

### Short Paper

# Solving Mathematical Word Problems in Distance Education: Basis for Developing a Learning Mapping Teaching Strategy

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## Abstract

This quantitative-descriptive study examined the students' perceptions and attitudes on solving mathematical word problems in distance education and the college instructors' teaching skills and utilization of instructional materials. This study involved 217 college students in one of the state universities in the Philippines in the school year 2021-2022. Results showed that students agreed that distance education was an effective learning modality in solving mathematical word problems and that it promoted positive attitudes. Meanwhile, students agreed that their instructors have sufficient and effective teaching skills in distance education, although they should enhance their enthusiasm to facilitate the teaching-learning process. While students agreed on the appropriateness and effectiveness of their instructors' use of instructional materials, diversifying instructional materials should be improved. Moreover, Perez's Learning Mapping was designed based on the study's results. It consists of four (4) learning procedures, focusing on what students have learned and identifying what students want to connect, create, and share. Also, this study suggests that instructors be exposed to instructional and digital skills training and that seasoned instructors should receive support in adopting digitalization in the present educational system. There should be a feedback mechanism for improving online learning, and institutions may allocate funding and incentives for student project-driven innovation. Furthermore, this study recommends using Perez's Learning Mapping as one of the strategies to aid students in the teaching-learning process.

**Keywords** –distance education, learning mapping, word problems, strategy, perceptions



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## INTRODUCTION

Distance learning is more advantageous and effective in providing a high-quality, accessible education in the better normal. Teaching innovations and tactics are widely employed and required because of the difficulties and significant effects brought on by the COVID-19 pandemic to make the teaching-learning process more relevant, collaborative, and effective. According to Sherry (1995), distance learning is extremely and rapidly evolving with the influence of media. Often, instructional developers and curriculum designers have been interested in modern technologies without considering the existing underlying issues related to learners' characteristics and needs, the accessibility of interactive delivery systems, and the roles of instructors in online learning modality. Some advantages of e-learning include convenience and flexibility for the learners, facilitation of communication between the instructors and students, and greater adaptability to meeting the learners' needs (Al-Arimi 2014). According to Gujjar and Malik (2007), online learning is a concept in the academic institution that focuses on self-paced learning through the offered courses with the utilization of technology that is supported by online sessions, tutorials, seminars, and among others to address the arising needs and concerns relevant to the expansion of the teaching force, raising professional standards, and modernizing teaching methods wherein upon its completion there will be obtained credentials. Moreover, distance education is becoming popular for those who want to pursue their studies since it offers flexible time and schedule for students, especially for those with hectic schedules due to excessive workloads and professionals working in the corporate world. According to Lawrence (2005), online learning provides courses that let the students choose courses without experiencing the fear of conflicts, and they can do their work at any time, depending on their availability.

In the study of Kotrikadze and Zharkova (2021), they summed up that educational institutions should take time to replace the traditional or face-to-face learning modality, knowing that there is still an insufficiency of educational platforms for the training of instructors. With this, more learning institutions, especially in the public sector, still need to gain the necessary technological equipment and digital tools to aid this kind of learning modality. It is true that through online learning, we can achieve accessible education. However, most basic education schools and state universities are not prepared to shift from face-to-face to online learning. Also, educational administrators should consider the availability of internet connections and gadgets for the students. Not all learners can provide both of these primary resources. Technical issues, concerns, and periodic failures regarding portals' operation and work should also be considered. Lawrence's study (2005) emphasizes that learners feel lonely without actual interaction with their classmates, regardless of how much they converse with one another through email, phone, or any social media platforms. With this, students' social interaction and collaboration are becoming limited.

