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# Massive Open Online Course in Elementary Statistics: From Analysis to Evaluation

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**Research Article**

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## Abstract

**Background/purpose.** This study aims to develop and validate a Massive Open Online Course (MOOC) in Elementary Statistics (ES) following the ADDIE Model of Instructional Development.

**Materials/methods.** Employing a descriptive-developmental research design, anchored on different MOOC development policies and guidelines and aligned to Philippine Professional Standards for Teachers, the MOOC-ES was crafted in collaboration with Mathematics and MOOC experts, alongside participation from Mathematics teachers and first-year BSEd Mathematics students. Each meticulously crafted unit within the MOOC-ES framework comprises essential components: Introduction, Course Outcomes, Learning Competencies, Pre-Assessment, Discussion, Discussion Forum, Activity, and Generalization.

**Results.** The design and content of the MOOC-ES garnered commendable feedback, with assessments indicating a classification of 'very good'. Mathematics educators lauded the utilization of the MOOC-ES as an innovative pedagogical tool for disseminating Mathematics content. Moreover, first-year BSEd Mathematics students expressed satisfaction with the MOOC-ES, highlighting its efficacy in elucidating Elementary Statistics concepts. The interactive nature of the material was well-received, resonating with their learning preferences amidst the prevailing 'new normal' paradigm.

**Conclusion.** The integration of the MOOC-ES into pedagogical practice heralds a transformative stride in the teaching and learning landscape of Elementary Statistics.

## 1. Introduction

The COVID-19 epidemic has impacted individuals globally, irrespective of race, education, income, or gender, as the globe grows more interconnected (Schleicher, 2020). Due to the increasing incidence of COVID patients, there is a necessity for creative educational methodologies to ensure effective instruction despite the obstacles presented by the epidemic.

The epidemic has profoundly affected higher education (Schleicher, 2020). Universities have transitioned from in-person lectures to online education. Concerns have emerged over the safeguarding and legal standing of international students, along with the social and networking opportunities essential to university education. To tackle these issues and maintain the provision of quality education, higher education institutions have modified their pedagogical approaches to facilitate distance learning.

Codamon (2020) delineates three modalities of remote learning: Modular remote Learning (MDL), Blended Learning (BL), and Online Learning.

An instance of blended learning is Massive Open Online Courses (MOOCs). MOOCs are complimentary online educational platforms accommodating a substantial number of participants. Instructed by esteemed scholars from renowned universities, these courses provide assignments, lectures, videos, and supplementary materials for a comprehensive distance learning experience (Kesim & Altınpulluk, 2015). In MOOCs, "massive" denotes their extensive reach, "open" signifies accessibility for anyone, and "online" emphasizes delivery via multimedia tools. MOOCs are utilized for training in universities, business institutions, and teacher education, however less frequently for mathematics. Safitri, M., Suryani, N., Asrowi, & Sukarmin (2024) assert that problem-solving is a fundamental component of mathematics education. Students can leverage their existing knowledge to gain experience by engaging in problem-solving activities. Nonetheless, a crisis in mathematical proficiency has resulted in a deficiency of qualified mathematics educators and adept specialists in disciplines necessitating mathematical instruction. Statistics is significant yet frequently deficient in proficiency. Universities are investigating the efficacy of MOOCs in enhancing mathematical skills, and a new educational policy centered on online learning has been formulated. Research has been undertaken to create MOOCs in Mathematics, encompassing Statistics.

The primary objective of this work was to build and validate a huge open online course in Elementary Statistics for usage by diverse higher education institutions.

### *Statement of the Problem*

Generally, this research paper sought to develop, validate, and assess a Massive Open Online Course in Elementary Statistics (MOOC - ES).

Specifically, this study aimed to answer the following:

1. How may the learning competencies of Elementary Statistics be analyzed in terms of its i) compliance with CHEd Memorandum No. 75, Series of 2017; and ii) time allocation?

2. How may the design of the proposed MOOC-ES be described in terms of i) components, ii) application standards, and iii) design solution?

3. How may the development of the MOOC-ES be described in terms of i) content development and ii) procedure development?

4. How may the implementation of the MOOC-ES be described?

5. How may the validity and assessment of the developed MOOC-ES be described based on the i) content and design by Mathematics and MOOCs expert; and ii) instructional use by Mathematics teachers and students?

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## 2. Literature Review

### *2.1. Remote-learning*

Schleicher (2020) writes that remote learning saves education during the pandemic, but digital technologies are more than a temporary cure. Digital technologies give learners new options for what, how, where, and when. More than textbooks, technology will allow teachers and students access to advanced materials in various formats and locations. Intelligent interactive learning systems educate science to students and examine their study habits, relevant assignments and reasoning, and difficult or uninteresting problems with teachers. Algorithms can, therefore, precisely and consistently adapt learning to learner styles. Virtual labs allow students to plan, conduct, and learn from experiments.

### *2.2. Distance learning through MOOC*

Kesim and Altınpulluk (2015) assert that the rapid advancement of ICTs has influenced education and other aspects of life. Remote education relies on technology, thus improvement in this field is vital. Web 2.0 has changed users from passive to active, inventive, productive, and agenda-setting, affecting education and society.

Technology makes many distance education influences unavoidable. MOOCs are popular in education. Since self-development is valued more than diplomas and degrees and institutions aim to reach more students for less money, MOOCs meet these goals.

Open courses, OER, and open access have grown in distance learning (Koutropoulos et al., 2012). MOOCs for open educational tools are the height of evolution, says Mozue (2013). Free MOOCs with open curriculum can be integrated into social media. Free courses include prerequisites and performance expectations in the summary. McAuley et al. (2010) say they're unaccredited.

MOOCs have other meanings. Esposito (2012) calls them a new sort of remote education with an open curriculum. Harding (2012) characterizes them as platforms that allow students in developing nations to choose and study Stanford, MIT, and Edinburgh courses using videos, discussion forums, and peer-marked assignments.

MOOCs provide self-development through superior college and instructor classes via videos and presentations in open and free courses and schedules. The above definitions assume this description is MOOCs.

### *2.3. The MOOC Types*

Literat (2015) found that the rise of massive open online courses (MOOCs) is due to several higher education trends: globalization and the push for internationalization; increasing demand for access to higher education; a celebration of lifelong learning and the change in learner demographics; increased personal access to technology and social media; and the need for alternative learning methods. Many observers have used Christensen's disruptive innovation theory (Christensen, 1997; Christensen, Horn, & Johnson, 2008) to explain MOOCs' worldwide learning impact. Recently, more pessimistic accounts have tempered the initial excitement about MOOCs as a democratizing force in higher education, suggesting that they could create a two-tiered system that separates on-campus students from those who must take massive online courses.

