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Research Article

INSTRUCTIONAL MODEL IN SCIENCE FOR STRUGGLING JUNIOR HIGH SCHOOL LEARNERS

[1]Pacita E. Delos Ama, [2]Jovenita A. Aragon and [3,*]Andrian A. Dela Cruz

[1]Department of Education, Talavera National High School, Talavera, Philippines
[2,3]Mariano Marcos State University, College of Teacher Education, Philippines

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Abstract

This descriptive study, integrating research and design methodology, determined the least and most preferred academic coping strategies that teachers are using in inclusive classroom for struggling learners which served as the basis for the development of the instructional models in science. Utilizing two research instruments which include the researcher-made interview guide for the Focused Group Discussion (FGD), and the validation tool for the instructional models., 21 science teachers of Grades 7 to 10 in the only secondary school that offers SPEd in Talavera North District, Schools Division of Nueva Ecija, data on the least and most preferred academic coping strategies that teachers are using in inclusive classroom for struggling learners in science were analyzed and interpreted using content analysis. On the other hand, the validity of the instructional model was described using means. Findings reveal that collaborative learning, such as small group discussion, peer tutoring, and brainstorming, integration of recreational games into instruction, laboratory experimentation, exhibits, and research projects are the academic coping strategies used by the JHS science teachers in helping struggling learners in the classroom. Among these strategies, small group discussion and peer tutoring are the most preferred academic coping strategies. These coping strategies served as the basis for the development of the instructional model in science titled, "Research-based Lesson Exemplars in Science (R-BLES)." In terms of its validity, the R-BLES obtained an overall mean of 3.75, indicating a *Very Much Valid* rating from the validators. Likewise, the R-BLES' learning objectives (3.92), subject matter (3.63), procedure (3.68), evaluation (3.75), and assignment (3.75) are all *Very Much Valid*, respectively. Thus, the R-BLES is recommended to be used for classroom instruction.

Keywords: Academic coping strategies, Instructional model, Struggling learners, Validity.

INTRODUCTION

In order to attain sustainable development, global communities aim to produce intellectual and competitive individuals who are able to contribute in a progressive and healthy community. The Sustainable Development Goals include in its fourth objective the elimination of disparities and equal access in education for all learners in all level, including learners with disability and children of vulnerable situation. Considerably, science is one of the most important and helpful disciplines taught in schools from basic education to tertiary levels as it promotes necessary skills like critical thinking, technical literacy, and problem-solving that are of equal importance for life survival and success in later life. Significantly, a plethora of international and local research studies revealed the unsatisfactory performance of Filipino students in science education (Oronganet al., 2019; Sadera *et al.,* 2020). Results of the international assessments like the International Learning Scales Assessment (ILSA), Programme for International Student Assessment (PISA), and Trends in International Mathematics and Science Study (TIMSS) revealed poor science education status of the Philippines (Behiga, 2022; Orbeta, 2020). In 2019, the TIMSS result revealed that among 58 countries, Philippines ranked 58 which was the lowest performance among the 58 participating countries (Mullis *et al.,* 2020). Moreover, the PISA results in 2018 revealed that the country placed second to last with scores in mathematics, science, and reading that were all below the global average for participating Organization for the Economic Co-operation and Development (OECD) countries (DepEd, 2019).

Corresponding Author:** ***Andrian A. Dela Cruz,
Mariano Marcos State University, College of Teacher Education, Philippines.

In the Philippines, the National Achievement Test (NAT) shows the decline in the performance of Junior High School (JHS) students for two consecutive years from 2016 and 2017, with a Mean Percentage Score (MPS) of 35.68, indicating low proficiency in science. Likewise, in 2017 and 2018, Filipino learners gained 32.11 MPS which was significantly lower than the 2012 results of 36.52 MPS (Behiga, 2022). The decline in the science performance of Filipino learners only manifests concerns that need to be addressed immediately. In adherence to Regional Memorandum No. 502, s. 2022, teachers in elementary and secondary schools in Region III conducted Regional Diagnostic Test (RDT) to assess learners from grades 1-10, and evaluate their level of proficiency in the different learning areas, including science. The RDT revealed an alarming data which showed that the students did not achieve the basic competency expected to JHS learners. The RDT also revealed that topics along determining how friction and gravity affect different object movements, describing an object's motion in terms of distance or displacement, speed or velocity, and acceleration, tracing a typhoon's path using a map and tracking data, and quantum mechanical model are the least learned competencies of the learners. The use of various innovative teaching strategies stems from the fact that there are various topics to be taught and skills to be developed. Many innovative strategies have been developed by educators in order to better involve students in the teaching-learning process. This regards as critical, and these strategies must be implemented in classrooms (Slavin, 2005). To address the learning gaps of struggling learners in inclusive classrooms, the researcher developed an instructional model for struggling JHS learners. A study by Arriola and Baetiong (2017) explored the effectiveness of using a lesson exemplar in teaching science. The researchers found that the lesson exemplar helped

