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Research Article

Mathematics E-learning Packets for Technical and Livelihood Education (TLE) Automotive Servicing

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ABSTRACT

This study aimed to develop and evaluate Mathematics e-learning packets tailored for Technical and Livelihood Education (TLE) Automotive Servicing students at a public national high school, in the City Schools Division of Marikina for the School Year 2023-2024. The impetus for the study was based on the increasing number of learners who are having difficulty solving basic mathematical problems. The research addressed the following questions: (1) identifying Mathematics 9 topics suitable for e-learning packets based on literature review, (2) evaluating the developed packets by automotive and mathematics teachers according to DepEd guidelines concerning content quality, instructional quality, technical quality, assessment, visuals, and plan layout, (3) assessing any significant differences between the evaluations of the two groups of respondents, and (4) gathering comments and suggestions for improvement. Utilizing a descriptive research method, the study involved evaluations from 15 mathematics teachers and 15 automotive teachers from two public national high schools in Marikina City, Philippines. Data were analyzed using Weighted Mean and the Mann-Whitney U Test. Key findings include (1) prioritized topics under the Matatag Curriculum: perpendicular and parallel lines, relations and functions, quadratic functions and equations, direct and inverse variations, trigonometric ratios, and probability of simple events; (2) both groups rated the e-learning packets highly acceptable, with grand weighted means of 3.50 and 3.60, respectively; (3) no significant difference was found between the evaluations of the two groups; (4) respondents praised the packets' adequacy, organization, relevance, and interactivity, offering suggestions to incorporate more visuals, expand topics and activities, add video demonstrations, and involve industry professionals. In conclusion, the developed e-learning packets were well-received and deemed effective, with recommended enhancements aimed at further enriching the learning experience and bridging theoretical knowledge with practical application.

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Introduction

The automobile industry is rapidly welcoming a new era. The advancements in the automobile industry are quite promising fueled by sustainability and changing consumer behavior, which includes the introduction of electric automobiles, connected cars, and new business models. As a result, curriculum planners consider teaching automotive maintenance in basic education to be an important course offering. The Department of Education saw this as an opportunity to train young Filipinos interested in automobile repair and manufacturing. Education experts also saw the need to incorporate fundamental subjects into technical vocation programs, which would improve the competency of Filipino graduates. This includes but is not limited to, teaching mathematics to automotive students. Like the other subjects, the use of mathematical skills and processes in the automotive industry is something that cannot be denied.

The Philippines is currently ranked sixth-lowest out of 81 nations in reading and math, and third-lowest in science. This is better than how it was placed in the 2018 cycle when Filipino learners came in second in math and science and lowest in reading comprehension. To be specific, the Philippines did better in mathematics compared to nations like Cambodia (which is the lowest in the world overall) and the Dominican Republic (which is ranked third). However, the Philippines was surpassed by nations like Palestine (which is rated 13th lowest) and Indonesia (which is ranked 12th lowest).

Interestingly, only 16% of Filipino pupils achieved at least the fundamental or baseline level of mathematical ability, which is referred to in the report as "Level 2 proficiency," based on the results of the PISA exam. This indicates that just around one out of five Filipino students who took part in the PISA test were able to determine how a basic scenario can be represented numerically through interpretation and recognition without direct instruction. According to PISA, fundamental arithmetic abilities include comparing the total distance across

two alternative routes or converting prices into a different currency. This indicates that 84% of Filipino test-takers lack the necessary mathematical skills to perform these tasks.

In connection with this, many teachers believe that incorporating mathematics into other subjects is challenging even for junior high school students. It takes a significant amount of time and effort on the part of the teacher. Further, the use of e-learning materials poses problems like the availability of devices and access to a stable internet. However, the advantages outweigh the disadvantages because integration of the mathematics subject provides students with skills that are useful in real-world situations.

The TLE Automotive program is available in selected Marikina City schools. It can be observed that the mathematical skills of the students enrolled in this program are deemed inadequate, which may cause difficulties in solving numerical problems. As a result, the researcher attempted to devise e-learning packets in learning lessons in mathematics with integration of automotive topics so that students will become familiar with basic numerical skills such as computations and measurements that are applied and required for class activities, particularly in TLE Automotive Servicing.