Solving mathematical word problems has recently received much attention from scholars and educators. The study of Phonapichat et al. (2014) shows that students guess without thinking when they do not understand the problem in mathematics. This is a usual initial response to learners facing challenges in the language of mathematics. Moreover, as per the study of Tambychika and Meerah (2010), students encountered problems in mathematics due to their incompetency in acquiring various mathematical skills and their lack of cognitive abilities. In addition, these difficulties might occur at any phase, including skills such as number-fact, information, and visual-spatial skills. In the study of Novriani and Surya (2017), the results show that students have struggles in problem-solving in text reading and questions, misinterpretation of the problem, guessing the solution and answer to the problem, students are not interested in identifying the solution of the given problem, and they have difficulty in interpreting problems into symbol form. Furthermore, as per Retnawati et al. (2020), learners can solve real-life and mathematical problems. If the students have difficulties describing mathematical connections, it will also be quite challenging to solve word problems. This study shows that learners have challenges in representations, relationships, connections about mathematical concepts, and the interrelationships between mathematical procedures. They recommended that in teaching mathematics, topics should contain problem-solving activities that are interrelated with solving mathematical concepts and procedures, and that can be connected with other learning disciplines and real-life scenarios.

The researcher was motivated to conduct this study since, nowadays, many students in state universities and colleges are struggling to solve mathematical word problems through distance education. It was found that many undergraduate students had difficulty accessing their lessons in online learning due to several factors, such as internet connectivity, teaching methods and strategies, instructional materials utilized by instructors, and also the students' attitudes toward solving word problems. The ultimate aim of this study is to develop a teaching strategy for college students in the school year 2021-2022 as aligned to the determinants in solving mathematical word problems in distance education. Specifically, it sought to answer the following:

1. How may college students' perceptions toward solving word problems in distance education be described?
2. How may college students' attitudes toward solving word problems in distance education be described?
3. How may college students' assessment of their instructors' teaching skills in solving word problems in distance education be described?
4. How may college students' assessment of their instructors' level of utilization of instructional materials in solving word problems in distance education be described?
5. Based on the results, what teaching strategy may be developed?

## LITERATURE REVIEW

It is believed that the following related pieces of literature support the aim of this study. The researcher ensured that the concepts were suited to this paper.

The study of Hannay and Newvine (2006) revealed that the learners strongly preferred distance education since it allows them on their part to balance their commitments more easily. In addition, the learners perceived that they could attain higher-quality educational outcomes through online learning. The study also suggested that state universities may consider the hybrid learning environment to benefit part-time students, commuters, and adult learners. Nowadays, higher education institutions are already adopting this learning setup to address rising concerns and meet students' needs, interests, and readiness. This is beneficial, especially for those who are struggling to manage their academic undertakings and work-related commitments. In addition, Manalo et al. (2022) found that the majority of the students perceived distance education as self-paced learning, convenient to anyone, providing opportunities, and taking full responsibility for their learning development. It also showed that learners can develop and enhance their digital literacy and improve their time management skills. However, the students encountered challenges, but the use of an action plan could enrich the online distance learning modality.

According to Abri et al. (2023), some challenges are usually experienced by instructors with distance education as learning modalities, including the additional workload and tasks, especially since they need to prepare their learning materials to ensure that learners can actively engage themselves within the duration of the lesson. Also, internet connectivity is one of the main contributors to the delivery of quality and accessible education. The intended learning competencies of the students may not be covered if the students and instructors have an unstable internet connection. In addition, they have suggested that instructors must reduce administrative tasks to enable them to implement strategies in distance learning. Educational institutions must provide guidelines and enhance the e-learning management system to lessen the burden on the part of the instructors. It is also recommended that adequate tools be provided for both educators and learners.

In addition, the study of DePruiter (2013) reveals that teaching strategies are essential in distance education. With this, instructors need to attend various training, seminars, peer teaching, and any professional development programs to keep themselves updated with the current trends and demands of the modernization of the educational system through online learning. The results of the students' assessment can also be used as a basis for tailoring the approaches to the learners' needs. Also, instructors must consider diverse learning styles and abilities through adaptive technological and digital strategies.