Popular MOOC narratives sometimes confuse pedagogical differences between cMOOCs and xMOOCs. Rodriguez (2012) concisely describes these essential differences: C-MOOCs establish massive many-to-many connections. xMOOCs reach many through one-to-many. The issue between learning as process and outcome continues in connectivist and instructional MOOCs. Siemens (2012) states that cMOOCs produce knowledge, while xMOOCs replicate it. Calling cMOOCs and xMOOCs

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the same is confusing and unhelpful because they have different aims and pedagogies. Conflating the two types of MOOCs (or using MOOC when critics are talking about xMOOCs) hinders nuanced and meaningful discourse and overlooks fundamental differences in pedagogy and goals. Understanding cMOOCs and xMOOCs would lessen polarization and ground the impassioned MOOC and higher education debate.

### *2.4. ADDIE Model*

In Hess (2016), ID scholars used Merrill's (2002) basic principles of teaching, Dick and Carey's (1985) systems approach model, and Kirkpatrick's (1994) evaluation model to create excellent learning experiences. ADDIE, the most popular instructional design approach, provides complete standards for practitioners to systematically develop and measure learning.

1. Learning situation analysis;

2. Creating issue-focused learning objectives and concepts;

3. Creating resources for these needs;

4. Use learning resources;

5. Evaluating these resources' educational value (Branch, 2009).

ADDIE's origins are unknown, but Molenda (2015) defined it as any process-based instructional content creation method. He added that the acronym is nearly synonymous with instructional design and covers a wide range of design structures. Branch's 2009 "input-process-output paradigm" describes its iterative study and revision.

## 3. Methodology

### *3.1. Research Design*

This study employed developmental studies to create consistent and successful instructional methods. The goal was to create an Elementary Statistics MOOC. Pappus' ADDIE instructional development paradigm, given by Forest (2014), was used as a guide. ADDIE organizes instructional content creation and refinement. Every phase of the model is structured to achieve the goals cohesively and comprehensively. This systematic approach streamlines instructional material production and promotes iterative improvement and continual evaluation.

### *3.2. Research Target/Subject*

The participants of the study were two (2) experts in the field of Mathematics, composed of one (1) Professor and one (1) SHS Master Teacher. One (1) Instructor with the experience in the field of MOOC Development also served as a participant of the study. The MOOC expert was selected considering that the latter has undergone at least two (2) pieces of training in MOOC development and has the experience to develop a MOOC. The selected MOOC expert was also a part of the University's training team assigned for the implementation of MOOC development in the University.

These evaluators examined the content of the MOOC-ES whether the parts and content followed the rules on MOOC development. These three experts evaluated the design and contents of the MOOC-ES.

Ten (10) Mathematics instructors/teachers selected based on their years of experience teaching Elementary Statistics and minimum educational attainment of Master Degree and twenty (20) 1st Year BSE Mathematics students of a particular University in the Philippines assessed the instructional use of the MOOC - ES.

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### 3.3. Instruments, and Data Collection Techniques

This study used instruments that helped obtain data for the success of the study. The following instruments were used:

*i) Design Solution Evaluation Tool*

Description: The Design Solution Evaluation Tool (DSET) is a teacher-made observation checklist used during the design phase of the MOOC-ES. It was used by the research adviser, mathematics instructor, and MOOC developer to describe and obtain observations and suggestions for the design. It focuses on the alignment of the design to objectives, integration of standards, creativity, and feasibility.

*ii) Content Development Rubric*

Description: The Content Development Rubric is a teacher-made observation checklist used during the content development phase of the MOOC-ES. It was used by the researcher, research adviser, and mathematics instructor to describe and obtain observations and suggestions for the content development. It focuses on compliance with CHEd memorandums and Philippine Professional Standards for Teachers.

*iii) Observation Protocol for Mathematics Instructors*

Description: The Observation Protocol for Mathematics Instructors (OPMI) is a teacher-made observation guide used during the evaluation phase of the MOOC-ES. It was used by mathematics instructors to obtain observations and suggestions for the implementation of MOOC-ES. It evaluates various aspects such as Introduction, Course Outcome, Learning Competencies, Pre-Assessment, Discussion, Discussion Forum, Activity, Generalization, Final Output, and Final Examination. Validation. The draft form of Questionnaire for Elementary Statistics & MOOC Experts was checked by the adviser.

The content validity of theses instruments were checked by three (3) Mathematics and Assessment Professors using the framework of Lynn (1981) for Content Validation. After incorporating suggestions and recommendations, the final Content Validity Index is 1.0.

*iv. Interview Guide for Mathematics Students*

Description. Interview Guide for Mathematics Students (IGMS) is a teacher-made Interview guide which was used by the students to assess and give their comments regarding the construction, delivery and modes of assessment of the MOOC - ES. This instrument was utilized by the Mathematics students to obtain their observations and recommendations in the construction, delivery and modes of assessment used in the MOOC – ES.

To establish the reliability of these instruments, Cronbach Alpha Test of Reliability was used. Furthermore, to assure the validity of the instruments, Lynn's Framework of Instrument Validation was used with a final content validity index (CVI) of 1.0.

### 3.4. Data analysis technique

1. The analysis of the learning competencies was done by analyzing the course outcomes and learning competencies for the course Elementary Statistics offered by the NEUST-College of Education and comparing them to the learning competencies of Elementary Statistics as part of the BSE-Mathematics program. The time allotment for each course outcome was also analyzed. The analysis and deliberation were described in text.

2. The design of the proposed MOOC-ES was described in terms of its components: Introduction, Course Outcome, Learning Competencies, Pre-Assessment, Discussion, Discussion Forum, Activity,

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Generalization, Final Output, and Final Examination. The delivery and organization of content were discussed in this part of the study.

3. The design of the proposed MOOC-ES was also described in terms of its application standards that were described in reference to the framework presented in Table 1.

**Table 1.** Framework for Application Standards

| Policies and Standards | Sections |
|---|---|
| CHEd Memoranda | In compliance to CHEd Memo No. 75, Series of 2017<br>a. section 6 (Program Outcomes); and<br>b. section 7 (Performance Indicators)<br>In compliance to CHEd Memo No. 4, Series of 2020<br>a. section IV (General Guidelines in the Implementation of Flexible Learning); and<br>b. section V (Various Modalities in the Implementation of Flexible Learning and Teaching) |
| Philippine Professional Standards for Teachers (PPST) | In compliance with Philippine Professional Standards for Teachers (PPST) as reflected in the following:<br>a. Domain 1 (Content Knowledge and Pedagogy);<br>b. Domain 2 (Learning Environment);<br>c. Domain 4 (Curriculum and Planning); and<br>d. Domain 5 (Assessment and Reporting) |
| xMOOC standards | In compliance with:<br>a. Content; and<br>b. Assessment standards. |

*Source: Hyflex Learning: Continuing Tertiary Education in a Post–Pandemic Environment (Alvarez & Galman, 2023)*

3. The development of the MOOC-ES was discussed, including the content development and procedure development for each unit. The contents for each unit were aligned with the syllabus of instruction, CHEd memoranda, and Philippine Professional Standards for Teachers. The Content Development Checklist was used to describe the content development of the MOOC-ES. The data in this part of development were analyzed using mean and standard deviation.