Section 10.3 (Production and Development of Materials) of Republic Act No. 10533 also known as the "Enhanced Basic Education Act" of 2013, states that the creation and development of locally produced learning materials are highly recommended. In compliance with the national policy, these instructional materials will be disseminated to the regional and division offices after thorough validation. This study is deemed necessary due to the lack of investigation into the development and evaluation of e-learning packets involving the integration of TLE Automatic Servicing into mathematics lessons for Grade 9 students. The researcher deemed it integral for the Grade 9 students to gain expertise in their chosen field, and learn the use of basic mathematics concepts in conjunction with their field of specialization which will help them maintain numerical skills

necessary in their daily lives. The researcher intends to use the aforementioned content to shift students' perceptions of mathematics and help ease their fear of it, as well as to refute the idea that "Automotive" is not as difficult as mathematics.

Statement of the Problem

This study aimed to develop and evaluate the Mathematics e-learning packets for Technical and Livelihood Education (TLE) TLE Automotive Servicing at two national high schools in the Division of Marikina during the School Year 2023 – 2024.

Specifically, it sought to find answers to the following questions:

1. What are the selected topics in Mathematics 9 which can be developed into e-learning packets for TLE automotive servicing based on the reviewed literature?
2. What is the evaluation of automotive and mathematics teachers on the developed Mathematics e-learning packets for TLE Automotive Servicing based on the DepEd guidelines and process on assessing instructional materials regarding the following criteria?
 - a. Content Quality
 - b. Instructional Quality
 - c. Technical Quality
 - d. Assessment
 - e. Visuals
 - f. Plan Layout
3. Is there a significant difference between the evaluations of the two groups of respondents on the developed Mathematics e-learning packets for TLE Automotive Servicing?
4. What are the comments and suggestions offered by the respondents to further improve the developed Mathematics e-learning packets for TLE Automotive Servicing topics?

Methods of Research

The descriptive method of research was employed in this study. The researcher opted to utilize this type of research investigation because the study is primarily concerned with evaluating the e-learning packets that the proponent of the study developed. The descriptive

method of research provides a clear picture of the strengths and weaknesses of the instructional materials the researcher was working on. In addition, it is noted that descriptive research does not begin with a fixed hypothesis or research question. Instead, the researcher changes the direction of research according to the data. Creswell (2021) is in favor of utilizing this process by emphasizing the idea that descriptive study determines and reports how things are happening in its natural setting. It has no control over what is, and it can only measure what already exists. The researcher made sure that all the things were taken into consideration, and all the potential biases were addressed. For instance, all the instruments are examined and validated using objective validation tools. The principal aim of employing this method is to describe the nature of a situation as a particular phenomenon. Finally, Creswell (2022) also defines descriptive research as a way of research that involves the collection of data to test a hypothesis or to provide solutions concerning the status of the subject of the study.

This method was used in this study because its main concern is to describe and evaluate the developed e-learning packets in Grade 9 Mathematics lessons with the integration of selected TLE Automotive Servicing based on Content Quality, Instructional Quality, Technical Quality, Assessment, Visuals, and Plan Layout.

Data Gathering Instruments

The data gathering instrument used in this study is the evaluation questionnaire which was submitted for validation to five (5) panel experts, including critic, panel member, Mathematics and TLE department heads, and research coordinator, before being used in the data gathering phase of the study.

The questionnaire was used for the evaluation of the developed e-learning packets in Grade 9 Mathematics lessons with integration of selected TLE Automotive Servicing as to the following criteria: Content Quality, Instructional Quality, Technical Quality, Assessment, Visuals, and Plan Layout. It was adapted from the study of Edejer (2021) entitled E-module in Trigonometry as Teaching Materials for Mathematics 9 and from the study of Arce (2020)

entitled Development and Evaluation of Educational Videos in Media and Information Literacy for Senior High School Students.

Data Gathering Procedure

The researcher sought permission to conduct the study from the Schools Division of Marikina City. Next, after the letter of request was approved, the researcher administered the research instruments that were used in evaluating and validating the e-learning packets. This was done face-to-face or onsite. The researcher used the evaluation tools to allow the respondents to determine the applicability and validity of the proposed instructional materials, which are the e-learning packets. Then, the proponents of the study collated, summed up, encoded, tabulated, and tallied the answers from the respondents after gathering the data.

Finally, the researcher processed and analyzed the responses from the participants using a set of rubrics that were validated alongside the research instruments. This method was used in this study because its main concern is to describe and evaluate the developed e-learning packets in Grade 9 Mathematics lessons with the integration of selected TLE Automotive Servicing based on Content

Quality, Instructional Quality, Technical Quality, Assessment, Visuals, and Plan Layout.

Result and Discussion

This chapter deals with the presentation and analysis of the collected data, and interpretation based on the result of statistical computation.