According to Dayal and Chandra (2016), some in-service teachers do not practice or apply contextualized mathematical knowledge in real-life situations. With this, they must be well-guided and assisted in enhancing and strengthening their mathematical and pedagogical content knowledge. This professional and technical assistance can also be materialized through attending to continuing professional development and conducting initiatives like peer tutoring and focus group discussions. On the other hand, learners also encountered difficulties in terms of factual, conceptual, metacognitive, and procedural information. Students experience these issues due to insufficient time, anxiety, quitting easily, carelessness, and eagerness to solve problems (Habibullah, 2019). According to Kurshumlia and Vula (2013), the development of the students' mathematical vocabulary plays a significant role in their understanding of terms and requirements in mathematics while providing constructive feedback that will improve the existing problem-solving gap. As per Devi and Silva (2021), most learners show a positive attitude toward distance learning, wherein students are satisfied with the results of their online assessment, delivery of the content, and acquisition of adequate knowledge and skills. Moreover, it indicates limited interaction among the learners and instructors or lecturers. As suggested, there must be strategies that will make the online classes interesting and interactive.

## CONCEPTUAL FRAMEWORK

Figure 1 below presents the schematic diagram of the study relevant to the determinants in solving mathematical word problems in distance education. This framework shows the interconnectedness of college students' perceptions and attitudes, their instructors' level of teaching skills, and their instructors' level of utilization of instructional materials in online learning.

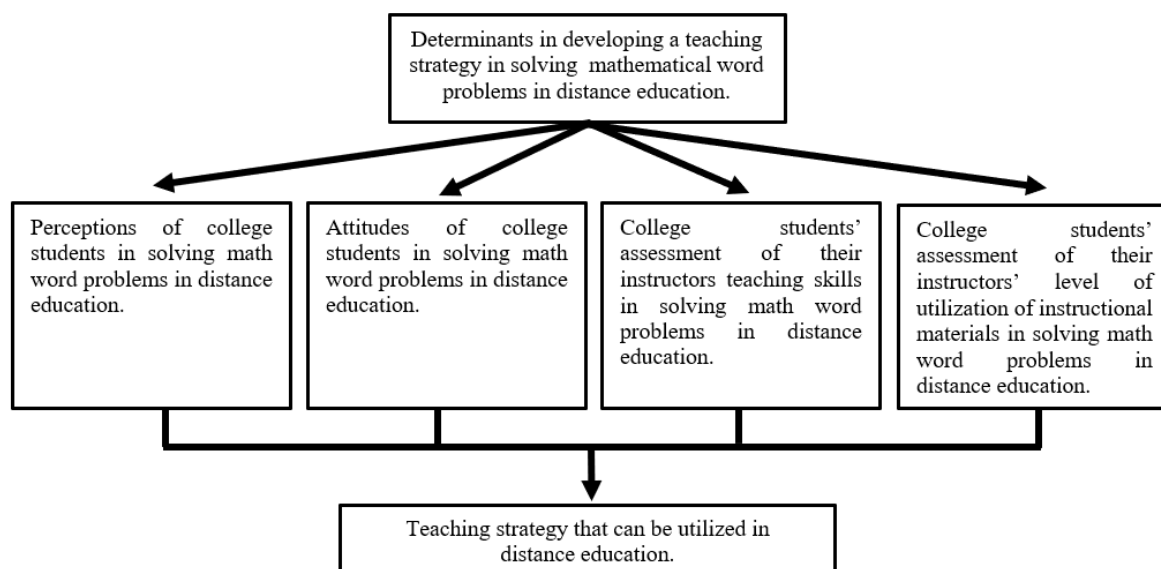


Figure 1. Schematic Diagram of the Study

Firstly, the researcher determined the learners' perceptions of the effectiveness, benefits, and challenges encountered during the application of distance education as a learning modality. This phase explored the previous and current experiences of the students with online learning following the institutional support and exposure to various innovative technological assistance offered to them.

Secondly, they were asked to respond to their predispositions towards distance education, which included their enthusiasm and motivation to study.

Thirdly, the undergraduate students assessed the level of teaching skills of their instructors, which involved their abilities and competencies in delivering the intended lessons in online learning. In addition, the technical skills and proficiency with their instructors' digital tools and platforms were also considered.

