WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Implementation of Modular Distance Learning Modality in Teaching Physics During COVID-19 Pandemic

Maria Teresa G. Olino[a], Jay D. Buscano [b]

[a]Principal I, Department of Education, SDO General Santos, General Santos City, 9500, Philippines
[b]Dean, College of Natural Sciences and Mathematics Mindanao State University - General Santos

A B S T R A C T

This study determined the status of implementation of modular distance learning modality in teaching Physics during the COVID-19 Pandemic. Quantitative data were collected through a questionnaire administered to teachers teaching physics purposively chosen from the three secondary schools in General Santos City and qualitative data through focus group discussion of selected participants. Data analysis used thematic analysis of qualitative data. Based on the findings of the study, the modular distance learning modality in teaching Physics during the COVID-19 pandemic is highly implemented in terms of pedagogical content knowledge, utilization of strategies and assessment. This indicates that teachers readily adopted the prescribed modality of the Department of Education at high level. The experiences, challenges and strategies shared by teachers in teaching Physics using the modular distance learning modality amidst the pandemic resulted to positive outcomes such as showing resilience in coping with the demand of dealing with the new normal educational setting. Strategies such as use of social media tools as a communication strategy, virtual innovative teaching tools as aide in lesson delivery, and applying flexibility in teaching and accommodation of learners are employed. Strengthening collaboration with parents and stakeholders focused on monitoring of learners and being open to peer teaching are the common approaches adopted by the teachers.

Keywords: *COVID-19, Physics, modular distance learning, pedagogical content knowledge, teaching strategies*

1. Introduction

1.1 Background of the Study

When the first coronavirus (COVID-19) incident in the Philippines occurred in March 2020, the nation was placed in a national emergency. This affects all sectors, including the education sector. To provide clear guidance, the Department of Education (DepEd) developed the Basic Education- Learning Continuity Plan (BE-LCP), a set of education interventions that responds to the challenges of the delivery of basic education during the pandemic. To develop a learning delivery strategy and operational guidance that ensures the health, safety and wellbeing of all learners and teachers, there should be a collaboration not just mere involvement of the internal and external stakeholders. (DepEd, 2020). Moreover, the LCP recognizes that DepEd must adopt alternative modes of delivering learning: Distance learning, Blended Learning and Homeschooling, to ensure that all learners will be given the chance to continue education in the absence of face-to-face learning (Memorandum OSEC-NEAP-OD-2020-0618).

Limitations of Internet connectivity and lack of gadgets may be the primary reason for implementing modular distance learning. However, its effectiveness is yet to be determined. Brillantes, KD et.al (2019) mentioned that the creation of the K-12 educational program is to improve the core functional system that will produce effective and accountable citizens with the required skills, abilities and knowledge that they can utilize for more learning and future employment.

The results of the Bongco study (2020) revealed that, in the implementation of curriculum policies in their classrooms, teachers face pressures, unnecessary strains and experiences that sometimes make no sense. Success in implementing the curriculum is largely dependent on how teachers understand and operationalize curriculum policies. Change does not happen overnight and learning how to implement the policy is not something you do once everyone has been ‘trained'. There would still be innovations based on the context and the approach of the teachers. Improved basic education law promotes an important and culturally sensitive curriculum that makes contextualization an essential characteristic of the new, thus, teachers are encouraged to contextualize, indigenize, or localize the lessons and its delivery (GovPH, 2013).

The difference between scientific knowledge of teachers from scientists is referred to as the pedagogical content knowledge (PCK). Teachers of a specific subject know how to integrate their knowledge of the content of the subject and their capacities to ensure the learning of the students. They should also consider the needs of learners as well as individual differences (Etkina, 2010).

Resurreccion, J. A. & Adanza, J. (2015) described Spiral Progression as the process where learners are introduced to basic principles in the first grade and continuously exposed to it with varying degree of complexity and deepening of the lesson. Science is one of the subjects offered in K-12 where spiral approach of teaching is applied and progresses the higher the grade level is. Accordingly, science which consists of four areas namely integrated science, biology, chemistry, and physics are offered at different grading periods.

So, in offering quality physics education, a teacher needs to keep this complexity in mind when developing teaching strategies and authentic tasks similar to that in the real world (Jatcho, 2016).

In the implementation of the modular distance learning modality, Physics as a subject requires deeper pedagogical content knowledge to impart the needed problem solving skills and other 21st century skills to the learners to make learning more interesting and relevant. It is in this light that the researcher aimed to study the different factors affecting the implementation of modular distance learning in teaching Physics to Junior High School Science and how these factors influence learning and development of students.

1.2 Distance Learning

With the current state of the educational system, ravaged by the COVID 19 pandemic, any face-to-face contact with students would have been dangerous. The risk management system must follow the established health protocols. This has resulted in a change in class delivery modalities from traditional face-to-face to distance learning. In this scheme, various learning areas which are usually taught in school will be now under new approach referred to as home-based perspective.