Table 1 shows the summary of the evaluation of the two groups of respondents on the developed e-learning packets regarding their content quality, instructional quality, technical quality, assessment, visuals, and plan layout.

As manifested in Table 1, the Mathematics and Automotive teacher respondents evaluated the developed e-learning packets with grand weighted mean ratings of 3.50 and 3.60, respectively, verbally interpreted as Strongly Agree (SA).

In summary, the results of this study are reflected in the paper of Carreon et al. (2022) wherein the research findings showed that contextualized learning module improves students' performance by adhering to the learning competency, content standard, performance standard, and learning activities recommended in the exploratory entrepreneurship course.

Table 1. Summary of Respondents' Evaluations on the Developed E-Learning Packets in Grade 9 Mathematics Lessons with Integration of TL Automotive Servicing

Factors	Respondents			
	Mathematics Teachers		Automotive Teachers	
	OWM	VI	OWM	VI
a. Content Quality	3.52	SA	3.60	SA
b. Instructional Quality	3.46	A	3.59	SA
c. Technical Quality	3.57	SA	3.62	SA
d. Evaluation	3.33	A	3.57	SA
e. Visuals	3.50	SA	3.61	SA
f. Plan Layout	3.62	SA	3.58	SA
Grand Weighted Mean	3.50	SA	3.60	SA

Note: OWM – Overall Weighted Mean

Table 2. Summary of Mann-Whitney U Test of Respondents' Evaluations on the Developed E-Learning Packets in Grade 9 Mathematics Lessons with Integration of TLE Automotive Servicing

Criteria	P-Value	α	Decision	Interpretation
a. Content Quality	0.647	0.05	Fail to Reject the H ₀	Not Significant
b. Instructional Quality	0.258	0.05	Fail to Reject the H ₀	Not Significant
c. Technical Quality	0.702	0.05	Fail to Reject the H ₀	Not Significant
d. Evaluation	0.099	0.05	Fail to Reject the H ₀	Not Significant

Criteria	P-Value	η^2	Decision	Interpretation
e. Visuals	0.424	0.05	Fail to Reject the H_0	Not Significant
f. Plan Layout	0.733	0.05	Fail to Reject the H_0	Not Significant

Table 2 suggests that the two groups of respondents strongly agreed that the developed e-learning packets in Grade 9 Mathematics lessons with integration of selected TLE Automotive Servicing have acceptable content quality, instructional quality, technical quality, assessment, visuals, and plan layout.

This is in line with multiple studies, such as that of Navalta (2020), and Castor (2019) where the quality of instructional materials was evaluated by multiple groups, and to know if there were any significant differences between the evaluation of multiple groups of respondents.

Comments

The respondents noted that the developed e-learning packet contains adequate topics, lessons, evaluations, and guide links for additional sources. Its clear organization is user-friendly, facilitating effective learning. The timely material is relevant and applies content knowledge throughout the curriculum, encouraging active learning and sparking learner interest. The interactive aspects promote curiosity and encourage independent exploration, making it a valuable resource for both educators and students.

Suggestions

The respondents suggested that to enhance the effectiveness of the E-learning packet, several improvements can be implemented.

Firstly, incorporating more pictures will aid in visualization and comprehension, making the content more engaging and to enhance problem-solving skills. Expanding the scope to include a wider range of topics and activities will provide learners with a more comprehensive learning experience. Secondly, integrating additional video demonstrations showcasing the application of mathematical concepts in automotive servicing tasks will offer practical insights and reinforce learning. Lastly, inviting professionals from the automotive servicing industry to share their experiences and demonstrate the real-world application of

mathematics will provide valuable context and inspire learners. These enhancements will enrich the e-learning packet, fostering deeper understanding and facilitating meaningful connections between theoretical knowledge and practical application.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. The developed mathematics e-learning packets for TLE Automotive Servicing are highly acceptable in terms of content quality, instructional quality, technical quality, assessment, visuals, and plan layout.
2. The evaluations of the two groups of respondents on the developed e-learning packets for Grade 9 Mathematics lessons, which include the integration of selected TLE Automotive Servicing, are the same.

Recommendations

Based on the findings and conclusions drawn, the following are recommended:

1. Teachers and students may use the developed e-learning packets to measure their efficacy.
2. Teachers at other levels may be encouraged to develop other learning materials in Mathematics using online platforms.
3. Studies about the integration of Mathematics and other Technology and Livelihood Education subjects may be further conducted.
4. Collaboration between mathematics and technical education departments in schools may be encouraged to promote interdisciplinary teaching and learning.
5. Other researchers may use the findings of this study as baseline data in conducting parallel studies.

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