4. The implementation of the MOOC-ES was described using data gathered through the Interview Guide for Mathematics students. Their responses in some parts of the MOOC-ES were also considered as a source of data in this phase.

5. During the evaluation stage of the developed MOOC-ES, the content, design, and instructional use were assessed. To assess Mathematics Instructors on the developed MOOC-ES and its instructional use, a qualitative description was employed. Furthermore, students provided feedback on their experience using and implementing the MOOC-ES in their classes. The data in this part of development were analyzed using mean and standard deviation.

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## 4. Results

The MOOC-ES development followed the ADDIE model: analysis, design, development, implementation, and evaluation.

### *4.1. Analysis*

This level investigated Elementary Statistics' learning competencies, as stipulated by the Commission on Higher Education by CHEd Memorandum No. 75, series of 2017. Also studied was the time allowed for each topic or unit in accordance with NEUST's College of Education course offerings. The exercises for each Elementary Statistics topic were chosen to represent the learning competencies and results.

According to the website, Datareportal.com reported that the global population was 7.75 billion in January 2020, with 67% of them mobile users, 59% online, and 49% on social media. This survey also shows that Facebook is the most popular social media network worldwide. According to this assessment, Facebook has great potential as a social media platform and a teaching and learning tool during the pandemic. Although Facebook was not designed for education, it can be utilized as a virtual classroom for information and idea exchange. The researcher and research adviser chose the Facebook social learning group as the MOOC-ES platform.

### *4.2. Design*

In this stage, MOOC–ES components, application standards, and design solutions were conceived.

#### *4.2.1 MOOC - ES Components*

According to the components, the researcher used online courses from the Department of Science and Technology's Program SPARTA. Introduction, Course Outcome, Learning Competencies, Pre-Assessment, Discussion, Discussion Forum, Activity, and Generalization comprised the MOOC – ES's seven units. The MOOC standards from the University Training Department required participants to complete Final Requirement and Final Examination at the completion of seven courses.

##### *4.2.1.1 Introduction*

The Introduction gives a brief overview of each unit's content. It helps pupils visualize what they'll learn at the end of the unit. Real-world applications were emphasised to make the introduction more user-friendly and engaging. In the graphic above, participants saw real-life data collection and display.

##### *4.2.1.2 Course Outcome*

As shown in the unit, the Course Outcome listed students' skills and abilities. Course outcomes are presented in text and image form to accommodate students with inadequate internet access. In the graphic above, two course outcomes were presented in text and video.

##### *4.2.1.3 Learning Competencies*

The third MOOC-ES component, Learning Competency, listed students' skills and abilities throughout the topic or unit. The researcher published the videos on YouTube. Copying the link to the learning competencies discussion. The figure above shows data collection and presentation learning competencies presented in video and text. Participants with inadequate internet connections received the learning competencies in text form.

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#### 4.2.1.4 Pre-assessment

The 5- to 10-item Pre-Assessment tests pupils' topic knowledge. This MOOC-ES section is not graded. However, Pre-Assessment is needed to determine pupils' topic knowledge. In the case above, students were questioned about fundamental statistics terminology to test their knowledge.

#### 4.2.1.5 Discussion

In the discussion, the researcher teaches via video. The debate was based on the Elementary Statistics textbook. The researcher posted the videos on Youtube. This link was copied to the discussion topic. The next thread included additional readings for learners or participants.

#### 4.2.1.6 Discussion Forum

Discussion forum threads encourage participation and collaboration in developing topic themes. This MOOC–ES section explored participant idea exchange. This has two questions: one to assess participants' learning and the other to encourage them to remark on each other's answers. Instructors can clarify as needed. The first question for the discussion forum in the image above is for students to identify and explore the importance of statistics in their future careers. The second exercise encourages participants to read and respond to first-question responses.

#### 4.2.1.7 Activity

Activity is a formative assessment of participants' learning after discussion and forum. A problem-based activity assessed unit topic application. Each task included a score guide. As indicated in the graphic above, the sample begins with participant information such as name, section, date submitted, and score. The second part had directions. The scoring rubric or point system was also explored. Activity proper concludes the activity. It includes learning competency-based questions and tasks. The graphic above shows that the issues span hypothesis testing learning competencies.

#### 4.2.1.8 Generalization

Three questions summarise unit learning in the Generalisation component. Students presented their findings and hypotheses. The three questions in the sample above reflect the Unit's learning abilities, which attempt to describe and distinguish statistical concepts and their applicability to real-life situations.

#### 4.2.1.9 The Final Output

The MOOC-ES participants' final output is designed to measure their ability to apply all the concepts taught in the online course. Participants in the final output must produce and analyze data and make statistical decisions based on the problem statement. As illustrated in the figure, the sample's last requirement is a GRASPS-based performance task. Performance task grading rubric was included. Since it requires applying statistics to educational research, the final result includes all MOOC-ES course outcomes.

#### 4.2.1.10 Final Exam

A 40-item final exam assesses course participants' cognitive and application content. Access it via Google Form. First, individuals' demographic profiles are examined. For ease, Google Form was chosen. According to Martin (2011), MOOC-ES development involved component creation. Instructional design documents summarize material. Patterson (2003), quoted by Galman & Del Rosario (2021), highlights MOOC-ES design alignment of learning competencies, debate, and evaluation.

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### 4.2.2. Application Standards

CHEd Memoranda, Philippine Professional Standards for Teachers (PPST), and xmooc regulations and standards govern MOOC–ES implementation.The MOOC-ES followed CHEd Memo. No. 75, series 2017 in these situations:This MOOC-ES helps Bachelor of Secondary Education majors in Mathematics achieve program goals. It improves participants' pedagogical content knowledge of Statistics and math skills in Elementary Statistics.The MOOC-ES meets section 7 performance indicators. Participants must accurately describe, demonstrate, and relate basic statistical ideas and techniques. The learning experiences should also foster problem-solving and critical thinking.CHEd Memo. No. 4, series 2020 states that MOOC-ES has met the following sections:

i. Massive Open Online Courses allow students to learn at their own pace and level. This meets CHEd Memorandum No. 4, series of 2020 section 4 requirements. Activities and output show that the MOOC - ES is outcome-based. Siemens (2012) states that MOOCs focus on course material while addressing users' convenience, interests, and abilities.

ii. The table of flexible learning and teaching modalities demonstrates that massive open online courses fit under medium level technology, suggesting a mix of online and offline activities. This technique is recommended for university students. MOOCs combine online and modular learning, according to Manalack and Yuriev (2016). Since MOOC resources may be downloaded and accessed offline, they say they don't require much data or internet access. Facebook uses 1 MB per minute and YouTube 1.5 MB per minute, according to wirefly.com (2020). This MOOC-ES comes into the medium-level technology category established by CHEd Memorandum No. 4, series of 2020 because it uses Facebook and YouTube as its learning platform.

