SCIENCE"		

Table 4 shows the comments and suggestions of the thesis adviser and panel members. It was suggested to remove the pictures of the animals that cannot be found in the local community to align the developed (CSIMs) with contextualization. Thus, the researcher replaced the background with the photo taken from the Mandulog River, which was the basis of the contextualization of the Strategic Intervention Material (SIM).

3.5 Teachers' Validation

Prior to pilot testing, the in-service science from public schools evaluated the developed Contextualized Strategic Intervention Materials (CSIMs) on the topics in Ecosystem utilizing the adapted rubric. The rubric was composed of the following components: content, format, presentation, organization, accuracy, and up-to-datedness of information. Four (4) science teachers evaluated the CSIMs.

Table 5. Expert's Rating of the Developed Contextualized Strategic Intervention Materials (CSIMs)

Components	Mean	Description
Content	3.89	Very Satisfactory
Format	3.88	Very Satisfactory
Presentation and Organization	3.95	Very Satisfactory
Accuracy and Up-to-datedness	4	Very Satisfactory
Overall Average	3.93	Very Satisfactory

Table 5 shows the summary of ratings from the in-service science teachers. The developed Contextualized Strategic Intervention Materials (CSIMs) were rated very satisfactory in all areas with an overall average mean of 3.93. Hence, this indicates good quality in terms of the different criteria that were mentioned and that the CSIMs can be

used as an instrument in the study after some revisions based on the comments and suggestions of the panel of evaluators.

(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3. the Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem

3.6 Features of the Developed and Enhanced Contextualized Strategic Intervention Materials (CSIMs)

There were nine (9) elements used in developing and enhancing a CSIM such as a Title Cad, Introduction, Table of Contents, Guide Card, Content, Activity Card, Assessment Card, Enrichment Card, and Reference Card.

Figure 3(a) shows the title card of the developed Contextualized Strategic Intervention Materials (CSIMs) which contained photos related to the topic of the CSIMs. These photos were taken by the researcher, showing the area of the Mandulog River, Basin located at Hinaplanon, Iligan City. The title card has undergone revision after it was face validated by the thesis adviser and the panel members. On the other hand, the panel of evaluators made no changes to the title card during the teacher's validation process.

Figure 3(b) shows the introduction of the CSIM which contained an overview of what the readers will learn from each CSIM. In addition, the background used in this part was made based on the biotic and abiotic components that were found in Mandulog River, Basin located at Hinaplanon, Iligan City. This part was included based on the comments and suggestions of the panel of evaluators, after the teacher's validation process.

Figure 3(c) shows the table of contents which served as a guide for readers to easily find the specific content of the Contextualized Strategic Intervention Materials (CSIMs) with the corresponding page number. This part was also included based on the comments and suggestions of the panel of evaluators after the teacher's validation process.

Figure 3(d) shows the guide card which contained learning competency that served as the basis for the development of Contextualized Strategic Intervention Materials (CSIMs). This part also contained the subtasks for each topic that the students need to accomplish at the end of each CSIM. The thesis adviser, panel members, and the panel of evaluators made no changes to the guide card during the face validation and the teacher's validation process.

Figure 3(e) shows the content that provides information about the topic of each CSIM. The thesis adviser, panel members, and the panel of evaluators made no changes to the guide card during the face validation and the teacher's validation process. Some of the contents have undergone revision after it was face validated by the thesis adviser and the panel members. On the other hand, the panel of evaluators made no changes to the contents during the teacher's validation process.

Figure 3(f) presented a sample of activity card from the CSIM. The activity card contained at least three (3) activities that were aligned with the subtasks from the guide card. The activities included in this part were based on the local community. The photos were taken by the researcher from the Mandulog River at Hinaplanon, Iligan City, which was the basis for the contextualization of the SIM. The activities have undergone revisions after it was face validated by the thesis adviser and the panel members. On the other hand, the panel of evaluators made no changes to the activities during the teacher's validation process.

Figure 3(g) shows the assessment cards which contained a formative test to assess the students learning from each CSIM. Assessment card is made in order to test whether the activities were effective in teaching the concept or not. It also provides exercises, drills, activities, or tests that allow students to assess and monitor their learning and identify the skill/s that they may need to enhance further (Verano and Comighud, 2020). The thesis adviser, panel members, and the panel of evaluators made no changes to the assessment card during the face validation and the teacher's validation process.

Figure 3(h) shows the enrichment cards that contained an additional activity that allow students to apply what they have learned, to think critically, and for a deeper understanding of the topic. An enrichment card provides more activities and exercises for the learner to have deeper and/or additional learning and for further application of knowledge or skill (Aranda et al., 2019). The enrichment card has undergone revisions

after it was face validated by the thesis adviser and the panel members. On the other hand, the panel of evaluators made no changes to the activities during the teacher's validation process.

Figure 3(i) shows the reference cards which provided a list of resources that the students can access for more information and other resources included in the CSIM that were not owned by the researcher. Furthermore, the thesis adviser, panel members, and the panel of evaluators made no changes to the assessment card during the face validation and the teacher's validation process.

5. Conclusion

During the conduct of the needs assessment for the school principal and science teachers, it was found that the teachers and school principal had encountered problems in teaching the topics in Ecosystem. In addition, it was found that the key informants were familiar with contextualizing the activities. However, only the school principal was able to attend a training about contextualization. On the other hand, the school principal and the science teachers were familiar with SIM as a remedial tool and instructional material. The results of the needs assessment of the school administrator and science teachers revealed the need to develop Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem. The needs assessment questionnaires were rated very satisfactory in terms of content and development, format, organization, structure, and grammar with an overall mean of 3.56.

Furthermore, the developed Contextualized Strategic Intervention Materials (CSIMs) were rated "Very Satisfactory" by experts with an overall mean of 3.93 in terms of content, format, presentation, organization, accuracy, and up-to-datedness. Hence, the developed Contextualized Strategic Intervention Materials (CSIMs) in Ecosystem may be implemented in the Grade 7 students.

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