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Evaluation of Developed Learning Module in General Physics 2 as a Self-Paced Distance Learning Material

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Abstract

The pandemic shifted the learning continuum, and the low performance of learners in the Science subject of the National Achievement Test (NAT) brought about challenges for educators. With this, a learning module in General Physics 2 patterned after the Department of Education's mandated Most Essential Learning Competencies (MELCs) was developed after a least-learned competency was assessed to develop a learning module. It was validated in terms of Content Quality, Instructional Quality, Technical Quality, and Other Findings by a set of field experts selected through purposive sampling. The study adopted a quantitative, descriptive research design. The field experts' evaluation shows very satisfactory remarks on the content, instructional, technical qualities, and other findings. The developed module is recommended to be used as a module exemplar, especially in General Physics 1 in the Department.

Keywords: Development and Evaluation, Learning Module, General Physics 2, Least-Learned Competency, Holy Angel University

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INTRODUCTION

A significant challenge encountered by learners, particularly those pursuing Science, Technology, Engineering, and Mathematics (STEM) disciplines, is their academic performance, notably in General Physics. Reyes et al. (2024) highlighted the persistent difficulty in facilitating improved scientific achievement across all grade levels within the Philippine Basic Education system. This concern has preoccupied educators for the past decade.

Aguinaldo (2019) reported that the Philippine Senate assigned a committee to review the educational system in 2019. Even with the promulgation of the R.A. 10533, widely known as the K to 12 Program, the results of the NAT still showed underwhelming results. It is believed that the curriculum is not given proper justice, and there is a mismatch between results and expectations. This caused a collective effort to improve the quality of education in the actual field.

Science learning, especially in physics, as expressed by Ornek et al., 2008 and Cutajar & Musumeci, 2022 is further made difficult by its abstract nature that maximises mathematics as a primary language – an already challenging skill to master. Additionally, Cho & Baek, 2019 and Apkarian et al., 2021 also emphasised that the ongoing report of very high-class sizes, traditional classroom setups, and teacher factors were also deemed to be challenging to physics learning.

Along with the challenges toward the achievement of learners reflected in their performance in the NAT, the Philippine educational system took another huge blow in the

form of a pandemic. Toquero (2020) and Tarkar (2020) explained that Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2), more commonly known as CoViD-19, is a fatal respiratory condition that is spread through droplets or being in contact with contaminated surfaces. The fast infection of the masses rapidly ceased business and educational operations and transformed the educative process through a different medium. With the extreme measures for social distancing, educational institutions are particularly challenged to swiftly adjust their systems of planning, implementation, and assessment. The proposition of a module not only provides an alternative means to learning for today but also addresses the need to provide learning material for learners that can provide learning experiences to students without the personal presence of the teacher.

Tsaqifah et al. (2024) reported that learning about math-based subjects involves conceptual and technical know-how. This is further clarified by Ayudia & Desnita (2024), who expressed that learning physics was still a great challenge to students, especially since they are observed to be embarrassed and lackadaisical in face-to-face setups of learning. This pushes for the development of learning materials in Physics that really involve the practice of skills. Bhakti et al. (2020) clarified the importance of practicum aside from content acquisition since it involves greater science process skills; however, the challenge lies with how and where such practicum may be implemented, especially with the limited resources present. With this, the idea of allowing distance learning to happen through a module came to fruition. Nozaleda and Agorilla (2019) explained that allowing distance learning to happen offers solutions to the need for access to education, which further eases the socio-economic demands of learning.

Studies involving the development and evaluation of General Physics 2 modules for the Senior High School level still need to be further conducted, especially since prior studies reflect the development of such materials is mainly focused at the Junior High School level. With this, the study aimed to develop a learning module through the ADDIE model, as Leonard and Wibawa (2020) elaborated, helps with comprehensive and systematic skills development, which will be the framework for the development of the module that contains sets of supplementary activities to aid the assessed least learned competency Senior High School students. However, the study is delimited to the evaluation of the developed module. It does not involve the assessment of the least-learned competency, which was the basis for the content of the module. Specifically, this study aimed to answer the following questions: How may the developed and designed learning module be adequate in terms of: a. Content Quality; b. Instructional Quality; c. Technical Quality; and d. Other Findings?

METHODS

Research Design

The study utilised the quantitative, descriptive research design. Descriptive research, as defined by Siedlecki (2020), helped the researcher describe the results of the evaluation of the prepared learning module. Descriptive research helps researchers to delve into individuals, events, and conditions in their natural state without other further intervention. In the study, the application of quantitative, descriptive research design provided insights on the outcome of the validation and evaluation of the module in its adequacy of being a viable learning material for SHS STEM students on the least-learned competency in General Physics 2.