#### 4.2.2.2. Philippine Teacher Professional Standards

The MOOC-ES follows the Philippine Professional Standards for Teachers (PPST) in these areas:

The MOOC-ES's Domain 1 (Content Knowledge and Pedagogy) focuses on mastering statistics and applying concepts to other areas through discussion portions and forums.

The use of Facebook as a learning platform aligns with Domain 2 (Learning Environment) due to its accessibility. For individuals without internet, text, movies, and figures are presented.

iii. Domain 4 (Curriculum and Planning) aligns course outcomes, learning competencies, and final assessment.

iv. Domain 5 (Assessment and Reporting) is obvious in unit activities and final assessments. The MOOC-ES progress section in each unit lets participants track their progress.

#### 4.2.2.3 The xMOOC Standards

The MOOC-ES meets xMOOC requirements. A typical xMOOC has a "teacher as expert" and "learner as knowledge consumer" structure, according to Cook (2017) (Siemens, 2013). XMOOCs like edX [Breslow et al., 2013] offer lectures, course materials, and evaluation exercises. Internal forums and social roles encourage student interaction, although the pedagogy is mostly "instructivist" (Lipson, 2013), with students absorbing content without participating in the teaching process. The MOOC-ES evaluates xMOOC material using Cook criteria. It provides the course's primary subject through video discussions and additional modules in seven increasingly complicated parts. Comments, discussion boards, and generalizations help teachers and students interact.

### 4.2.3 Design Solution

The MOOC–ES design solution was described to ensure that it meets various design construction and implementation requirements. Table 2 shows the design solution evaluation.

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Table 2. Design Solution of the MOOC – ES

| Descriptors | WM | Verbal Interpretation |
|---|---|---|
| The design of the MOOC - ES reflects the realization of the objective for which the design is crafted for. | 3.00 | Completely Satisfied |
| The components of the design functions to serve the objectives of the design problem | 3.00 | Completely Satisfied |
| The design aims to achieve a holistic design that awarely integrates standards | 3.00 | Completely Satisfied |
| The design aims to achieve a holistic design that awarely integrates creativity | 3.00 | Completely Satisfied |
| The design aims to achieve a holistic design that awarely integrates feasibility | 3.00 | Completely Satisfied |
| **Grand Mean Rating** | **3.00** | **Completely Satisfied** |

*Legend:1.00 – 1.66 (Not Satisfied at All), 1.67 – 2.33 (Moderately Satisfied), 2.34 – 3.00 (Completely Satisfied).*

The statement "The design of the MOOC-ES reflects the realization of the objective for which the design is crafted for" received a 3.0 verbal grade, indicating perfect satisfaction. The MOOC-ES's design solution was also praised for its user-friendliness and ability to help users understand the lessons/topics with numerous learning experiences and resources. The MOOC-ES was also praised for its accessibility and logical content.

"The components of the design functions to serve the objectives of the design problem" received a 3.0 grade, indicating perfect satisfaction. The reviewers liked that the design uses a discussion forum to enhance a teaching-learning process. The MOOC-ES's design resembles Coursera, UPOU, and other popular MOOCs, which the assessors liked.

The statement "The design aims to achieve a holistic design that awarely integrates standards" received a 3.0 verbal rating, indicating perfect satisfaction. According to the application standards, the evaluators liked how the MOOC was built using multiple standards. Evaluators applaud the MOOC-ES design's alignment with these requirements.

In general, the MOOC-ES design solution received a grand mean rating of 3.0, indicating perfect satisfaction. This means that all MOOC-ES design criteria are carefully evaluated. This phase is also supported by Rollins (2018). Naturally, plan and organize your course material first. For a MOOC or other eLearning material, you must examine and establish your course structure (chapters or core themes) and decide what knowledge to offer when and in what context. The latter stated that MOOC content design must address many standards and norms without compromising quality.

### *4.3. Develop*

In this stage, MOOC-ES content and process were designed.

### *4.3.1 Content Development*

The MOOC-ES was based on an educational statistics book. The researcher got permission from the book's writers before using its content. Appendix A contains the approval letter.During MOOC-ES creation, the researcher consulted his adviser and college dean. Appendix B lists MOOC-ES subjects and time allocation. The initial MOOC-ES document, including the curriculum, was exhibited and commented on. The MOOC-ES's first draft was amended to incorporate teachers' suggestions. The

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Mathematics instructor and researcher reviewed the second MOOC-ES draft for input. Different approaches by Alzaghibi, M.A. (2010) and Seeletso, M.K. (2010) support this scenario (2011). According to the former, teaching activities are cyclically examined before usage. The teachers' enactments could improve the original design. However, the latter underlined that material structure can affect learner comprehension. Colors should be appealing, illustrations should be basic and relevant to the content, and repetition should be used simply to accentuate crucial ideas. Therefore, needless details must be omitted. In conclusion, Manallack and Yuriev (2016) support the study's development steps. They think instructional material production should follow a structure like this research's.

**Table 3.** Result of the Content Development Checklist

| Criteria | WM | Verbal Interpretation |
|---|---|---|
| The content of the MOOC is designed and presented in a uniform and consistent manner | 3.00 | Completely Satisfied |
| Resources are current (less than 10 years) and information is relevant to the learning competencies. | 3.00 | Completely Satisfied |
| Information presented in all parts of the MOOC - ES are manageable and reasonable for the time allocated. | 3.00 | Completely Satisfied |
| More than two (2) credible and relevant learning resources were added to the learning experience. | 3.00 | Completely Satisfied |
| More than one learning objective engages the learner in activities, analysis, synthesis, and evaluation. | 3.00 | Completely Satisfied |
| Assignments, activities, readings, and/or projects within the course are supplemented to attain the learning competencies. | 3.00 | Completely Satisfied |
| The course follows the principles of grammar and sentence structure and is without typing errors. | 3.00 | Completely Satisfied |
| Multimedia used throughout the course reflects the progression of course content | 3.00 | Completely Satisfied |
| Expertise in the content area is evident in the presentation of knowledge. | 3.00 | Completely Satisfied |
| The MOOC-ES included at least one (1) activity that will strengthen the interactions with students | 3.00 | Completely Satisfied |
| **Grand Mean Rating** | **3.00** | **Completely Satisfied** |