students understand and retain scientific concepts better than traditional lecture-based teaching. The study highlighted the importance of developing well-designed and structured lesson exemplars to enhance students' learning outcomes.

THEORETICAL FRAMEWORK

This study is anchored on Vygotsky's Social Learning Theory and Constructivist Learning Theory. Vygotsky's Social Learning Theory emphasizes that instead of isolation, learning takes place by creating meaningful context through social interactions with a more knowledgeable other in a social setting. Their communication impacts their internalization, perception, and understanding about a certain concept (Bransford *et al.,* 2000). In instruction, scaffolding enables the learners to assimilate knowledge built through interacting with a more knowledgeable other in activities that are a little above the level of competencies that they can perform alone (Olson & Pratt, 2000). This is known as the Zone of Proximal Development with the assistance coming from a more knowledgeable other which serves as their scaffold in learning (Bransford *et al.,* 2000). As learners engage in collaborative learning which is usually done in a small group setting, they slowly build upon their prior knowledge, and the teacher may gradually lessen the scaffolds until then (Hartman, 2002). Scaffolding can help learners with disability and struggling learners to improve their motivation through positive feedbacks from their group mates instead of getting frustrated alone and shutting down after finding the activity difficult for his own capability (Der Stuyf, 2002).

In Paget's Constructivist Learning Theory, teachers mediate students' interpretations of assessment standards as they apply implicit or explicit criteria to the analysis of exemplars through peer interaction (To & Liu, 2018). This emphasizes the significance of offering student opportunities for peer feedback, as well as clear assessment criteria in order to enhance their learning outcomes and develop their critical thinking skills. Teachers help students notice quality features and develop their evaluative judgment by using co-constructed insights (Tai *et al.,* 2018). Teachers not only provide clear assessment criteria and peer feedback opportunities, but they also facilitate learners' co-construction of insights through group discussions, peer reviews, and other collaborative learning activities. Additionally, they can empower students to take ownership of their learning and develop lifelong skills that could benefit them in both their personal and professional lives by doing so. Through the implementation of the instructional model, students are poised not only to enhance their critical thinking skills, increase engagement, and improve academic performance, but also to acquire the necessary skills and knowledge to succeed in science, thereby, competing on equal footing with their peers. This initiative aims not only to uplift academic standards, but also to foster a generation equipped to navigate and contribute meaningfully to the global scientific landscape.

METHODOLOGY

Research Design

This study used the descriptive research design, integrating research and development (R&D) methodology. Research and design methodology is a product-oriented research design that develops and validates educational product with the aim to improve the quality of education. First, this study used the descriptive research design because it determined and described the most preferred academic coping strategies that teachers are using in inclusive classroom for struggling learners in science. The R&D methodology was employed because an instructional model in science was developed for struggling learners. Following the R&D methodology, the identified academic coping strategies were used as bases in the development of the instructional model to address the least learned competencies in science. The model was validated by four experts in the field of education and instructional materials development. All revisions, corrections, and remarks from the validation were incorporated for the finalization of the instructional models.

Population and Sampling Procedure

This study included 21 science teachers of Grades 7 to 10 in the only secondary school that offers SPEd in Talavera North District, Schools Division of Nueva Ecija. The respondents of the study were purposively chosen based on their fulfilment of the inclusion and exclusion criteria. Included are teachers who are: 1) handling struggling learners in science; 2) teaching topics that are identified as the least learned topics based on the RDT; and 3) willing to participate in the FGD. The teachers were grouped into four based on the grade levels they are handling. On the other hand, two master teachers in science, one school head, and one SPEd teacher were chosen to validate the develop lesson exemplars.

Research Instruments

This study utilized two research instruments which include the researcher-made interview guide for the FGD, and the validation tool for the instructional models. The interview guide was utilized during the FGD to determine the least and most preferred academic coping strategies that science teachers in the inclusive classrooms are using for struggling learners. On the other hand, the researcher-made validation tool was used to determine the level of validity of the instructional models in terms of objectives, content, learning resources, and procedure. Using the 4-point Likert scale below, the content validity of the material was determined.