Distance learning is a form of instruction in which students learn from an instructor who is physically separated from them. Modular Distance Learning (MDL), Online Distance Learning (ODL), and TV/Radio-Based Instruction are the three forms of this modality. Teachers provide instructions that allow students to use printed SLMs in modular distance learning, pdf, or electronic copy, whichever is applicable and preferred by learners and parents. Also, other learning tools, such as Learner's Aids, textbooks, LAS, study guides, and other condensed learning materials, can be provided by teachers. Learners may access electronic or softcopies of these learning materials through a computer, tablet PC, or smartphone. E-learning materials can also be delivered using CDs, DVDs, USB storage, and computer-based devices including e-book readers. In cooperation with parents or guardians at home, the teacher is responsible for delivering learning materials as well as tracking the progress of the students. The teacher can also provide assistance to the students via e-mail, phone, text message/instant messaging, and other means. To the extent possible, the teacher must make home visits to learners who require corrective action or assistance. Any family member or other members of the community must act as para-teachers who, in one way or another, will help or support learners in formulating their responses.to the modules or any learning materials given to them (DepEd, 2020).

According to Codamon (2020), here are some benefits of modular distance learning: (a) Flexible. Students can set their own schedule to complete tasks in the module, but they still need to be mindful of the set time. (b) Student-centered. Students are responsible in accomplishing the task that is self-paced therefore taking charge also of their own learning. (c) Accessibility. Resources within the locality are made available to the learners with the help from the community. In this way, they learn to inquisitive, innovative and creative in looking for answers prior to the conduct of scheduled activities.

(d) Simplified. The contents are made simple and conforms with the needs of the learners. (e) Cost-efficient. Parents and guardians can save a lot in terms of transportation and other related expenses. The only expense is in the printing of modules which are shouldered by schools, the local government units (LGU), and the agency itself through the Schools Division Office.

1.3. Pedagogical Content Knowledge(PCK)

The process through which teachers master both content and diverse pedagogical practices which describes this major reform in the structure for quality education. Simply, a shift from teacher- centered to learner-centered approaches. Content areas such as mathematics, science and language where many students perform poorly on academic tests, teachers are particularly looking for support since this requires careful preparation. Furthermore, due to fast demographic changes, teaching and learning processes should reflect diverse pedagogy-specific practices (Borko, 2014).

Moreover, PCK is an educational concept that refers to a collection of interconnected domains of information that science educators can use in the classroom or outside of it. Both areas are subject-specific material awareness and teaching pedagogy knowledge. It is complicated because it is just one part of a teacher's professional knowledge, so it is tied to particular subjects and even teaching situations. It may be a collection of pedagogical methods that an experienced teacher develops after teaching a subject several times. The more teachers work in the classroom, the more likely they are to use reforms and advancements in their teaching. These elements are important for effective teaching of a broad subject to happen (Pompea, Walker & Sparks, 2014).

Using educational materials that help educators develop their PCK is a complementary approach to enhancing science education in both the classroom and out of school environments. This approach stresses the development and use of high-quality instructional resources that are aligned with the educational system's learning competencies. To deal with the rapid changes in educational environments, most educational institutions take this approach. Additional professional development and training can, of course, be beneficial, but one solution should not rule out the other. If instructional materials provide well-tested approaches and model best practices from experienced and successful teachers, and are subjected to quality assurance, teachers' PCK can be enhanced. Educative curriculum materials are educational materials that can assist educators in improving their PCK. They will

assist educators in improving their teaching by enhancing their material and pedagogical skills by the use of learning materials that have been thoroughly validated and represent best practices in all aspects of PCK (Walker et al, 2015).

Therefore, the teachers' PCK, which is to enhance the quality of teaching and learning in vital core subject areas, is at the center of successful content teaching. It will have to fight and conquer certain long-held technical learning practices. Instead, it should consider and extend the perspectives of professionals who cultivate subject matter teaching competence, commit to high-quality professional growth, and contribute to the classroom's and school system's overall objectives and priorities (Solis, 2019).

1.4 Utilization of Strategies

A typical physics classroom is characterized by learning concepts and problem-solving exercises. The teacher introduces a scientific principle, theory or law then give students problem solving exercises either answered individually or by group.

Two learning paradigms, cognitivism and constructivism, are still present in all classrooms in daily physics instruction. The cognitive process to be used will be dictated by the learning design of a subject, course, or program based on the information, acquisition, and skill development required. As a result, several cognitive processes are chosen to facilitate student learning tasks. As a result, physics phenomena are widely viewed in daily life, and the technical nature of physics makes the modern lifestyle seem more understandable than it was many years ago (Zewdie, 2014).

Another important factor to consider when teaching physics is the most used instructional approaches, which are ineffective for teaching various physics principles. When students are asked to solve physics problems, many of them do not develop the necessary conceptual understanding, instead attempting to memorize only the mathematical formula and follow the pattern in the textbook. Because of the simplicity of the technique, this has become the standard method of teaching Physics. While physics teachers prefer to teach using the lecture method, students are more interested in physics when a variety of teaching methods or techniques are used, such as the use of diagrams and ICT-assisted applications (William, 2010).