*Legend:1.00 – 1.66 (Not Satisfied at All), 1.67 – 2.33 (Moderately Satisfied), 2.34 – 3.00 (Completely Satisfied).*

Based on the table above, the MOOC-ES content was evaluated as follows: "The content of the MOOC is designed and presented in a uniform and consistent manner," received a 3.0 verbal rating, indicating perfect satisfaction. This is evidenced by the MOOC-ES's consistent and uniform material presentation in each unit. Unit presentations are as follows: Introduction, course outcome, learning competencies, pre-assessment, discussion, supplemental materials, forum, activity, and generalization.The statement, "Information presented in all parts of the MOOC-ES are manageable and reasonable for the time allocated," received a 3.0 rating and verbal interpretation of entirely satisfied. This MOOC-ES's syllabus supports this claim. More time is allotted to units with more

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complex themes. A grand mean rating of 3.0, verbally defined as entirely satisfied, was given to this MOOC-ES. The reviewers praised the topic's validity, delivery, and presentation methods.

### *4.3.2 Procedure Development*

The researcher created a Facebook social learning group to develop the approach. The procedures to create a Facebook social learning group are listed below.

First, sign into Facebook. Enter your username or email address in the appropriate tabs. Click "Log In" to access your Facebook account after entering this information.

Step 2: Group Formation. Click “Create” or "+" and select “Group.” Enter the group name. This study uses MOOC in Elementary Statistics as the Group Name.

Step 3: Social Learning Group Type Change. After group creation, set type to “Social Learning.” Click “Edit Group Setting” under “More.” Under “Group Type,” click “Change” and select “Social Learning,” then “Save.”

Step 4: Course Content Creation and Organization. Go to the "Guides" Tab, click "Create Guide," write the Guide name and description, then click "Create Guide." After building instructions, the researcher can put text, files, or links under each unit. This platform allows multiple-choice quizzes Mes,senger room meetups, and movie parties. According to Rollins, A. (2018), the final step before publishing a MOOC is technical integration, which involves formatting course material on the platform. Some methods are complicated and need programming or web development abilities. The Facebook social learning group is the most important medium given the university students' nature.

### *4.4. Implementation*

This stage tested the second MOOC-ES draft with students who were trained to use it. Three Statistics Instructors/Professors from the same College and University observed MOOC-ES.

Introduction to Statistics Unit 5: The researcher and class completed Position Measures effectively. Students grasped the unit introduction. Course outcome and learning competency were stated. The pre-assessment activity helped students understand the process. Few students scored 100%, indicating space for growth in their statistics expertise. Discussions were clear and illustrated with examples. Students participated effortlessly after following the instructions. The instructors-observers like the activity scoring. Generalization guide questions were answered properly. The teacher-observers had no ideas for teaching statistics basics.

The researcher and class completed Units 6 and 7. Researchers properly explained unit introductions to students. Course outcome and learning competency were stated. Students comprehended the evaluation process in pre-assessment. However, as few pupils passed, their topic knowledge can be improved. Explained nicely, the topic was illustrated with examples. Students followed the directions and participated enthusiastically. Teachers praise the scoring provisions. The generalization guide questions were answered correctly.

Teacher-observers said MOOC-ES was a novel way to teach elementary statistics. Students participated more when taught Elementary Statistics using new methods like MOOCs. The preceding steps led to the effective implementation phase in this study. Deductions from students' replies and reactions enhance the analysis and design stages' suitability. The definition of Rowan, Correnti, and Miller supports this. E. Cambun (2009) notes that the implementation process decides whether the design intent meets the workability test (Galman & Del Rosario, 2021). He adds that successful design and implementation are required to achieve predicted teaching and learning improvements. During this time, teachers are more crucial. According to Leach, J. (2005), referenced by Galman and Del Rosario (2021), teachers' ability to detect design elements is crucial to instructional material logic or intent. Keep or change these aspects carefully.

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### *4.5. Evaluation*

Each phase was evaluated based on compliance with the standards and steps. It was shown that the development strictly followed the Gantt Chart during the Analysis phase. The parts undermined in the Design phase were considered, and the actual contents were developed based on the design in the Development phase, while considering the guidelines set forth in the Implementation phase. The evaluation phase was carried out in each phase using qualitative analysis, as suggested by Galman and Del Rosario (2021). They describe the evaluation phase as crucial in design studies, as it suggests possible improvements and provides the basis for domain-specific guidelines. Qualitative analysis is recommended to optimize understanding of the effectiveness of the design under evaluation.

#### *4.5.1 Assessment of the Design and Content of the MOOC-ES*

The MOOC-ES was subjected to the evaluation of two Mathematics experts and a MOOC developer of the University. The results of their evaluation on the design and content of the MOOC-ES were considered in the final draft of the MOOC-ES. The data collected using the evaluation - questionnaire were treated using weighted mean.

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#### *4.5.1.1. Assessment of the Design of the MOOC – ES*

Table 4. Summary of evaluation on the design of MOOC - EC by mathematics expert and the MOOC developer

| Components | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 | Unit 7 | WM | Qualitative Rating |
|---|---|---|---|---|---|---|---|---|---|
| The Introduction conveys the idea and content of the lesson/unit | 3.00 | 3.00 | 3.00 | 2.67 | 3.00 | 3.00 | 3.00 | 2.95 | VG |
| There is alignment in the Learning Competencies and course outcome | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| The learning competencies convey the idea and content of the lesson/unit and direct to the attainment of the course outcome | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| The discussion conveys the idea and content of the lesson/unit and directs to the attainment of the learning competencies. | 3.00 | 3.00 | 3.00 | 3.00 | 2.67 | 3.00 | 2.67 | 2.91 | VG |
| The Discussion Forum conveys the idea and content of the lesson/unit and directs to the attainment of the learning competencies. | 3.00 | 3.00 | 3.00 | 2.67 | 3.00 | 2.67 | 2.67 | 2.86 | VG |
| The Activity conveys the idea and content of the lesson/unit and directs to the attainment of the learning competencies. | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Formulation of guide questions is concrete and clear and helps the students to lead to the Generalization | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| The final output conveys the competencies in each lesson/unit and directs to the attainment of the learning competencies | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| The final examination is based on the competencies in each unit/lesson and directs to the attainment of the learning competencies | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Provisions of Scoring | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| **Grand Mean Rating** | **3.00** | **3.00** | **3.00** | **2.93** | **2.98** | **2.98** | **2.93** | **2.97** | VG |
| **Qualitative Rating** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | |

*Legend:1.00 – 1.66 (Poor), 1.67 – 2.33 (Good), 2.34 – 3.00 (Very Good).*

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Two mathematics experts and one MOOC developer assessed the MOOC-ES design in Table 4.