Scale	Range of Means	Descriptive Interpretation
4	3.50 – 4. 00	Very Much Valid (VMV)
3	2.50 – 3.49	Much Valid (MV)
2	1.50 – 2.49	Slightly Valid (SV)
1	1.00 – 1.49	Not Valid (NV)

Statistical Treatment of Data

The data gathered pertinent to this study were collated, tabulated, analyzed and interpreted. Content analysis was used to determine the least and most preferred academic coping strategies of teachers in improving the least mastered competencies of struggling learners in science. Likewise, mean was used to identify the validity of the instructional model. The following range of means, along the descriptive interpretations, was used to analyze and interpret the model's validity.

Science teachers' academic coping strategies for struggling learners

Collaborative Learning

Collaborative learning is central to creating inclusive classroom environments where students feel empowered to contribute and support one another's learning journeys. By working together on projects and problem-solving activities, students develop critical thinking skills and interpersonal communication abilities. Collaborative learning, grounded in Vygotsky's sociocultural theory, not only enhances academic achievement, but also nurtures social and emotional development. Through peer and group interaction, students learn from other through reflecting from one another's idea, discussion of their own perspectives, and understanding their experiences (Tabuada, 2018). Among these teaching strategies, collaborative learning is particularly preferred due to its ability to foster a sense of belonging and collective achievement within the classroom community. Through collaboration, students not only learn academic content, but also Collaborative learning has proven to improve academic performance in English, social science, and general science (Siddiqui, 2003; Perveen, 2003; Arbab, 2003). There are several types of collaborative learning activities which include Think-Pair-Share (TPS), simulations, peer tutoring, and small group discussion.

Small group discussion

Among the academic coping strategies mentioned by the respondents, small group discussion is the most preferred strategy. Consider the responses of the teachers during the FGD. During small group discussion, not only one learner is the talker and the other is listener compared to peer tutoring. Here, everyone is given the chance to provide their input and own understanding on the lesson that is being tackled. The learner, whether struggling or not, was able to critically evaluate the information from the other students and allows them compare with their existing knowledge and decide for themselves whether to acquire or assimilate the newly found information that they gather [Teacher 19]. Although both are proven effective, small group discussion (in comparison to peer tutoring) better develop the communication and critical thinking skills of the learners. Struggling learners are not just passive receivers of information but they are actively engaging with the exchange of knowledge with their group mates [Teacher 7]. When activities are given in a small group, whether the chances are not always 100%, but the learners are given higher chance to be with their peers. When they are comfortable with their learning environment, they are more motivated to learn and participate in the lesson or activity. Based on the responses of the teachers, small group discussion fosters greater academic achievement by providing a comfortable and nurturing learning environment to the struggling learners where they can freely express their opinions and ideas to collaborate with their group mates and peers. It is proven to be highly effective in promoting active engagement, critical thinking, and improving communication and socialization skills of the learners. According to Chandra (2015), during small group discussion, learners are given opportunities to share various perspectives based on their cultural and social backgrounds and reflect in the variety of responses given. Sharing meaningful learning experiences with synergic efforts leads to happier undertaking of activities and better outcomes (Alahdal & Alhattami, 2014). It also motivates the learners to participate in class discussion and interact with others (Bedel, 2016).

Peer tutoring

Peer tutoring remains a powerful vehicle for academic support and social interaction, enabling students to learn from one another in a collaborative and supportive environment. By engaging in peer tutoring, students not only reinforce their own understanding of subject matter, but also develop empathy, communication skills, and leadership abilities. In relation, the teachers' responses about peer tutoring are shown below.

Peer tutoring is done by pairing one struggling learner with non-struggling learner. Through this strategy, both of the learners are benefitting from each other. The non-struggling learner was able to explain, in his own words, how he understood the lesson. On the other hand, the struggling learner was able to understand the lesson through more simple terms which could easier for him to comprehend [Teacher 4].

Tutoring is usually done by the teachers but sometimes learners feel a bit awkward and shy to raise questions to their teachers. Peer tutoring is an effective way for them to grasp the concept of the lesson by feeling more comfortable to ask questions and clarification from their peers [Teacher 12].