Lastly, the learners assessed their instructors' level of utilization of instructional materials. In this part, they evaluated the digital resources and content used in facilitating distance education as a learning modality. This includes digital textbooks, multimedia presentations, online assessments, and innovative online learning modules. The output of this study is a learning mapping strategy that will help educators enhance their teaching performance in distance education, specifically in solving mathematical word problems.

## **THEORETICAL FRAMEWORK**

This study is anchored on Davis' (1989) Technology Acceptance Model (TAM), which explains the user's technology acceptance. Additionally, it suggests that users' attitudes toward technology are influenced by their perceptions of technology's usefulness and ease of use (Noh et al. 2021). Within this theory, this study explored the students' perceptions and attitudes toward solving mathematical word problems in distance education, as well as their perceptions of their college instructors' teaching skills and utilization of instructional materials and how it influenced their acceptance and use of distance education as a learning modality for solving word problems.

## **METHODOLOGY**

### ***Research Design***

In this study, quantitative research was utilized. This research approach involves collecting, analyzing, and interpreting numerical data to determine trends and averages, analyze causality, conceptualize hypotheses, and extrapolate findings to a larger population (Bhandari 2020). Furthermore, descriptive-quantitative research was used to describe the determinants in developing a learning mapping as a teaching strategy for solving mathematical word problems in distance education, specifically for college students. Descriptive research design is an important and appropriate tool usually used

by researchers and scientists to collect data on a particular sample, group, or phenomenon, which helps to obtain a deeper understanding of a specific issue that can inform future studies (Sirisilla 2023).

## **Respondents**

The study's respondents were 217 college students in one of the state universities in the Philippines who had lessons about solving mathematical word problems in the school year 2021-2022. The undergraduate learners who became part of the study were from the following programs: Bachelor of Science in Industrial Technology, majoring in Food Services Management, Graphics Technology, Electrical Technology, and Automotive Technology. These student-respondents were chosen considering their number of units in studying mathematics-related courses such as Plane and Spherical Trigonometry, Mathematics in the Modern World, and Applied Industrial Mathematics. This study utilized the simple random sampling technique, usually used in quantitative research studies with survey instruments. During the selection, all the population members were given an equal opportunity to be chosen as one of the samples (Noor, Tajik, and Golzar 2022).

## **Research Instrument**

In this study, the researcher-made questionnaire was used and validated by research, language, and math experts. The opinions and recommendations of the recognized validators were considered to meet the requirements for validity and dependability. They were asked to evaluate each indicator's thoroughness and clarity as well as the suitability of the descriptive rating scale. The instrument was created based on various related publications, particularly courses on solving word problems in mathematics in distance education. The survey's administration process was carried out using a Google Form. Additionally, the tool was pilot-tested among fifteen volunteer respondents using a 4-point Likert scale and had its content validated by both internal and external validators. The calculated Cronbach Alpha of 0.85 indicates that the instrument has good internal consistency. The survey questionnaire consisted of four parts. The first part determines the perceptions of distance education as a learning modality for solving mathematical word problems. The second part identifies the attitudes of the respondents toward distance education. The third part is the students' assessment of their instructors' teaching skills. The last part is the students' assessment of the instructors' utilization of instructional materials in online learning.

## **Data Gathering**

When distributing the questionnaire, the researcher followed the data-gathering steps. First and foremost, the researcher requested permission in a formal letter sent to the campus director and signed by the chairs of the relevant programs. Following the

letter's clearance, the researcher created an activity plan for the data collection process. Each respondent was given a brief explanation of the study's nature and objectives. Finally, Google Forms were used to distribute the questionnaires.