Participants of the Study

The experts who validated the module were five purposively selected, either male or female, beyond 18 years of age, must have taught Physics for at least 2 years, must be licensed professional teachers and are currently teaching science in the field and may have handled Science in the field for the past 5 years. According to Bhardwaj (2019), purposive sampling is a type of sampling technique wherein the members from a bigger sample are selected to participate in a study. Some references term it as deliberate sampling or judgmental sampling as well. In addition, Quinones et al. (2001) mentioned that years of work experience are positively correlated with expertise, which justifies the basis for the purposive criteria.

Instruments

To evaluate the validity and content of the module, the researcher employed the Department of Education – Learning Resource Management and Development System (DepEd-LRMDS) Evaluation Rating Sheet for Non-Print Materials. Subject matter experts utilised this instrument, which comprises four primary domains: Content Quality, Instructional Quality, Technical Quality, and Other Findings. Content Quality encompasses ten statements assessing the overall content's accuracy, relevance, and adherence to established standards. Instructional Quality evaluates ten statements concerning the clarity of learning objectives, instructional design, and the material's overall effectiveness in facilitating learning. Technical Quality comprises thirteen statements assessing the technical aspects of the module, including the quality of visual, audio, and video elements, as well as their appropriateness and synchronisation. Finally, Other Findings encompasses four statements that assess the presence of notable errors or inconsistencies within the material. The DepEd-LRMDS Evaluation Rating Sheet for Non-Print Materials is publicly available and can be utilised without requiring prior permission.

Data Gathering

The process of evaluating the self-paced learning module began with the seeking of consent and permission of the institution where the study was conducted through email correspondence. Due to the pandemic, correspondence, permissions, updates, and information dissemination were done online. The researcher coordinated with the administration of Holy Angel University and then with the Basic Education Department about the study to be conducted. After the drafting and designing of the module, the help of field experts was sought to validate the contents and design of the module using the LRMDS Evaluation tool for Non-Print Materials, wherein they were given one (1) week to read through and evaluate the module. After the data collection for the effectiveness of the module, the data was tabulated through Microsoft Excel and was analysed through the Statistical Packages for Social Science (SPSS). All data gathered were kept confidential and stored in a password-encrypted computer for 3 years. The data will be disposed of after the set time following the necessary deletion protocol.

Data Analysis

Descriptive statistics such as frequency, mean, percentage, and standard deviation were used for the identification of the least-learned competency and evaluation of the learning module in terms of learning goals, content, clarity, design, learning activities, and flexibility. Pimentel (2019) provided a structure in interpreting the intervals of responses

for a 4-point Likert scale employed by the LRMDS Evaluation Rating Sheet for Non Print Materials where 1.00 to 1.50 signifies Not Satisfactory, 1.51 to 2.50 signifies Poor, 2.51 to 3.50 signifies Satisfactory, and 3.51 to 4.00 signifies Very Satisfactory rating as well as 1.00 to 1.50 signifies Do not evaluate further, 1.51 to 2.50 signifies Present and requires major redevelopment, 2.51 to 3.50 signifies Present but very minor but must be fixed, and 3.51 to 4.00 signifies Not present rating.

RESULTS & DISCUSSION

Results

The problem statement was addressed by presenting the results and findings of the evaluation process on the self-paced distance learning module.

How may the developed and designed learning module be adequate in terms of: a. Content Quality; b. Instructional Quality; c. Technical Quality; and d. Other Findings?

Table 1. Content Quality

Indicators	Mean	Std. Deviation	Descriptive Interpretation
Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level at which it was intended.	3.80	.4472	Very Satisfactory
Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives.	3.40	.8944	Satisfactory
The content is accurate.	3.80	.4472	Very Satisfactory
The content is up-to-date.	3.80	.4472	Very Satisfactory
Content is logically developed and organised.	3.40	.8944	Satisfactory
Content is free from cultural, gender, racial, or ethnic bias.	3.80	.4472	Very Satisfactory
Content stimulates and promotes critical thinking.	3.60	.5477	Very Satisfactory
Content is relevant to real-life situations.	3.40	.8944	Satisfactory
Language (including vocabulary) is appropriate to the target user level.	3.40	.5477	Satisfactory
Content promotes positive values that support formative growth.	3.60	.8944	Very Satisfactory
Overall Mean	3.60	.6462	Very Satisfactory