Unit 1 Introduction to Statistics has a 3.0 (Very Good) mean rating. No changes were suggested for this unit. Each segment efficiently defines unit objectives and delivers content, according to experts.

In Unit 2, Data Collection and Presentation, the mean evaluation was 3.0 (Very Good). Teachers liked the inventive lesson discussion strategies.

Unit 3 Measures of Central Tendency had a mean value of 3.0 (Very Good). The experts commended the instruction, organization, presentation, and lesson complexity.

Unit 4, Measures of Variability, averaged 2.93 (Very Good). The experts commended the content delivery method and organization. Since learners may not understand math, they advised using real-life films to show its application.

Unit 5, Measures of Position, averaged 2.98 (Very Good). The experts liked the content delivery and conclusions that showed how the concepts are applied. One expert suggested using educational materials to emphasize the point.

Unit 6, Normal Distribution, averaged 2.98 (Very Good). Experts commended the content delivery plan and arrangement. The examples of how the concepts apply to actual life were also praised. One expert suggested adding learning resources to improve learning.

Unit 7, Hypothesis testing, averaged 2.93 (Very Good). Each unit's evaluators commended the content delivery and attitude. Despite the lesson's difficulty, they praised MOOC-ES's diverse learning experiences. Conclusions that illustrate real-world applications were also praised. One expert suggested a hypothesis-testing statistics software tutorial video.

The MOOC-ES had a grand mean rating of 2.97, indicating good design. Online course delivery and design were highly complimented by evaluators. One evaluator advised adding more videos to discuss the themes. Evaluators praised MOOC-ES's material delivery method.

#### *4.5.1.2. Assessment of the Content of the MOOC - ES*

**Table 5.** Summary of evaluation on the content of MOOC - EC by mathematics expert and the MOOC developer

| Components | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 | Unit 7 | WM | Qualitative Rating |
|---|---|---|---|---|---|---|---|---|---|
| The introduction is parallel to the Discussion Proper. | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Statement of the course outcome | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Appropriateness of Learning Competencies | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Discussion | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Discussion Forum | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 2.67 | 2.95 | VG |
| Activity and Scoring | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Generalization | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Final Output and Scoring | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| Final Exam and Scoring | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | VG |
| **Grand Mean Rating** | **3.00** | **3.00** | **3.00** | **3.00** | **3.00** | **3.00** | **2.96** | **2.99** | **VG** |
| **Qualitative Rating** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | **VG** | |

*Legend:1.00 – 1.66 (Poor), 1.67 – 2.33 (Good), 2.34 – 3.00 (Very Good).*

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Unit 4, Measures of Variability, averaged 2.93 (Very Good). The experts commended the content delivery method and organization. Since learners may not understand math, they advised using real-life films to show its application.

Unit 5, Measures of Position, averaged 2.98 (Very Good). The experts liked the content delivery and conclusions that showed how the concepts are applied. One expert suggested using educational materials to emphasize the point.

Unit 6, Normal Distribution, averaged 2.98 (Very Good). Experts commended the content delivery plan and arrangement. The examples of how the concepts apply to actual life were also praised. One expert suggested adding learning resources to improve learning.

Unit 7, Hypothesis testing, averaged 2.93 (Very Good). Each unit's evaluators commended the content delivery and attitude. Despite the lesson's difficulty, they praised MOOC-ES's diverse learning experiences. Conclusions that illustrate real-world application were also praised. One expert suggested a hypothesis-testing statistics software tutorial video.

The MOOC-ES had a grand mean rating of 2.97, indicating good design. Online course delivery and design were highly complimented by evaluators. One evaluator advised adding more videos to discuss the themes. Evaluators praised MOOC-ES's material delivery method.

### *4.5.2. Assessment of the Instructional Use*

#### *4.5.2.1. Assessment of the Instructional Use by the Mathematics Instructors*

Ten math teachers assessed the MOOC-ES Elementary Statistics course's seven parts. All ten instructors agreed that each unit's introduction was straightforward. They discovered that the introduction's data and information engaged pupils and made reading enjoyable. The MOOC-ES improved by including an application in the introduction to help students focus.

All 10 instructors thought course outcomes were clearly stated and offered enough information and statistics. The course outcomes provided a general picture of students' intended outcomes, unit by unit.

All 10 teachers said the learning competencies were clearly described and delivered in a particular, measurable, attainable, realistic, and time-bound manner. This section defined the learning content students needed to learn by unit's end.

All material and data were clearly conveyed in the discussion section, according to the 10 instructors. Each unit's sample problems and examples were well-delivered and addressed. One instructor advised evaluating conversation duration to keep students engaged. The debate was intriguing and held students' attention.

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#### *4.5.2.2. Assessment of the Instructional Use by the Mathematics Students*

Students' assessments of the seven MOOC-ES lessons included their experience utilizing the MOOC and their thoughts and feelings regarding its instructional usage.

All twenty randomly interviewed students loved the MOOC-ES's Elementary Statistics strand. They also said the MOOC-ES helped them grasp Units 1 to 5 even though they already knew them. Since their lecturer instructed them to click the guidance button for simpler MOOC-ES access, all students reported no problems accessing the content. All students preferred MOOC-ES because it has multiple learning resources, when asked which learning modality best suited their learning. The learners also found supplementary films and materials helpful in studying each Unit's contents.

Nineteen randomly selected students said they enjoyed learning about normal distribution, skewness, and kurtosis using the MOOC-ES. Despite the topic's or unit's difficulty, all students said they learnt and understood the lesson from the video's well-discussed and presented chat and other learning aids and exercises. Students said they learned the lesson by using MOOC-ES even if they had no prior understanding of the issue. One student said she had to view the video numerous times to understand the task. Students have found technical or operational issues with using Facebook social learning group as a learning tool. Finally, students preferred MOOC-ES to modular learning for normal distribution, skewness, and kurtosis. They found that learning videos and associated resources helped them understand each unit.

Eighteen of twenty randomly selected students said they enjoyed learning the seventh unit's hypothesis testing ideas and calculations in the MOOC-ES. Students also noted that the instructor delivered the subject well and covered the topic with concrete examples in the video, despite the topic's and unit's difficulty. The students said they struggled to understand the unit's content even after seeing the video numerous times owing to its complexity. With other learning tools and discussion sites, they got suggestions from classmates. These helped them grasp the lesson. The pupils said they had trouble learning the lesson because of its complexity, not its delivery.

## 5. Discussion

Teachers found the MOOC-ES to be an effective tool for online Elementary Statistics instruction, expressing confidence in its structured and well-designed materials. The accessibility of the platform, especially via Facebook, was a significant advantage. Teachers noted that students could learn at their own pace and review lessons as needed, which is particularly helpful for complex topics. The MOOC-ES provided a flexible and interactive way for students to grasp mathematical concepts, ensuring consistent and comprehensive learning despite the challenges of online education.