In this regard, teachers must employ a variety of creative and imaginative teaching strategies to maximize student success by engaging them in learning activities; otherwise, students would simply memorize what they are taught without knowing it conceptually.

Another issue that students face is the lack of motivation and negative attitude toward the Physics course. Physics is often regarded by students as an overly complex and abstract subject with little practical application. This low motivation among physics students can be attributed to most physics teachers' use of the conventional physics teaching system. Teachers continue to use the conventional teaching method rather than the interactive method; such method demonstrated inability to enhance student motivation and performance in physics (Aina, 2013).

Teachers are the most important part of any educational system. According to observations, the success or failure of any educational program is largely determined by the availability of professionally trained, knowledgeable, and dedicated teachers. Teachers are the most significant factor in determining the standard of education in any educational system; when teachers are evaluated, student learning and achievement are considered (Ohio TES, 2015).

In the implementation of the new modalities in education, it has been observed that DepEd is providing virtual trainings or webinars to teachers to better equipped each one in the delivery of lesson to learners. According to de Vera (2020), teachers realized the need to innovate teaching strategies to cope up with technology as well as the lifestyle and culture of todays learners.

1.5 Assessment

Beyond the new learning objectives in the new educational environment, a clear understanding of the requisite skills is needed. Even though some educational systems have established early frameworks that involve increasing levels of competency, there are no prescriptive examples that show how some of these skills "progress." This ostensible advancement is jeopardizing the creation of 21st-century skills tests (21CS). In preparing for evaluation in the new normal, factors such as information gained, skills built, and attitude improved are taken into account. Without a complete understanding of a learning domain, or "build," it is difficult to design evaluation frameworks and tasks. Even, if one does not understand the increasing level of competency, it is difficult to write evaluation assignments that will target various levels. Despite the introduction of terms such as "assessment for learning" or "formative assessment," which would tell teachers whether students are learning anything, summative evaluations remain the dominant element in national education systems–for use in certification, determining eligibility for educational success, and system accountability. Teachers did not place a high priority on 21st century skills during the planning and delivery of lessons, as observed in a typical classroom environment. The assessment of 21CS, which is still in its early stages, does not easily adhere to the modes of assessment used in the field, which usually populate summative assessment approaches (Care et al., 2019).

2. Method

2.1 Research Design

The study utilized the descriptive mixed-method design (quantitative-qualitative research design) in which a researcher-made questionnaire and Focus Group discussion (FGD) were used to gather data. A mixed methods research design is a procedure for collecting, analyzing, and “mixing”

both quantitative and qualitative research and methods in a single study to understand a research problem (Creswell, 2008). The study analyzed the factors affecting implementation of modular distance learning among teachers teaching Physics to the Junior High School Science. Likewise, it determined the experiences of Physics teachers in implementing the modular distance learning. Based on the findings, policy adjustments may be implemented in distance learning modality in teaching Physics during COVID-19 pandemic.

2.2 Research Respondents

The respondents of this study, purposively chosen, were the Junior High School teachers who are currently teaching physics to Grade 7-10 learners of the three secondary schools, representing small, medium and large schools, of General Santos Ciy division namely: Bula National School of Fisheries, General Santos City National High School and Lagao National High School (Main) during COVID 19 pandemic. Grade 9 Science teachers were not included as respondents since Physics is taught during the fourth quarter of the school year, and it is already beyond the period covered by the study.

2.3 Research Instrument

A researcher-made survey questionnaire on the status of implementation of the distance learning delivery modalities in teaching Physics and an interview guide based on the instrument developed by Alimuddin, Tjakraatmadja & Ghazali (2020) for the conduct of focus group discussion were utilized to determine the experiences of teachers in implementing modular distance learning. This questionnaire was subjected for validation by experts. The questionnaire was validated using the Survey Instrument Validation Rating Scale adopted from the study of Oducado (2020). The consolidated validation rating given by the validators is equal to 4.72. For these instruments to be accepted, an overall mean of 3.00 must be achieved. A five-point Likert scale was used to determine the level of acceptability of the said research instrument in determining the status of implementation.

Scale	Interval Range	Description	Interpretation
5	4.50-5.00	Very highly implemented	Implementing factors of DLDM/Level of Teaching physics is VERY HIGH
4	3.50-4.49	Highly implemented	Implementing factors of DLDM/Level of Teaching physics is HIGH
3	2.50-3.49	Moderately implemented	Implementing factors of DLDM/Level of Teaching physics is MODERATE
2	1.50-2.49	Poorly implemented	Implementing factors of DLDM/Level of Teaching physics is LOW
1	1.00-1.49	Not implemented at all	Implementing factors of DLDM/Level of Teaching physics is POOR

2.4 Data Analysis

In determining the status of implementation of modular distance learning modality in teaching physics to learners, mean was used.