## **Data Analysis**

After collecting the data, the researcher organized and combined it by transferring the respondents' responses into an MS Excel file. To determine the validity and trustworthiness of the data, the summary of responses was examined. Additionally, these were tabulated and analyzed using a 4-point Likert scale (1-Strongly Disagree, 2-Disagree, 3-Agree, and 4-Strongly Agree). The mean ranges and verbal interpretation include: 1.00-1.49=Strongly Disagree, 1.50-2.49=Disagree, 2.50-3.49=Agree, 3.50-4.00=Strongly Agree. The information obtained from the survey questions was categorized, totaled, and tabulated.

## **RESULTS**

Table 1 presents the data on college students' perceptions of solving word problems in distance education. As indicated below, the highest mean value was 3.24 with a standard deviation of 0.73, which means that college students agree that they are willingly open to communicating with their classmates and instructors in mathematics through distance education. On the other hand, the lowest mean value of 2.60 with a standard deviation of 1.01 indicates that the undergraduate believed that learning to solve mathematics word problems through distance education is more motivating than attending face-to-face learning. Furthermore, the computed general weighted mean was 3.02 with a standard deviation of 0.80, which means that college students agree that distance education is an effective learning modality for solving mathematical word problems.

Table 2 shows the data about the college students' attitudes toward solving mathematics word problems in distance education. As reflected in the data, indicator 10 had the highest computed mean value of 3.10 with a standard deviation of 0.76. This indicates that college students agree that they find ways to solve word problems in distance education when they do not know the operations. The lowest mean score was 2.76 for indicators 4 and 8, with a standard deviation of 0.88 and 0.82, respectively. The calculated general weighted mean of 2.89 with a standard deviation of 0.81 indicates that college students agree that distance education promotes positive attitudes toward solving mathematical word problems.



Table 1. College students' perceptions toward solving word problems in distance education

Indicators	Weighted Mean	Std. dev.	Descriptive Interpretation
I am comfortable communicating with my classmates and instructors in mathematics through distance education.	3.19	0.86	Agree
I am willingly open to communicating with my instructors and classmates in mathematics through distance education.	3.24	0.73	Agree
I feel that my prior experience in solving mathematics word problems on time through distance education will be beneficial to my studies.	3.14	0.68	Agree
I believe recalling what I have learned in solving mathematics word problems through distance education will help me remember it better.	2.90	0.76	Agree
I can complete my assignments on time and use them effectively in solving mathematics word problems through distance education.	3.00	0.80	Agree
As a learner, I am glad to collaborate with my classmates in solving mathematics word problems through distance education.	3.07	0.84	Agree
I believe that learning to solve mathematics word problems through distance education is more motivating than attending face-to-face learning.	2.60	1.01	Agree
I can work in a group to solve mathematics word problems in distance education.	3.00	0.70	Agree
<b>General Weighted Mean</b>	<b>3.02</b>	<b>0.80</b>	<b>Agree</b>

Legend: 3.50-4.00 Strongly Agree 2.50-3.49 Agree 1.50-2.49 Disagree 1.00-1.49 Strongly Disagree

Table 2. College students' attitudes toward solving word problems in distance education

Indicators	Weighted Mean	Std. dev.	Descriptive Interpretation
I find it easy to solve mathematics word problems in distance education.	2.83	0.79	Agree
I usually practice solving mathematics word problems at home.	2.98	0.90	Agree
I found it interesting when my instructor discussed word problems in distance education.	2.86	0.78	Agree
I like solving word problems in distance education.	2.76	0.88	Agree
I tend to guess the answers to solving word problems in distance education if I find them difficult to solve.	3.02	0.75	Agree
I got high scores on our quizzes in solving word problems in distance education.	2.88	0.89	Agree
I was able to improve my skills in solving word problems through distance education.	2.90	0.73	Agree
I find it easy to translate word problems into mathematical symbols because of distance education.	2.76	0.82	Agree
I am determined when I am solving word problems in distance education.	2.83	0.79	Agree
I find ways when I do not know what operations to use in solving word problems in distance education.	3.10	0.76	Agree
<b>General Weighted Mean</b>	<b>2.89</b>	<b>0.81</b>	<b>Agree</b>