From the students' perspective, MOOC-ES was highly effective in aiding their understanding of Elementary Statistics. The platform's structure and content delivery enabled them to master difficult mathematical topics without sacrificing instructional quality. Students appreciated the ability to revisit previous lessons, reinforcing their understanding. The self-paced nature of the MOOC-ES allowed them to progress through the course in a way that suited their individual learning styles.

Students also found the Facebook-based social learning group to be an advantageous feature. Clear guidance from teachers on how to navigate the MOOC-ES ensured full engagement with the course content1. As students were already familiar with Facebook, it was a comfortable platform for learning. Facebook’s minimal data consumption made it accessible for students with limited internet resources, enabling participation without financial strain.

Overall, students agreed that the MOOC-ES was the most effective method for learning Elementary Statistics, given their preferences, learning needs, and available resources. Its

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accessibility, ease of use, and structured design contributed to a positive and productive learning experience.

A research by Dan Bugler, Stacy Marple, Elizabeth Burr, Min Chen-Gaddini, and Neal Finkelstein (2017) supports the content, design, and instructional use evaluation results. The former researchers mentioned in their study that instructional materials must be triangularly evaluated by stakeholders to be valid and appropriate to improve learning. The stakeholders in this study were experts, students, and teachers. The validity and instructional application of this MOOC-ES were considerably enhanced by these three stakeholders.

Furthermore, findings of De Witte, K., Haelermans, C., & Rogge, N. (2024) emphasizes the importance of a comprehensive evaluation process involving key stakeholders in assessing instructional materials. A rigorous triangular evaluation involving experts, teachers, and students strengthens the validity and instructional applicability of educational resources like MOOC-ES, ensuring they meet high educational standards and cater to the needs of both educators and learners.

## 6. Conclusion

The research underscores the efficacy of the MOOC-ES in conforming to the Commission on Higher Education (CHEd) regulations, demonstrating Facebook as a viable platform for massive open online courses. This method not only satisfies educational criteria but also cultivates an interactive learning atmosphere. The course was carefully crafted to meet its goals, incorporating validated content that provides students with straightforward access to fundamental understanding in Elementary Statistics. The excellent execution exemplifies a novel and inventive approach to conveying intricate content, showcasing flexibility in pedagogical methods.

The quality and validity of the MOOC-ES are emphasized by a rigorous assessment process that incorporates comments from experts, educators, and students, guaranteeing a thorough evaluation of its efficacy. The application of the ADDIE model in the development process underscores a methodical approach, facilitating ongoing improvement and optimization of the course materials. The data confirm that the MOOC-ES is a substantial progression in online education, integrating convenience with academic quality.

## 7. Suggestions

In line with the results, numerous recommendations are made. First, analyze several aspects that could improve the MOOC-ES. The University may use this study to standardize future Massive Open Online Courses. Future studies could use this work to validate and evaluate MOOC content and development. Researchers should also explore internal and external issues that may affect MOOC-ES deployment. The University may hire an IT specialist to create a learning management system for the MOOC and future MOOCs. Further research should examine how the MOOC-ES affects students' academic performance and math attitudes. Future research should examine how MOOCs affect student behavior and online learning perspectives. Further research could examine MOOCs in other math fields. The University may organize a core committee for MOOC design, validation, and evaluation to meet diverse audience needs. Finally, this study could help the University plan its future projects and perform Open University development studies.

## 8. Implications and Limitations

The research suggests that social media platforms such as Facebook can function as viable substitutes for conventional Learning Management Systems in the dissemination of MOOCs. This indicates that educators and institutions can utilize widely available platforms to improve student participation and accessibility while preserving academic integrity. The limitation of the study is its

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primary focus on the efficacy of the MOOC-ES within a particular subject (Elementary Statistics) and in the context of CHEd regulations. The results may not be universally applicable to other fields or varying regulatory environments. Moreover, dependence on Facebook as a platform may provide issues about data protection, internet accessibility, and possible distractions for students.

## Declarations

**Author Contributions.** Mr. Alvarez was chiefly accountable for the idea and design of the MOOC-ES, assuring its compliance with the Commission on Higher Education (CHEd) regulations and educational standards. They performed comprehensive research on utilizing Facebook as a medium for delivering massive open online courses and spearheaded the creation of the course content, assuring its validity and accessibility for students. Dr. Galman concentrated on the execution and assessment of the MOOC-ES. They streamlined the evaluation process by orchestrating comments from experts, educators, and students to ascertain the course's quality and validity. Furthermore, they employed the ADDIE paradigm to enhance the teaching materials, facilitating a systematic and efficient development process. The writers collaborated to develop a comprehensive and creative learning experience in Elementary Statistics.

**Conflicts of Interest.** The authors assert the absence of financial or personal affiliations that would unduly affect their work. All conclusions and analyses articulated in this work are exclusively derived from the data gathered and examined throughout the study process.

**Funding.** The authors confirmed that no funding from local and international associations were obtained in the conduct of this research.

**Ethical Approval.** The Institutional Review Board (IRB) ethically authorized "Massive Open Online Course in Elementary Statistics & Probability: From Analysis to Evaluation" safeguarding privacy and participant rights. Data will be securely stored with restricted access and anonymized or destroyed. Informed consent means participants know their rights, including the freedom to leave the study at any moment without penalty. Ethics have been taken to reduce risks, and the study follows privacy and dignity rules. This permission shows that the research will follow ethical norms.

**Data Availability Statement.** All data provided in this study were obtained and gathered at the University where the researchers were affiliated.

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## References

Alvarez, J. I., & Galman, S. M. (2023). Hyflex learning: Continuing tertiary education in a post–pandemic environment. *Advances in Social Science, Education and Humanities Research*, 745, 584–601. https://doi.org/10.2991/978-2-38476-056-5_57

Alvarez, J. I. (2024). Evaluating The Impact of Ai–Powered Tutors Mathgpt And Flexi 2.0 In Enhancing Calculus Learning. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *8*(2), 495-508. https://doi.org/10.22437/jiituj.v8i2.34809

Alzaghibi, M.A. (2010). *Instructional Design: Development, Implementation and Evaluation of a Teaching Sequence Abut Plant Nutrition in Saudi*. University of Leeds, Leeds.