The experiences of Physics teachers in implementing the modular distance learning modality were determined using a focus group discussion (FGD) to gain insight into how people think and gain a better understanding of the phenomenon under investigation. Further, focus groups have primary benefits such as group engagement and nonverbal communication, which can allow participants to make correlations to different topics through conversations that may not occur during individual interviews. (Greenbaum, 2009).

Moreover, the question topic and the themes that emerged for the concept were the core of the qualitative data of the study. The significance of the discussion was an indication of how important the topic was in the focus group. Focus topics with significant statements indicated a theme which was more important statements among the stated discussions during the FGD.

The qualitative data were analyzed using the Reflective Thematic Approach developed by Virginia Braun and Victoria Clarke (2014), which involved a six-phase process. Although these phases are sequential, and each build on the previous, analysis is typically a recursive process, with movement back and forth between different phases. In this process, there is a need for the primary investigator to explicitly identify their biases, values, and personal interests about the research. This process involved the following:

Familiarization with the data. This phase involved the need to review and understand all the stated information from the participants about their challenges in teaching physics during COVID-19 pandemic with modular distance learning modality.

Coding. This phase involved generating of information from the transcript of the Focus Group Discussions (FGD) and identifying important features of the data that might be relevant to answering the research question. Furthermore, the minutes of the FGD were transcribed wherein the transcripts of the FGD session was coded, and after that, collating all the codes and all relevant data extracts, together for later stages of analysis. The coding of the data was further divided into the following columns: Text from the transcript, Significant Statements, Codes, Categories and Themes.

Generating initial themes. This process entailed looking over the codes and data to see whether there are any important patterns of significance (potential themes). It then collected data specific to each candidate theme to work with the data and assess the feasibility of each candidate theme.

Reviewing themes. This process included comparing the candidate themes to the dataset to see if they tell a compelling story about the data and address the research question. Themes are usually refined in this process, which may include splitting, combining, or discarding them. Themes are characterized as a pattern of shared meaning underpinned by a central concept or idea in the TA approach.

Defining and naming themes. This phase involved developing a detailed analysis of each theme, working out the scope and focus of each theme, determining the 'story' of each. It also involved deciding on an informative name for each theme.

Writing up. This final phase involved weaving together the analytic narrative and data extracts and contextualizing the analysis in relation to existing literature.

3. Results and Discussions

Status of Implementation of Modular Distance Learning Among Teachers Teaching Physics during COVID-19 Pandemic

Table 2.1 shows the status of implementation of modular distance learning in terms of pedagogical content knowledge. Specifically, teachers evaluated that they highly implemented the conduct of activities that develop problem-solving skills of the learners (M = 4.02). Similarly, teachers begin classes with springboard activities that encourage learners to learn physics (M = 4.02). Also, identifying the least mastered skills in Physics (M = 3.69), employing strategies that encourage learning Physics in a distance learning scheme (M = 3.77), using of labelling of quantities to establish relationships among quantities in Physics (M = 3.77) were all highly implemented.

In summary, with an overall obtained mean score of 3.85, the teachers highly implemented the pedagogical content knowledge in teaching Physics in a distance learning modality at this time of the COVID-19 pandemic. This means that teachers implemented pedagogical content and knowledge factors through distance learning to a high level.

Table 2.1

The Status of Implementation of Modular Distance Learning in terms of Pedagogical Content Knowledge

Indicators	Mean	Description
1. Start lessons with springboard activities that motivate learners to learn Physics.	4.02	Highly Implemented
2. Conduct activities that develop the problem-solving skills of learners.	4.02	Highly Implemented
3. Identify least mastered skills in Physics.	3.69	Highly Implemented
4. Employ strategies that encourage learning Physics in a distance learning scheme.	3.77	Highly Implemented
5. Use labelling of quantities to establish a relationship among quantities in Physics.	3.77	Highly Implemented
Over-all Mean	3.85	Highly Implemented

Table 2.2

The Status of Implementation of Modular Distance Learning in terms of Utilization of Strategies

Indicators	Mean	Description
1. Provide individually the learners with self-learning modules in print or digital.	4.27	Highly Implemented
2. Utilize Learning resources in Physics like textbooks, activity sheets and study guides.	3.79	Highly Implemented
3. Access learning materials in physics with computer, tablet or smartphones.	3.73	Highly Implemented
4. Deliver non-electronic materials/printed copies to learners.	3.87	Highly Implemented
5. Conduct home visitations to assist learners needing remediation or assistance.	2.90	Moderately Implemented
Overall Mean	3.71	Highly Implemented

With regards to the implementation of modular distance learning modality in terms of utilization of strategies, teachers evaluated that they highly implemented the provision of self-learning modules to individual learners either in print or digital (M = 4.27), the delivery of non-electronic materials or printed copies to learners (M = 3.87), and the accesses to learning materials in Physics with computer, tablet or smartphones (M = 3.73). They likewise highly implemented the utilization of learning resources in Physics like textbooks, activity sheets and study guides (M = 3.79). On the other hand, conducting home visitations to assist learners who need remediation or assistance (M = 2.90) was moderately implemented.