Field experts' opinions were also gathered in terms of four factors. Table 2.1 reflects descriptors on Content Quality. With this, the generalised response is reported to

be Strongly Agree, with a mean of x bar equal to 3.60 and a standard deviation of cap S cap D equal to 0.6462. It can be noted that the highest rating items with a mean of $\bar{x} = 3.80$ with varying standard deviations are responses stating: *[Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level it was intended.], [Content is accurate.], [Content is up-to-date.],* and *[Content is free from cultural, gender, racial, or ethnic bias.].* On the other hand, the lowest rating items with a mean of $\bar{x} = 3.40$ with different standard deviations are items with statements: *[Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives.], [Content is logically developed and organised.] [Content is relevant to real-life situations.],* and *[Language (including vocabulary) is appropriate to the target user level.].*

Table 2. Instructional Quality

Indicators	Mean	Std. Deviation	Descriptive Interpretation
The purpose of the material is well-defined.	4.00	.0000	Very Satisfactory
Material achieves its defined purpose.	3.40	.8944	Satisfactory
Learning objectives are clearly stated and measurable.	3.40	.8944	Satisfactory
The level of difficulty is appropriate for the intended target user.	3.60	.5477	Very Satisfactory
Graphics/colours/sounds are used for appropriate instructional reasons.	3.40	.5477	Satisfactory
Material is enjoyable, stimulating, challenging, and engaging.	3.40	.5477	Satisfactory
The material effectively stimulates the creativity of the target user.	3.20	.4472	Satisfactory
Feedback on the target user's responses is effectively employed.	3.60	.5477	Very Satisfactory
Target users can control the rate and sequence of presentation and review.	3.80	.4472	Very Satisfactory
Instruction is integrated with the target user's previous experience.	3.60	.5477	Very Satisfactory
Overall Mean	3.54	.5422	Very Satisfactory

Reflected in Table 2. are findings on Instructional Quality. It can be seen that the overall response is Strongly Agree with a mean of $\bar{x} = 3.54$ with a standard deviation of $SD = 0.5422$. It can be noted that the highest rating item with a mean of $\bar{x} = 4.00$ with a standard deviation of $SD = 0.0000$ It is the statement that mentions *[Purpose of the material is well defined.].* It can also be viewed from the report that the lowest rating item with a mean of $\bar{x} = 3.20$ with a standard deviation of $SD = 0.4472$ Are items with statements: *[Material effectively stimulates the creativity of target user.].*

Table 3. Technical Quality

Indicators	Mean	Std. Deviation	Descriptive Interpretation
Audio enhances understanding of the concept.	3.40	.5477	Satisfactory
Speech and narration (correct pacing, intonation, and pronunciation) are clear and can be easily understood.	3.60	.5477	Very Satisfactory
There is complete synchronisation of audio with the visuals; if any	3.40	.5477	Satisfactory
Music and sound effects are appropriate and effective for instructional purposes.	3.60	.5477	Very Satisfactory
Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.	3.40	.5477	Satisfactory
Visual presentations (non-text) are clear and easy to interpret.	3.60	.5477	Very Satisfactory
Visuals sustain interest and do not distract the user's attention.	3.60	.5477	Very Satisfactory
Visuals provide an accurate representation of the concept discussed.	3.60	.5477	Very Satisfactory
The user support materials (if any) are effective.	3.60	.5477	Very Satisfactory
The design allows the target user to navigate freely through the material.	3.80	.4472	Very Satisfactory
The material can easily and independently be used.	3.80	.4472	Very Satisfactory
The material will run using minimum system requirements.	3.80	.4472	Very Satisfactory
The program is free from technical problems.	3.60	.5477	Very Satisfactory
Overall Mean	3.60	.5245	Very Satisfactory

The technical quality, which encompasses elements that allow the module to function as expected in an online medium, was assessed in the Technical Quality in which the outcomes of the survey, as seen in Table 2.3, report a summarised response of Strongly Agree with a mean of $\bar{x} = 3.60$ with a standard deviation of $SD = 0.5245$. The items that acquired the highest rating with similar means of $\bar{x} = 3.80$ and with standard deviations of $SD = 0.4472$ state *[The design allows the target user to navigate freely through the material.], [The material can easily and independently be used.],* and *[The material will run using minimum system requirements.]*. Meanwhile, the items that garnered the lowest rating with similar means of $\bar{x} = 3.40$ and with standard deviations of $SD = 0.4472$ state *[Audio enhances understanding of the concept.], [There is complete synchronisation of audio with the visuals, if any],* and *[Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.]*.