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach* (Vol. 722). Springer Science & Business Media

Bugler, D., Burr, E., Finkelstein, N., Gaddini, M.D., and Marple, S. (2017), *How Teachers Judge the Quality of Instructional Materials*, Retrieved from: https://www.wested.org/wp-content/uploads/2017/03/resource-selecting-instructional-materials-brief-1-quality.pdf

Codamon, Daniel B. (2020). *Understanding the Distance Learning Delivery modalities,* Philippine Information Agency, https://pia.gov.ph/news/articles/1049277

CHEd Memorandum No. 75, series of 2017, Policies, Standards, and Guidelines for Bachelor of Secondary Education, https://ched.gov.ph/wp-content/uploads/2017/11/CMO-No.-75-s.-2017.pdf

CHEd Memorandum No. 4, series of 2020, Guidelines on the Implementation of Flexible Learning, https://ched.gov.ph/wp-content/uploads/CMO-No.-4-s.-2020-Guidelines-on-the-Implementation-of-Flexible-Learning.pdf

Cook, Ronald (2017). *MOOClm: Learner Modelling for MOOC, School of Information Technology*, Faculty of Engineering, University of Sydney

Conrad, D. & Openo, J. (2018). Assessment Strategies for Online Learning, AU Press, Athabasca University 1200, 10011 – 109 Street, Edmonton, AB T5J 3S8

DepEd Order No. 42, s. 2017, National Adoption and Implementation of the Philippine Professional Standards for Teachers, https://www.deped.gov.ph/wp-content/uploads/2017/08/DO_s2017_042-1.pdf

De Witte, K., Haelermans, C., & Rogge, N. (2024). The Effectiveness of a MOOC as a Form of Professional Learning. *Education Sciences*, *14* (10) 1114. https://doi.org/10.3390/educsci14101114

Drake, J. R., O'Hara, M., Seeman, E. (2015). Five principles for MOOC design: With a case study. *Journal of Information Technology Education: Innovations in Practice,* 14, 125-143. Retrieved from http://www.jite.org/documents/Vol14/JITEv14IIPp125-143Drake0888.pdf

Forest, Ed. (2014). The ADDIE Model: Instructional Design - Educational Technology., Educationaltechnology.net Date Accessed: 01/30/2021

Galman, S.M.A. and Del Rosario, J.C. (2021). Linking Real - Life Situations with Classroom Assessment: Development of Real-Life Performance - Based Tasks in Business Mathematics. *Journal of Applied Mathematics and Physics*, 9, 485-502. https://doi.org/10.4236/jamp.2021.93034

Istiadji, A. D., Hardiman, G., & Satwiko, P. (2024). Exploring the evolution of sustainability science, understanding the complexity and development of sustainability programs. *Journal of Law and Sustainable Development, 12*(5). https://doi.org/10.55908/sdgs.v12i5.3720

Lambert, S. (2015). Reluctant Mathematician: Skills-Based MOOC Scaffolds Wide Range of Learners, *Journal of Interactive Media in Education,* 2015(1): 21, pp.1–11, DOI: http://dx.doi.org/10.5334/jime.bb

Literat, I. (2015). Implications of massive open online courses for higher education: mitigating or reifying educational inequities?, *Higher Education Research and Development* (May 2015), https://www.researchgate.net/publication/276509982

Manallack DT, Yuriev E. (2016). Ten Simple Rules for Developing a MOOC. PLoS Comput Biol 12(10): e1005061. https://doi.org/10.1371/journal.pcbi.1005061

Martin, F. (2011). Instructional Design and the Importance of Instructional Alignment. *Community College of Research and Practice*, 35, 955-992. https://doi.org/10.1080/10668920802466483

Mehmet Kesim and Hakan Altınpulluk. (2015). A Theoretical Analysis of Moocs Types From A Perspective of Learning Theories, Academic World Education and Research Center Procedia - Social and Behavioral Sciences 186 (2015), https://www.researchgate.net/publication/268447148_A_Theoretical_Analysis_of_MOOCS_Types_From_a_Perspective_of_Learning_Theories

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International journal of educational research open*, *1*, 100012.

Nichols Hess, A.K. & Greer, K. (2016). Designing for engagement: Using the ADDIE model to integrate high-impact practices into an online information literacy course. Communications in Information Literacy, 10(2), 264-282. https://files.eric.ed.gov/fulltext/EJ1125456.pdf

Panero, M., Aldon, G., Trgalová, J. & Trouche, L. (2017). Analyzing MOOCs in terms of their potential for teacher collaboration: the French experience. Presented to TWG15 of the 10th Conference of European Research on Mathematics Education (CERME). Dublin, Ireland http://publications.cetis.ac.uk/wpcontent/uploads/2013/03/MOOCs-and-Open-Education.pdf

Paterson, C. (2003). Bringing ADDIE to Life: Instructional Design at Its Best. *Journal of Educational Multimedia and Hypermedia*, 12, 227-241.

Philippine National Research Center for Teacher Quality. (2020). Prototype Syllabi for Pre - Service Teacher Education Compendium Series, https://rctq.ph/files/prototype-syllabi/6MathematicsSyllabiCompendium.pdf

Porter, S. (2015). To MOOC or not to MOOC: How can online learning help to build the future of higher education? Chandos Publishing. http://publications.cetis.ac.uk/wpcontent/uploads/2013/03/MOOCs-and-Open-Education.pdf

Powell, S., & Yuan, L. (2013). MOOCs and open education: Implications for higher education. Bolton: CETIS. Retrieved October 20, 2013, from http://publications.cetis.ac.uk/wpcontent/uploads/2013/03/MOOCs-and-Open-Education.pdf

Richey, Rita C., and James D. Klein. (2005). Developmental Research Methods: Creating Knowledge from Instructional Design and Development Practice. . Journal of Computing in Higher Education, Spring 2005, Vol. 6 (2), 23 – 28

Rollins, A. (2018). 6 Steps To Creating A MOOC, eLearning Industry, https://elearningindustry.com/creating-a-mooc-cooc-6-steps

Safitri, M., Suryani, N., Asrowi, & Sukarmin. (2024). Validity of metacognitive awareness inventory as a measuring tool for metacognitive ability in mathematics problem solving. *Journal of Law and Sustainable Development, 12*(1). https://doi.org/10.55908/sdgs.v12i1.2246

Schleicher, Andreas (2020) The Impact of COVID – 19 on Education: Insights from Education at a Glance, OECD.org, https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf

Seeletso, M.K. (2015). The Design and Development of Instructional Materials as Potential Contributor to Academic Success of Secondary School Open and Distance Learners in Botswana. PhD. Thesis, University of Pretoria, Pretoria.

Wirefly. (2020). How Much Data does Facebook use?, https://www.wirefly.com/guides/how-much-data-does-facebook-use Date Accessed: May 5, 2021

Wirefly. (2020). How Much Data does Youtube use?, https://www.wirefly.com/guides/how-much-data-does-youtube-use

Yousuf, M.I., Anwar, M.N. and Sarwar, M. (2008) Perceptions of Course Coordinators and Course Writers for Developing Distance Learning Materials. Turkish Online Journal of Distance Education, 9, 123-127

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