In summary, the teachers in Physics highly implemented the utilization of strategies in the distance learning delivery mode during the time of the COVID-19 pandemic. This means that the teacher's utilization of the strategies is at a high level.

Table 2.3

The Status of Implementation of Modular Distance Learning in terms of Assessment

Indicators	Mean	Description
1. Assist learners to self-assess their work	3.63	Highly Implemented
2. Engage learners with critical and meaningful reflection	3.65	Highly Implemented
3. Train learners to identify, analyze and evaluate Physics problems carefully.	3.63	Highly Implemented
4. Instruct learners to draw images of the possible situation described by the equation in Physics.	3.58	Highly Implemented
5. Use tests, assignments and problems set to assess performance in Physics.	3.96	Highly Implemented
Overall Mean	**3.69**	**Highly Implemented**

In terms of assessment, the teachers evaluated that they highly implemented the use of test, assignments and problem sets to assess the learner's performance in Physics as shown by a mean score of 3.96. Also, they engage learners with critical and meaningful reflection (M = 3.65) and assist them to self-assess their work (M = 3.63). Similarly, they highly implemented in training learners to identify, analyze and evaluate Physics problems carefully (M = 3.63) and instructing learners to draw images of the possible situation described by equation (M = 3.58).

The quantitative result of the study shows that the teachers highly implemented the assessment factor of the distance learning delivery mode during the time of the COVID-19 pandemic (M = 3.69). This means that teachers have put in place this form of distance education at a high level.

Table 2.4

Summary Table for the Status of Implementation of Modular Distance Learning

Factors	Mean	Description
Pedagogical Content Knowledge	3.85	Highly Implemented
Utilization of Strategies	3.71	Highly Implemented
Assessment	3.69	Highly Implemented
Overall Mean	3.75	**Highly Implemented**

In summary, the status of implementation of modular distance learning in teaching Physics in terms of pedagogical content knowledge, utilization of strategies and assessment as revealed by the quantitative data resulted to the evaluation of teachers as highly implemented with an overall mean of 3.75. This means that modular distance learning is widely use by the teachers in teaching Physics.

Experiences Of Physics Teachers In Implementing The Modular Distance Learning During Covid-19 Pandemic

Table 3

Summary of Findings that Explored Experiences of Teachers in Teaching Physics during the COVID-19 Pandemic

Structured Theme	Emerging Theme
The description of modular distance learning	• Preferred modality to continue education;and • As a self-learning modality of education.
The actual experiences in teaching Physics during the COVID-19 pandemic	• The utilization of pedagogical content knowledge in Physics; • Utilization of SLMs; • Application of required teaching methodology under new normal education such as employing social media tools; and • Emphasizing the role of parents in monitoring the learners.
Overcoming the challenges encountered in teaching Physics	• Teaching which is not the specialization of teachers; • -Limited access of learners to virtual teaching tools; and • Monitoring conduct of activities in the SLMs without physical interaction.
The strategies employed in teaching Physics using the modality prescribed in their respective schools	• Employing different modalities in teaching Physics; • Use of required social media practices and online teaching tools; • Engaging parents in monitoring the learners; and • Utilization of experts in the field to enhance learning.
The improvement of the implementation of the modular distance learning	• Application of flexibility of teachers in the delivery of lesson; • Simplification of content and instructions in the SLM; • Use of simplified learning activity sheets;and • Provision of support to economically deprived learners.

Policy Adjustment on the Implementation of Modular Distance Learning

Table 4

Policy Adjustments Based on Findings

Findings of the Study	**Suggested Policy Adjustments on the Implementation of Modular Distance Learning Modality in Teaching Physics**
Teachers showing innovativeness in coping with the demand of dealing with the new normal educational setting especially in using social media tools as a communication strategy and virtual teaching tools as aide in lesson delivery.	Provide appropriate training and guidance for teachers specifically on competences that would enable them to function in multiple learning environments (including the online and distance learning and assessment of learning).
Teachers engaging parents in monitoring learners	Provide support for parents through intensifying the giving of feedback and gathering of feedback from parents and learners.
Teachers showing resilience and flexibility in dealing with learners and in employing different modalities in teaching Physics	Provide trainings to teachers that will strengthen the psychological well-being, enhance pedagogical skills and address digital literacy gap.
Flexible learning is the new normal	Provide measures to prepare for the gradual shift to face to face interaction.

4. Conclusions and Recommendations

4.1 Conclusions

Based on the findings of the study, the modular distance learning modality in teaching Physics during the COVID-19 pandemic is highly implemented in terms of pedagogical content knowledge, utilization of strategies and assessment. This indicates that teachers readily adopted the prescribed modality of the Department of Education at high level. The experiences, challenges and strategies shared by teachers in teaching Physics using the modular distance learning modality amidst the pandemic resulted to positive outcomes such as: showing resilience in coping with the demand of dealing with the new normal educational setting especially in using social media tools as a communication strategy and virtual teaching tools as aide in lesson delivery, applying flexibility in teaching and accommodation of learners, being innovative in producing effective instructions, strengthening collaboration with parents and stakeholders focused on monitoring of learners and being open to peer teaching.