Table 4. Other Findings

Indicators	Mean	Std. Deviation	Descriptive Interpretation
Conceptual errors.	4.00	.0000	Very Satisfactory
Factual errors.	4.00	.0000	Very Satisfactory
Grammatical and/or typographical errors.	3.60	.5477	Very Satisfactory
Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.).	4.00	.0000	Very Satisfactory
Overall Mean	3.90	.1369	Very Satisfactory

Other Findings involved other notable findings or overall ratings of respondents. In Table 2.4, it can be seen that the response as a whole is Very Satisfactory, with a mean of $\bar{x} = 3.90$ with a standard deviation of $SD = 0.1369$. The highest rating responses that garnered means of $\bar{x} = 4.00$ with standard deviations of $SD = 0.0000$ are statements: *[Conceptual errors.], [Factual errors.],* and *[Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.).]* while the response that acquired the lowest rating with a mean of $\bar{x} = 3.60$ with a standard deviation of $SD = 0.5477$ Is statement: [Grammatical and/or typographical errors.]

Discussion

The K To 12 Basic Education Curriculum - Senior High School curriculum guide includes the content standards and learning competencies set by the DepEd to ensure that learners are well-equipped with varied skills, especially in analysing scientific and mathematical situations and, in turn, solving them on their own by providing a reference for goal setting. Logan et al. (2021) emphasised that self-regulated learning (SRL) must be highly considered in crafting modules. There are three phases to it: forethought, performance, and self-reflection. In the forethought phase, task analysis, strategic planning, goal setting, and self-motivation are necessary. Goal setting can be hallmarked by allowing learners to visualise expectations by stipulating goals and expectations early on. Once they are engaged, the learners are then given chances to self-reflect in the end. The results of the study in terms of content quality show a similar pattern to these ideas. The respondents highly rated that the learning module developed adhered to the DepEd Learning competencies and that the content was reported to be accurate and up to date. Alongside their rating in terms of content adherence and timeliness, gender and cultural sensitivity were also evaluated highly. The Department of Education's Vision, Mission, Core Values, and Mandate. (n.d.). Clearly mentioned in their mission statement that it is the department's driving force to uphold the right of every Filipino to quality, equitable, culture-based, and complete basic education where students can be nurtured in a child-friendly, gender-sensitive, safe, and stimulating environment. Even though descriptors such as Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives, Content is logically developed and organised, Content is relevant to real-life situations, and Language (including vocabulary) is appropriate to the target user level - are marked as lowest, the interpretation is still satisfactory. Santoso et al. (2021) elaborated on the importance of logical and organised content. Organisation is needed to assimilate information easily and make more sense of the material. Aside from this, organisation through real-life application is also essential. Rohm et al. (2021) expressed that in order for learning to become robot-proof, future-proof, and real-world-ready, learning designs that

are realistic and relevant to everyday human experience, real-world work, interactions, and challenges are needed. The evaluators' call for more real-life applications was evident in these reports by other studies. Finally, Tursunovich (2022) expounded that language sensitivity is also relevant in terms of creating learning materials. Language appropriate to certain settings must be utilised so as not to create misunderstanding. Meaningful relationships and interaction heed for proper language competence. This is made evident by the response of the field experts, who rated the overall language of the material as lower than that of the other descriptors.

Logan et al. (2021) mentioned that the relevance of informing learners on the goals early in the task allows them to set their goal markers and strategies on how they deal with the process of applying the skills required and expected of them to show. Results regarding the instructional qualities, in particular, the setting of goals of the module, showed that evaluators rated the module highly and gave it a very satisfactory rating. Both Ayllón et al. (2016) and Khalid et al. (2020) claimed that creativity is a skill not thoroughly expected to be utilised in technical content such as mathematics. In line with this, the module evaluators rated the module's ability to elicit creativity lower than the others, though the mark was still satisfactory. There is a clear pattern to this response as physics problem-solving expects learners to follow an organised pattern in performing problem-solving skills where creativity is not much expected.