*Legend: 3.50-4.00 Strongly Agree 2.50-3.49 Agree 1.50-2.49 Disagree 1.00-1.49 Strongly Disagree*

Table 3 shows the interpretation of data about the instructors' teaching skills in distance education. As indicated below, the highest weighted mean was 3.38 for

indicators 4 and 2, with the same value for the standard deviation of 0.62. This means that undergraduate learners agree that their instructors show smartness, confidence, and firmness when teaching word problems in distance education and use appropriate teaching strategies when teaching word problems in distance education. However, the lowest mean value was 3.19 with a standard deviation of 0.67, which means they agree that their instructors facilitate the teaching-learning process enthusiastically in teaching word problems through distance education. The general weighted mean was 3.30 with a standard deviation of 0.62, indicating that the college students agree that their instructors have sufficient and effective teaching skills in distance education.

Table 3. College students' assessment of their instructors' teaching skills in solving word problems in distance education

Indicators	Weighted Mean	Std. dev.	Descriptive Interpretation
My instructor in distance education explains the objectives of the lesson clearly about solving word problems before he/she presents the topic.	3.31	0.60	Agree
My instructor shows smartness, confidence, and firmness in teaching word problems in distance education.	3.38	0.62	Agree
My instructor in distance education has mastery of the subject matter especially solving word problems.	3.36	0.62	Agree
My instructor uses appropriate teaching strategies in teaching word problems in distance education.	3.38	0.62	Agree
My instructor in distance education gives various examples of how to solve word problems.	3.33	0.57	Agree
My instructor has effective classroom management in distance education.	3.29	0.60	Agree

Legend: 3.50-4.00 Strongly Agree 2.50-3.49 Agree 1.50-2.49 Disagree 1.00-1.49 Strongly Disagree

Table 3. College students' assessment of their instructors' teaching skills in solving word problems in distance education (cont.)

Indicators	Weighted Mean	Std. dev.	Descriptive Interpretation
My instructor maximizes the integration of ICT tools in discussing word problems in distance education.	3.24	0.58	Agree
My instructor knows how to contextualize the examples about word problems so that his/her students can relate to the discussions.	3.26	0.66	Agree
My instructor in distance education is very effective in improving the ability of his/her students to solve word problems.	3.21	0.65	Agree
My instructor facilitates the teaching-learning process with enthusiasm in teaching word problems through distance education.	3.19	0.67	Agree
<b>General Weighted Mean</b>	<b>3.30</b>	<b>0.62</b>	<b>Agree</b>

*Legend: 3.50-4.00 Strongly Agree 2.50-3.49 Agree 1.50-2.49 Disagree 1.00-1.49 Strongly Disagree*

Table 4 presents the data about the instructional materials utilized by instructors in distance education. As reflected in the data, the mean score with the highest value was 3.29 for indicators 1 and 4, with a standard deviation of 0.55 and 0.71, respectively. This means that the college students agree that the instructional materials utilized by their instructors in discussing word problems match the course objectives and that the PowerPoint presentation is effective and efficient in distance education when their instructors discuss the topic of solving word problems. The lowest computed mean score was 3.05 with a standard deviation of 0.82, meaning that the college students agree that most of the time, their instructors used chalk, board, and Google Jamboard to solve word problems in distance education. The general weighted mean being computed was 3.22 with a standard deviation of 0.68, which indicates that the undergraduate students agree that their instructors utilized appropriate and effective instructional materials in distance education.