4.2 Recommendations

The results of the study suggest that there should be a feedback mechanism among teachers, learners, parents and the community to monitor learners' performance. Assessment practices of teachers should also be revisited and reshaped to conform with the changes in the educational setting and the modality being implemented. Moreover, policies being implemented in the field should be evidence-based and a reflection of the experiences of teachers and learners so that curricular reforms would be more realistic. Conduct of further studies should also be encouraged to help everyone prepare for the smooth transition to face to face classes.

References

Aina, K.J. (2013). Instructional materials and improvisation in physics class: Implications for teaching and learning. *IOSR Journal of Research & Method in Education (IOSRJRME), 2*(5), 38-42. https://doi.org/10.9790/7388-0253842

Alimuddin, Z., Tjakraatmadja, J. H., & Ghazali, A. (2020). Developing an instrument to measure pedagogical content knowledge using an action learning method. *International Journal of Instruction, 13*(1), 425-444. https://doi.org/10.29333/iji.2020.13128a

Bagood, J. (2020, October 9). *Teaching-learning modality under the new normal.* Philippine Information Agency. https://pia.gov.ph/features/articles/1055584

Bongco, R., & David, A. (n.d.). Filipino teachers' experiences as curriculum policy implementers in the evolving K to 12 landscape. *Issues in Educational Research, 33*(1), 19-33. shorturl.at/tBEI1

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. Educational Researcher, 33(8), 3-15. https://doi.org/chx3zk

Braun V, Clarke V, Rance N. (2014). How to use thematic analysis with interview data. In: Vossler A, Moller N, editors. The counselling and psychotherapy research handbook. London: Sage

Brillantes, K. D. B., Orbeta, A. J. C., Francisco-Abrigo, K. A., Capones, E. M., & Jovellanos, J. B. B. (2019). Status of senior high school implementation: A process evaluation. *Philippine Institute for Development Studies*.

Cahapay, M. B. (2020). Reshaping assessment practices in a Philippine teacher education institution during the coronavirus disease 2019 crisis. *Pedagogical Research, 5*(4), em0079. https://doi.org/10.29333/pr/8535

Care, E., Kim, H., Vista, A., & Anderson, K. (2018). Education System Alignment for 21st Century Skills: Focus on Assessment. *Center for Universal Education at The Brookings Institution*. shorturl.at/tOVW2

Chantaranima, T., & Yuenyong, C. (2014). The pedagogical content knowledge exploration from the Thai expert physics teacher's class. *Procedia-Social and Behavioral Sciences, 116*, 389-393.

Codamon, D. (2020, August 3). *Understanding the distance learning delivery modalities.* Philippine Information Agency. shorturl.at/qwK78

Cogal, M. (2019). Effective implementation of the senior high school curriculum: A descriptive analysis. *International Journal of Engineering Research and, V8*(12). https://doi.org/10.17577/ijertv8is120084

Davis, E., Palincsar, A. S., Arias, A. M., Bismack, A. S., Marulis, L., & Iwashyna, S. (2014). Designing educative curriculum materials: A theoretically and empirically driven process. *Harvard Educational Review, 84*(1), 24-52. https://doi.org/10.17763/haer.84.1.g48488u230616264

De Vera, J. L. (2020). Challenges and Teacher Resilience: The New Normal Classroom Instruction Using Social Media in the Philippine Context. *Available at SSRN 3760369.*

Department of Education (2020). *Adoption of Basic Education Learning Continuity Plan (BE-LCP)for School year 2020-2021 in Light of the Public Health Emenrgency*. DepEd Order 12 s. 2020. http:// www.deped.gov.ph/.pdf

Department of Education (2020, June 19). *Implementation of the Learning Delivery Modalities (LDM) 1 course for Division and School Leaders under the Basic Education Learning Continuity Plan (BE-LCP).* DepEd Memorandum OSEC-NEAP-OC-2020-0618. http:// www.deped.gov.ph/.pdf

Department of Education. (2016, May 14). *Senior high school modeling: moving towards the new k to 12 curriculum*. SEAMEO INNOTECH. https://www.seameo-innotech.org/

Donde, R. (2018, May 22). 21st century leadership in collaboration. *About my Brain Institute Blog*. https://blog.aboutmybrain.com/21st-century-leadership-in-collaboration

Dumlao-Valisno, M. (2012*). The nation's journey to greatness: Looking beyond five decades of Philippine Education.* Fund for Assistance to Private Education.

Etkina, E. (2010). Pedagogical content knowledge and preparation of high school physics teachers. *Physical Review Special Topics - Physics Education Research, 6*(2). https://doi.org/dvv692

Fahraeus, A. (2013). Research supports learner-centered teaching. *Journal of the Scholarship of Teaching and Learning, 13*(4), 126.