Peer tutoring follows small group discussion with a minimal gap of votes from the respondents. Responses show that peer tutoring enables both of the learners to develop articulate concepts, reduce anxiety, listen actively, and provide direct feedback at shorter span of time compared to the small group discussion. Peers can provide explanation of concepts and guidance that resonates better to the struggling learner which makes it more relatable to them and easier to comprehend.

These findings can be linkedto what Kenan (2018) and Smrcka and Camska (2016) postulated that peer support system encourages internal critical thinking based on the external collaborative discussion where the learners can acquire or modify the knowledge that they have gained which leads to higher cognitive skills.

Brainstorming

One of the least preferred academic coping strategies, brainstorming is also a type of collaborative learning activity close to small group discussion. During brainstorming session, ideas are usually shared in a free-flowing manner amongst the group. The focus is on coming up with as many ideas as you can without immediate evaluation. Conversely, small group discussions could take a more methodical approach. Brainstorming serves as a dynamic tool to ignite critical thinking and problem-solving skills among students. By encouraging free-flowing idea generation and discussion, it cultivates a collaborative atmosphere where curiosity thrives and diverse perspectives are valued. The teachers' responses about brainstorming are highlighted below.

Brainstorming accumulates more time to gain consensus. The idea of brainstorming is only applicable when the aim is to generate more ideas. However, if the teacher wants the learners to achieve consensus decisions, brainstorming might not be the best option for it [Teacher 9].

As it is free-flowing, the exchange of ideas lacks focus and direction which oppose to small group that one or more

learners may facilitate the discussion to help the group come up with one idea [Teacher 1].

The teachers find brainstorming effective as it allows students to express their thoughts and opinions. However, this strategy requires a lot guidance from the teacher to instil discipline and may lead to students speaking so loudly that others may barely hear them, making it difficult for them to maintain discipline.

The ideas from the teachers can be associated to what Arana and Magbanua-Claur (2022) claimed that brainstorming is a decision-making strategy that can be used in any setting where people are expected to participate.

Aside from collaborative learning activities, other academic teaching strategies are employed by the teachers to help the struggling learners. However, these are least preferred due to different circumstances.

Recreational Games

Recreational games enable the learners to actively engage in class discussion as it alleviates the anxiety of having to answer in front of the class. It enriches the learning experience of the learners by providing opportunities for creative thinking, strategic thinking, and problem-solving. Paired with rewards, it is highly motivational for the learners to have an interaction with others and opportunities to experience success and failures. Consider the teachers' responses about recreational games.

Recreational games are highly engaging especially when rewards are involved but they are highly consuming from preparation down to the application [Teacher 20].

Realistically speaking, a teacher does not have enough resources to provide for a reward to the amount of classes that he/she teach. Points can't always be an option either [Teacher 8].

It requires a lot of preparation in terms of time management, as it consumes a lot of your time, sometimes inequality in opportunities arises in the student. They were given short amount of time to think and analyze questions. It is good for motivation but ensure that too much engagement will not lead to distraction [Teacher 13].

Incorporating recreational games is one of the least preferred teaching strategies because of limited time and resources. The science teachers find it hard to balance their time covering essential content and integrating recreational games. At the same time, recreational games frequently necessitate supplies and prizes that may not be readily available. They also find this strategy to be time consuming.

Recreational games into instruction add an element of interactivity and enjoyment to the learning process. This approach, consistent with Piaget's constructivist theory, encourages active participation and hands-on exploration, deepening students' understanding of scientific concepts (Lefa, 2014; Tabuada 2018). Positive reinforcements such as the rewards system heightens motivation of the learners which led to the redirection of behavior and accounts for the level of persistence and extended effort in the learner's work (Gordan, 2014).

Experimentation

Experimentation stands out as a cornerstone of scientific inquiry, providing students with invaluable opportunities for hands-on exploration and practical application of theoretical concepts. Through experimentation, students not only deepen their understanding of scientific principles, but also hone essential skills in critical thinking and problem-solving.

Experimentation is not always aligned with the objective of every lesson in science. One cannot incorporate just because of the benefits that it presents [Teacher 3].

Experimentation is great but it is not for all. Not all schools or teachers have enough resources to facilitate or employ experimentation. Besides, it also presents a lot of hazards which we may need to consider, especially if we are talking not only to the struggling learners but also the learners under the mainstreamed program which is our learners with disability [Teacher 16].

The respondents, however, finds that the insufficient resources made it to be one of the least preferred among the science teachers as reflected in the statements above. Without adequate resources, educators struggle to provide students with meaningful laboratory experiences that align with curriculum standards and learning objectives.