Pinili (2020) designed a comic-based learning module that allowed learners to independently go through the content with minimal supervision from the teacher. Such independence allows learners to boost their interest and enthusiasm while they are learning. This is directly tied to Garcia's (2018) idea of guided practice, which provides learners with opportunities to delve into learning while having as much autonomy as they can. This shows coherence with the results as reflected in the responses of the evaluators. The module's technical quality was reported to show facilities that allow learners to navigate through the material freely, easily, and independently with minimal system requirements. Though the descriptors that veer towards audio being able to enhance the concepts, complete synchronisation of visuals, and displays are uncluttered, easy to read and visually pleasing were marked lower than others, the response is still interpreted as satisfactory. These could have been rated as such due to internet connectivity problems or online limitations of playing such media embedded within the text. Mutisya and Makokha (2016), as well as Rotas and Cahapay (2020), delved into the possible problems towards online learning materials and modalities in Africa and the Philippines, respectively were addressed in two separate studies where one of the emerging problems is unstable internet connectivity. The reasons for such are explained to be geographic. With this, Badalova (2021) elaborated that audio-visual learning materials facilitate better learning by providing more means of sensory experiences all at the same time. This also becomes an integral consideration in making sure that learning becomes less wordy, more straightforward, and no longer highly abstract.

Other findings were also evaluated by field experts, which opened up the means to assess the module as a whole in terms of conceptual errors, factual errors, computational errors, possible inclusion of obsolete information, and errors in the visuals. Such descriptors were marked as very satisfactory. This means that the evaluators deemed that the module does not contain any of the errors. Adonis (2020) reported in a news article that there is a certain number of released learning modules from the Department of Education with varying types of errors. This is feared to bring about misinformation and disruption of learning outcomes since learners are exposed to such inexcusable errors. With this, the results of the study show that the module is free from crucial errors, which is helpful in maintaining a level of credibility and reliability within its content. On the other hand, The evaluators rated the descriptor, which tests out the materials' inclusion of

typographical errors or grammatical errors, with the lowest mark out of all the statements within the factor in focus. However, still, the response is very satisfactory. This could be explained by minor typographical errors found within the material.

Learning must be dynamic. The field experts' overarching comment includes suggestions to include more illustrations and real-life applications. Badalova (2021) emphasised the importance of audio-visual materials, which stimulate the learner's ability to see actual images or diagrams in action. This opens up possibilities for them to connect what they can see to what they already know and, in the end, make a meaningful connection with the learning content. In line with this, Pinili (2020) designed a comic-style learning module in Physics. The thought behind such an idea is to make learning not one-note. Learning in such a manner, which includes visual cues, helps facilitate the learning utilities of a learner, especially using their sight along with their mind process. Rohm et al. (2021) also addressed one important component of learning, and that is real-life applications. The module evaluators expressed the call for more real-life applications within the content to contextualise better learning. With this regard, the module was further improved and developed until it reached its final version. Additional comments mentioned: Use simpler language; Typographical errors; Text formatting; Usage of proper pronouns; Add more fun facts and other up-to-date information; Add more illustrations and real-life applications; Make a logical connection between subtopics; Convert some deep dive content into note-taking activity; Revise rubrics to include content-based competencies; Indicate manner of submission of answers; Indicate page numbers for easier access of family manual; Remove repetitive content; Transfer answer keys to last portion of module; Modify and clarify instructions; Use numbers to indicate steps and not bullets; Add congratulatory message for accomplishing module and answer key; Competencies are adequately covered and clear; and Design and layout is adequate.

CONCLUSION

The developed learning module in General Physics 2 based on the assessed least-learned competency was evaluated by field experts from the Senior High School Department of Basic Education Department of Holy Angel University. The evaluations show that the learning module prepared is Very Satisfactory in terms of Content Quality. This means that the learning module as a whole is adherent to the content standards, performance standards, and learning competencies stipulated in the MELCs. It also shows timeliness and accuracy in terms of overall content. It has well-organized, logical, age-appropriate and adequate components that allow real-life application of critical thinking and formative growth. It also contains content that is aligned with the Vision, Mission, Goals and Objectives of the Department of Education. When it comes to Instructional Quality, the material is shown to be Very Satisfactory. The purpose of the material is well-stipulated, defined, and measurable. The level of difficulty, elements, and inputs are appropriate to the age and level of the Grade 12 students. The mechanisms for obtaining feedback, stimulation of creativity, constructivism, and physical control facilitated and designed for learners are also adequate. The Technical Quality of the module is evaluated as Very Satisfactory. The online modality of the module calls for audio clarity, visual principles, accessibility, and overall physical design to be marked as up to standards. The field experts remark on other findings as very satisfactory, where such findings show no significant errors regarding concepts, facts, computations, obsolete information, or visual errors. Though minor typographical errors were pointed out, they were immediately addressed in the final revision. Overall, the module is evaluated by field experts as adequate.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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