Table 4. College students' assessment of their instructors' level of utilization of instructional materials in solving word problems in distance education

Indicators	Weighted Mean	Std. dev.	Descriptive Interpretation
The instructional materials utilized by my instructor in discussing word problems match the course objectives.	3.29	0.55	Agree
The instructional materials used by my instructor in distance education are useful and accessible to the students.	3.26	0.59	Agree
My instructor uses worksheets and textbooks to present word problems in distance education.	3.19	0.67	Agree
The PowerPoint presentation is effective and efficient in distance education when my instructor discusses the topic of solving word problems.	3.29	0.71	Agree
My instructor in distance education always uses films and videos to motivate the students to listen to the discussion of word problems.	3.24	0.66	Agree
Measurement tools, models, and realia are being utilized by my instructor in distance education whenever he/she is presenting a lesson about solving word problems.	3.21	0.78	Agree
Most of the time, my instructor uses chalk, board, and Google Jamboard to solve word problems in distance education.	3.05	0.82	Agree
<b>General Weighted Mean</b>	<b>3.22</b>	<b>0.68</b>	<b>Agree</b>

Legend: 3.50-4.00 Strongly Agree 2.50-3.49 Agree 1.50-2.49 Disagree 1.00-1.49 Strongly Disagree

## DISCUSSION

According to Combo et al. (2022), despite the challenges encountered in distance learning, instructors are finding ways to meet the needs of the students. This only indicates that online learning addresses the learners' needs and interests. At the same

time, unlike face-to-face learning, it is not that expensive. This online learning is highly important, especially for those who can't afford to attend classes via actual teaching-learning modality.

According to Reed et al. (2010), facilitating learning with the aid of digital tools in mathematics needs to consider several factors, such as improving students' attitudes, modifying learning behaviors, and providing an opportunity for generating new knowledge in mathematics. It has already been proven that encouraging learners to link mathematical ideas helps to improve their learning.

In relevance to the study conducted by Beaudoin (1990), distance education is based on a learner-centered approach, with educational activities geared toward encouraging learning. The instructor provided study materials for the learner with explanations, references, and reinforcement. Independent study emphasizes learning rather than teaching and is founded on the premise that what students do, not what instructors do, is the key to learning. It is a highly individualized process for transforming incoming knowledge into new insights and ideas. The institution's job, and its instructional personnel's duty, is to assist and improve that process—regardless of distance—to achieve optimal learning results.

The study by Ansayam & Tan (2021) shows that instructors have been attending webinars or seminars, professional training with peers, training via online, academic training, and experiences with self-directed learning to acquire necessary skills relevant to the utilization of digital instructional materials and digital tools for online learning. Instructors are expected to capacitate themselves when utilizing appropriate instructional materials to ensure that the learners can interact during the discussion.

The study's above-indicated results show that undergraduate students in distance education are experiencing an effective and efficient teaching-learning process. Furthermore, Perez's Learning Mapping is developed to enrich the students' skills, competence, and capabilities and guide them as they learn in an online learning modality. Perez's learning mapping as a teaching strategy is anchored in constructivism theory. This suggests that learners can conceptualize new information based on their prior knowledge. This also means that students make sense of what they have acquired, perceive, and construct meaning from the existing information (Bada and Olusegun 2015). With this, learners are required to represent their learning by creating new ideas through distance education.

### ***Description of the Teaching Strategy***

This is a teaching strategy where the members of the class are required to represent their learning by generalizing what they have learned, critically thinking about what is the impact of their lesson in their life and how the learning competencies are

relevant and connected to them, promoting collaboration and active engagement of the students in their macro-environment through sharing what they have learned; analytically thinking about how they can integrate, elaborate and generate new knowledge-based from their prior schema. This strategy benefits any learning style and multiple intelligences of the learners. Lastly, this is also one way of assessing the students' learning, understanding, thinking ability, and creativity. The instructor here may have his/her assessment checklist concerning the students' learning progress.

### ***Desired Learning Outcomes***

Perez's Learning Mapping increases every student's critical and analytical thinking. It also promotes collaboration and builds intrapersonal and interpersonal skills. In addition, it enhances the learners' oral and verbal communication since they are encouraged to freely express their thoughts, ideas, and expressions. Moreover, it makes the students more self-aware and goal-oriented through their acquired knowledge.

### ***Learning Procedures***

#### ***What have I Learned?***

After discussing the lesson, the students will make a summary or generalization about what they have learned. The instructor should allow the students to wrap up their learning through diagrams, models, key points, or other methods depending on the learners' learning styles and multiple intelligences.