FlipScience. (2020, October 5). *'Tagapagdaloy': How Filipino parents can help ensure successful modular distance learning.* FlipScience - Top Philippine science news and features for the inquisitive Filipino. shorturl.at/dlDJO

Gensler (2013). What we have learned about focus in the workplace. http://www.gensler.com/uploads/documents/306/file/Focus_in_the_Workplace_10_01_2012.pdf

George, M. L. (2020). Effective teaching and examination strategies for undergraduate learning during COVID-19 school restrictions. *Journal of Educational Technology Systems, 49*(1), 23-48. https://doi.org/10.1177/0047239520934017

Ghani, U., & Khan, A. (n.d.). The effect of feedback mechanisms on students' learning in the use of simulation-based IT training in a computer networking program. *2014 ASEE Annual Conference & Exposition Proceedings.* https://doi.org/10.18260/1-2--23136

Gonzales, N. (2019). Narrative Experiences of Seasoned Teachers in Teaching Science Using Spiral Progression Curriculum .IOER International Multidiscipinary Research Journal, 1(2), 59-68. https://orcid.org/0000-0002-9400-367X

Greenbaum, T. (2009). The Handbook for Focus Group Research, Second Edition. New York: Sage Publications.

IvyPanda. (2019, April 18). *Management skills in 21st century*. Retrieved from https://ivypanda.com/essays/management-skills-in-21st-century-report/

Jain, S., Lall, M., & Singh, A. (2020). Teachers' voices on the impact of COVID-19 on school education: Are ed-tech companies really the Panacea? *Contemporary Education Dialogue, 18*(1), 58-89. https://doi.org/10.1177/0973184920976433

Jatsho, S., & Rinchen, S. (2016). Strategies for teaching physics: An action research. *EIPEducational Innovation, 53*.

Kay, K. (2011, October 16). Becoming a 21st century school or district: Use the 4Cs to support teachers (6 of 7). *Edutopia.* shorturl.at/hktPR

Keller, M. M., Neumann, K., & Fischer, H. E. (2016). The impact of physics teachers' pedagogical content knowledge and motivation on students' achievement and interest. *Journal of Research in Science Teaching, 54*(5), 586-614. https://doi.org/10.1002/tea.21378

Kirschner, S., Borowski, A., & Fischer, H. E. (2011). Physics teachers' content knowledge and pedagogical content knowledge: Developing test scales and measuring the relation. *In Annual Meeting of NARST, Orlando, FL*.

Kola, A. J., & Sunday, O. S. (2015). A review of teachers' qualifications and its implication on students' academic achievement in Nigerian schools. *International Journal of Educational Research and Information Science, 2*(2), 10-15.

Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., & Liu, J. (2020). Projecting the potential impact of COVID-19 school closures on academic achievement. *Educational Researcher, 49*(8), 549-565. https://doi.org/10.3102/0013189x20965918

Kyba, C. C., Wagner, J. M., Kuechly, H. U., Walker, C. E., Elvidge, C. D., Falchi, F., Ruhtz, T., Fischer, J., & Hölker, F. (2013). Citizen science provides valuable data for monitoring global night sky luminance. *Scientific Reports, 3*(1). https://doi.org/gjsmdk

Lai, E. R., & Viering, M. (2012). Assessing 21st Century Skills: Integrating Research Findings. *Pearson.*

Marek, M. W., Chew, C. S., & Wu, W. V. (2021). Teacher experiences in converting classes to distance learning in the COVID-19 pandemic. *International Journal of Distance Education Technologies, 19*(1), 89-109. https://doi.org/gf8t

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Ascd.

Nacorda, S and Paras, M.(2019). Effective Implementation of the Senior High School Curriculum: A Descriptive Analysis. International Journal of Engineering Research and Technology, 8(12). http://www.ijert.orgISSN: 2278-0181

Northouse, P. G. (2004). *Leadership: Theory and practice*. SAGE Publications.

O'HARA, M. (2017). Rising to the occasion: New persons for new times. *Estudos de Psicologia (Campinas), 34*(4), 454-466. https://doi.org/10.1590/1982-02752017000400002

Olabode Thomas, O., & Julius Olugbenga, A. (2012). Effect of teacher's qualification on the performance of senior secondary school physics students: Implication on technology in Nigeria. *English Language Teaching, 5*(6). https://doi.org/gf62qv

Onah, D. U., & Ugwu, E. I. (2010). Factors which predict performance in secondary school physics in Ebonyi north educational zone of Ebonyi State, Nigeria. *Advances in Applied Science Research, 1*(3), 255-258.

Perez, R. B. (2018). Becoming successful k to 12 implementers: Operational preparedness of senior high schools in Hagonoy, Bulacan, Philippines. *Online Submission*.

Pompea, S. M., Walker, C. E., & Sparks, R. T. (2013, July). The evolution of optics education at the US National Optical Astronomy Observatory. *In Education and Training in Optics and Photonics* (p. ETuC1). Optical Society of America.