The benefit of laboratory experiment to improve learners' critical thinking skills cannot be overlooked. Thus, experiential learning approach equips students with the tools they need to excel in more advanced studies and real-world applications. Scientific inquiry and problem-solving enables the learners to understand the process at which something works. Understanding deepens scientific content knowledge and hones the scientific skills of the learners (Duruk *et al.,* 2016).

Exhibits

Exhibits serve an important role in presenting students with tangible, real-world experiences that connect academic understanding to practical application. Interacting with exhibits helps students expand their comprehension of scientific concepts and obtain vital insights into how these concepts materialize in the world around them. The statements below show the problems the teachers meet in using exhibits in the classroom.

Exhibits are good as they provide real life and hands on experience but there are no readily available exhibits that are easy to access for every school. Even if the school makes one, it will take time and considerable amount of effort [Teacher 5].

Science exhibits are often hindered by financial constraints. There may be available exhibits but the distance does not make it easy to access for all [Teacher 2].

Based on the statements, the teachers find that accessibility issues contribute significantly to why science exhibits are among the least preferred teaching strategies among the science teachers. While science exhibits offer valuable opportunities for hands-on exploration and interactive learning, several barriers hinder their widespread adoption and effectiveness, both inside and outside the classroom. The distance, transportation barriers, and financial constraints may

prevent students from accessing science exhibits outside of the classroom. Nonetheless, limited resources are the reason why science exhibit is not feasible inside the classroom.

Research Projects

Research projects act as accelerators for scientific inquiry, problem solving, and self-directed learning. Students that perform research improve their critical thinking skills, sharpen their analytical talents, and gain a better understanding of scientific procedures and methodologies. The following statements show the teachers' thoughts about research projects. Research has a lot of benefits but it takes time to accomplish such task especially if done individually. Competencies should be evaluated at the end of the lesson, but it will be difficult to do so when doing research projects [Teacher 18].

Academic coping strategies are supposed to help the struggling learners to easily comprehend the lesson and I don't think it will be achieved by giving them harder task to accomplish. It takes a lot of critical thinking and in-depth study to do research which does not match their level of readiness and competency. Academic coping strategy should allow students to cope up with the lesson [Teacher 6]. Based on the responses of the teachers, doing research projects does not match their students' level of readiness and competency because it is too hard for them to accomplish such task. On the contrary, research indicates that students who engage in research-based learning experiences demonstrate improved conceptual understanding, problem-solving abilities, and scientific inquiry skills (National Research Council, 2012).

Validity of the Instructional Models in Science for Struggling JHS Learners

This section discusses the validity of the instructional model in science for struggling JHS learners in terms of learning objectives, subject matter, procedure, evaluation, and assignment. After developing the instructional model, it was submitted to the validators for initial validation. The validators carefully assessed the model and provided constructive suggestions to enhance its quality and effectiveness. These are as follow:

The objectives are aligned with content and the assessment tool used for the evaluation. It is also aligned with the MELCs prescribed in the curriculum of the learners [Validator 1].

The main academic coping strategy used is collaborative learning in the form of small group discussion but having differentiated instruction and various activities will also help the learner to enjoy the lesson and further excel in the discussion especially when doing something that he/she might be good at so it is good that there are various activities that were included in the developed R-BLES [Validator 2].

Ensure that the activities that were included in the developed R-BLES are aligned with the skills of the learners. Also, the activities should be attainable within the time-frame that is allotted to make sure that all the required and expected competencies are tackled and achieve [Validator 3].

Aside from using video lessons, integrate the use of technology in other forms such as gamified activities or the introduction AI technology [Validator 4]

The validators commend the alignment of the parts and content of the instructional model from its objectives up to the evaluation. The validators, however, suggested that the activities be aligned with the skills of the learners, especially that it is designed to enable the struggling JHS learners for them to understand easily the lesson and ultimately improve their academic performance. These activities should also strictly follow the required time frame. Hence, to ensure effectiveness, the activities shall allot considerable time-frame. After the initial evaluation, the model was validated using the validation tool developed by the researcher.

Table 1 presents the validation results of the instructional models based on the ratings of the validators.