#### ***What do I want to Connect?***

The students will think about the importance and relevance of the discussed topics in their lives. Aside from this, they also conduct self-assessments about how ready they are to apply the learning competencies they have acquired. Moreover, the students relate the effect and what the lessons can do to make them holistically developed individuals and lifelong learners.

#### ***What do I want to Create?***

The students will generate new knowledge based on what they learned. In addition, learners create new ideas through data gathering, research, experiments, and observations. Through these, students become innovators and problem-solvers after successfully testing the assumptions.

#### ***What do I want to Share?***

The students will make a plan or action to be taken by sharing what they have learned with the other people in their community. Students are encouraged to share their learning through any of the following: video presentation, audio-visual presentation, picture, song, poem, illustrations, and others.

## **CONCLUSIONS**

The computed general weighted mean of 3.02 with a standard deviation of 0.80 means that college students agree that distance education is an effective learning modality in solving mathematical word problems. The calculated general weighted mean of 2.89 with a standard deviation of 0.81 indicates that college students agree that distance education promotes positive attitudes toward solving mathematical word problems. The general weighted mean of 3.30 with a standard deviation of 0.62 infers that the college students agree that their instructors have sufficient and effective teaching skills in distance education. The general weighted mean being computed of 3.22 with a standard deviation of 0.68 indicates that the undergraduate students agree that their instructors utilized appropriate and effective instructional materials in distance education. Therefore, as per the interpreted data, it shows that solving mathematical word problems in distance education with the determinants of the perceptions, attitudes, instructors' teaching skills, and instructors' utilization of instructional materials indicates that students are becoming lifelong learners as they learn by and within themselves in distance education as a learning modality specifically in solving mathematical word problems.

## **RECOMMENDATIONS**

The instructors from Higher Educational Institutions (HEIs) should be exposed to various training activities that will enable them to enrich their instructional and digital skills, especially in distance education as a learning modality. Also, seasoned instructors should prioritize providing technical and professional assistance to cope with the digitalization program of the present educational system. There must be a regular feedback mechanism from the students about improving online learning, especially the digital tools and ICT-integrated learning materials that instructors utilize. Perez's Learning Mapping is recommended to be integrated by instructors as one of the teaching strategies to enable the learners to generate and innovate new ideas based on what they have acquired during the teaching-learning process. Furthermore, the institution may allocate funding and incentives for the students' sustainable, impactful, and project-driven innovations to encourage them to create more basic and applied knowledge.

## **IMPLICATIONS**

This study may significantly improve the learners' learning styles and abilities by using learning mapping as a teaching strategy in distance education. Through this



systematic approach, instructors can ensure that students understand the problem-solving processes more clearly. Also, it provides opportunities for curriculum designers and implementers to develop, review, and enhance the e-learning management system that is accessible, relevant, and adaptive to the needs, readiness, and interests of both the instructors and the students. Furthermore, the results of this study may be utilized to improve learning mapping as a teaching strategy.

## **ACKNOWLEDGEMENT**

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## **FUNDING**

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## **DECLARATIONS**

### ***Conflict of Interest***

No conflict of interest exists between the author and the concerned respondents and stakeholders that might affect the article's content.

### ***Informed Consent***

The consent form contained a statement promising to defend and uphold the respondents' rights to full disclosure, confidentiality, and non-maleficence, and the collected data was erased after being analyzed. Additionally, the respondents' right to opt out of the study was taken into account, and it was stated that a safe place, logistical arrangements, and technical considerations would be made for both the respondents and the researcher when conducting online surveys. Also, the respondents were given informed consent.

### ***Ethics Approval***

Throughout the research process, the researcher followed ethical guidelines. The respondents' opinions and decisions were considered as the researcher described the nature and objective of the research investigation. Furthermore, the data was handled with the highest discretion. The researcher also informed the program chairpersons of the respondents and requested the campus director's permission. The respondents were also told about the goals, objectives, and contributions they may make to this research study.

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