Rasmitadila, R., Aliyyah, R. R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M., & Tambunan, A. R. (2020). The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: A case study in Indonesia. *Journal of Ethnic and Cultural Studies, 7*(2), 90. https://doi.org/10.29333/ejecs/388

Resurreccion, J. A. & Adanza, J. (2015). Spiral progression approach in teaching science in selected private and public schools in Cavite. DLSU Research Congress 2015, De La Salle University, Manila, Philippines, 2-4 March 2015. http://docplayer.net/29477390- Spiral-progression-approach-in-teaching-science-in-selected-private-and-publicschools-in-cavite.htm

Roessger, K. M. (2012). Toward an interdisciplinary perspective. Adult Education Quarterly, 62(4), 371-392.

Rotherham, A., & Willingham, D. (2010). 21st Century Skills: The Challenges Ahead. *American Educator, 17*(1), 17-20. https://dbweb01.aft.org/

Russell III, W. B., & Waters, S. (2010). Instructional methods for teaching social studies: A survey of what middle school students like and dislike about social studies instruction. *Journal for the Liberal Arts and Sciences, 14*(2), 7-14. shorturl.at/aeAH3

Samillano, J. (2015). *Competency among MAPEH teachers in teaching performing arts in selected public secondary schools in north Cotabato*. Academia.edu - Share research. shorturl.at/emD08

Seebruck, R. (2015). Teacher quality and student achievement: A multilevel analysis of teacher credentialization and student test scores in California high schools. *McGill Sociological Review, 5*, 1-18. https://www.mcgill.ca/msr/files/msr/seebruck_2015.pdf

Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content- Area literacy. *Harvard Educational Review, 78*(1), 40-59. https://doi.org/10.17763/haer.78.1.v62444321p602101

Shulman, L. S. (2013). Those who Understand: Knowledge Growth in Teaching. *Journal of Education*, *193*(3), 1–11. https://doi.org/10.1177/002205741319300302

Solis, A. (2009). Pedagogical content knowledge: What matters most in the professional learning of content teachers in classrooms with diverse student populations. *IDRA Newsletter, August 2009*.

Stauffer, B. (2020, May 7). W*hat are the 4 C's of 21st century skills?* Digital Curriculum for CTE & Elective Teachers | AES. https://www.aeseducation.com/blog/four-cs-21st-century-skills

Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2012). Rethinking giftedness and gifted education: A direction forward based on psychological science. *PsycEXTRA Dataset*. https://doi.org/10.1037/e665862012-001

Susetyo, B. (2015). Prosedur penyusunan dan analisis tes untuk penilaian hasil belajar bidang kognitif. Bandung: PT. *Refika Aditama*.

Susilo, A. B. (2012). Pengembangan model pembelajaran IPA berbasis masalah untuk meningkatkan motivasi belajar dan berpikir kritis siswa SMP. *Journal of Primary Education, 1*(1).

Tarragó, F. R., & Wilson, A. E. (2010, September). Educational management challenges for the 21 st century. *In IFIP International Conference on Key Competencies in the Knowledge Society* (pp. 389-400). Springer, Berlin, Heidelberg.

The Editors of Encyclopaedia Britannica. (2019). War college | History, programs, & locations. *Encyclopedia Britannica.* https://www.britannica.com/topic/war-college

The National Academies Press. (2001). *The critical importance of well-prepared teachers for student learning and achievement | Educating teachers of science, mathematics, and technology: New practices for the new millennium | The National Academies Press*. The National Academies Press. shorturl.at/kruxO

Tregoe, B. (2019). *Critical thinking skills for the 21st century.* Kepner-Tregoe - Consulting Services - Leadership Development - Business Training. shorturl.at/djowW

UNICEF East Asia and Pacific Regional Office. (2020, April 27). *GUIDANCE: ASSESSING AND MONITORING LEARNING DURING THE COVID-19 CRISIS*. ReliefWeb - Informing humanitarians worldwide. shorturl.at/anoxZ

Vidal, R. V. (2010). Creative problem solving: An applied university course. *Pesquisa Operacional*, *30*(2), 405-426. https://doi.org/b7ndkk

Vilches, M. L. (2018). Involving teachers in the change process: One English language teacher's account of implementing curricular change in Philippine basic education. In M. Wedell & L. Grassick, International perspectives on teachers living with curriculum change (pp. 15-37). UK. https://link.springer.com/chapter/10.1057/978-1-137-54309-7_2

Walker, C. E., Tellez, D., & Pompea, S. M. (2015). Dark Skies Africa. *Proceedings of the International Astronomical Union*, *11*(A29A), 408-409. https://doi.org/gf8n

Wilkinson, A. (Ed.). (2009). *The SAGE handbook of human resource management.* Sage Publications.

Zewdie, Z. M. (2014). An investigation of students' approaches to problem solving in physics courses. *International Journal of Chemical and Natural Science, 2*(1), 77-89. shorturl.at/acovB