Criteria	Mean	VI
Learning Objectives		
The learning objectives are clear	4.00	VMV
The SLM covered the targeted Most Essential Learning Competencies	3.75	VMV
The learning objectives are anchored on the MELCs	4.00	VMV
Composite Mean	3.92	VMV
Subject Matter		
The content is current, relevant, and accurate	3.75	VMV
The content is appropriate to the needs of the target learners	3.50	VMV
Composite Mean	3.63	VMV
Procedure		
The content is logically developed and organized	3.75	VMV
The instructional design contains motivational strategies	3.75	VMV
The instruction design allows the review, comparison, and integration of past lesson (if applicable)	3.75	VMV
The content reflects current and accepted methodology	3.50	VMV
The activities enable the teacher to present information in appealing ways		
LM uses process questions and activities which require different levels of cognitive domain to achieve desired learning outcomes.	3.75	VMV
The written and performance task are differentiated based on the learners' learning style, multiple intelligence, and readiness level	3.75	VMV
The activities enable the learners to develop Higher Order Thinking Skills and 21st century skills;	3.50	VMV
The activities integrated desirable traits and values	3.75	VMV
The activities used contribute to the achievement of the learning objective	3.75	VMV
Composite Mean	3.68	VMV
Evaluation		
There are sufficient assessment activities that tracks the progress of the learner and the mastery of the target competency	3.75	VMV
The assessment is aligned with the learning objectives and the content	3.75	VMV
There are variety of assessment types	3.75	VMV
The assessment activities contain clear and direct instruction and rubric that will serve as a guide on how these are used	3.75	VMV
The assessment activities ensure the active engagement of the learners	3.75	VMV
Composite Mean	3.75	VMV
Assignment		
The content of the assignment is appropriate to the learners' level of comprehension and experience	3.75	VMV
The content of the assignment is coherent with the lesson	3.75	VMV
The instructions, questions, and activities are clear to the learners.	3.75	VMV
Composite Mean	3.75	VMV
Overall Mean	3.75	VMV

Legend:

Range of Means	Verbal Interpretation (VI)
3.50 – 4. 00	Very Much Valid (VMV)
2.50 – 3.49	Much Valid (MV)
1.50 – 2.49	Slightly Valid (SV)
1.00 – 1.49	Not Valid (NV)

Conclusion

The most common academic coping strategies used by the participants are small group discussion and peer tutoring. Likewise, it can be concluded that small group discussion and peer tutoring are the most efficient and effective strategies that improve the academic performance of the struggling learners in science. Moreover, collaborative learning activities like problem-solving and differentiated instructions enable the learners to reflect and discuss on each other's ideas, and understanding, improve their interpersonal skills, and develop their higher order thinking skills through problem-solving activities and differentiated instruction to help them achieve their required learning competency. Further, the developed instructional model is well-designed to meet the needs of the struggling learners in inclusive classrooms and effective in improving their academic performance in science.

Recommendation

Science teachers are recommended to utilize the results of this study, especially the developed instructional models which could serve as their guide towards using effective teaching strategies and appropriate activities which are helpful in assisting the academic needs of struggling learners. The instructional model is also recommended to be utilized as guide in developing home-based learning materials which can help parents in conducting follow-up activities at home. Moreover, it is recommended that the instructional model be adopted in the school or district level through a pilot-testing to broaden its impact by generating positive outcomes in the academic performance of the learners, diminish the number of struggling learners, and ultimately improve the performance of the school in delivering quality education. Lastly, other researchers may conduct and design research-based instructional model for other disciplines to test the study's efficacy in different disciplines and contexts, involving a wider scope.

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About the Authors

Pacita E. Delos Ama currently holds the academic rank of Master Teacher I at the Department of Education– Schools Division of Nueva Ecija, Talavera National High School where she teaches Science subject in the inclusive education setting. She earned her master's degree in special education from Mariano Marcos State University- Graduate School.

Jovenita A. Aragon is an Associate Professor V at Mariano Marcos State University, specializing in major subjects within the special education program and professional education. Her research focuses on elementary education, teacher education, inclusive education, and stakeholder participation, with her work published in international peer-reviewed journals, including those indexed by Scopus and the ASEAN Citation Index.

Andrian A. Dela Cruz holds the academic rank of Assistant Professor at the Mariano Marcos State University and an Associate Member of the National Research Council of the Philippines (NRCP) Division 1: Governmental, Educational, and International Policies. He published his research articles focusing on children's behavior, teachers' personality traits, professional development and self-efficacy, pre-service teachers' career readiness, and inclusive education in international peer-reviewed, Scopus Index and ASEAN Citation Index journals.

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