

## Interactive E-Learning Portal for Enrichment of Conceptual Understanding of Grade 8 Learners in Physics

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### **Abstract**

This study dealt with the use of interactive e-learning portal for the enrichment of Grade 8 learners' conceptual understanding in Physics at Luis Palad National High School for the School Year 2014 - 2015. This study utilized experimental method of research employing the use of post-test control group design. An interactive e-learning portal containing some hyperlinked lectures, interactive games, e-quizzes with rubrics and readily available answers, an e-dictionary in Physics, and the simulated demonstrations was developed for Grade 8 learners in Physics. Based on the findings, it was concluded that the interactive e-learning portal can enrich the learners' conceptual understanding of the students in Grade 8 Science-Physics. Therefore, the use of e-learning portal may be adopted not only in lessons in Physics but also in Biology, Chemistry and Earth Science. However still, further modification of the material may be done by providing add-ons aside from features presented in the current e-learning portal.

**Keywords:** Interactive, e-learning, Physics, Grade 8 learners, enrichment

### **1. Introduction**

Technology is advancing rapidly and is beginning to provide the educators with wealth of potential tools. The future of education is in finding technologies that enable active learning experiences for all students. Yet, the use of computer and other instructional technologies, including multimedia and animation tools, must be governed by literature in learning, learning styles, as well as instruction (Mohler, 2010). The Information and Communications Technologies (ICTs) play a variety of roles in school (Belen, 2011). They can be used to teach, facilitate the study of traditional content-area topics and provide opportunities for students to learn how to use technology, or give the students tools for performing academic tasks more efficiently.

ICT may be infused into classroom activities through the use of interactive learning objects for instruction, enrichment and remediation. Using ICT would provide fresh approaches in the way science lessons are presented to facilitate student's understanding and retention of lessons which can eventually improve achievement in Science. The use of ICT empowers the learners to increase their productivity, thus, may be a key to significant improvement in Science education.

Bahague Jr. (2009) stated that the globalization and technological change, processes that have accelerated in tandem over the past fifteen years, created a new global economy "powered by technology, fuelled by information and driven by knowledge" (p.114). Hence, knowledge of ICT and the skills to utilize ICT in teaching-learning process has gained enormous importance for today's teachers.

Furthermore, Mohler (2010) stated that interactive multimedia provides a unique avenue for the enhancement of learning among the 21st century learners. It is vital that educators continue to integrate the digital tools into their classrooms because they provide unique ways for active student learning opportunities. Thus, the Interactive e-Learning Portal is quickly becoming a media of choice for learning and information distribution throughout the world. It is incorporated into areas of education, marketing, and training due to its apparent success as the medium for transfer of information at high pace in the advent of digital era.

### 1.1 Statement of the Problems

The purposes of this study are as follows: (1) develop an interactive e-learning portal for the enrichment of Grade 8 learners' conceptual understanding in Physics; (2) determine the profile of respondents in terms of average grades in Science 7, and pre-test scores; and (3) ascertain if there is a significant difference between the pre-test and post-test scores of the control and experimental groups with and without the application of the interactive e-learning portal.

### 1.2 Importance of the Study

The use of interactive e-learning portal for the enrichment of conceptual understanding in Physics would be significant to the following:

*Students.* As the focal point of the study, careful rendering of necessary instructional material would cater their needs. They would greatly benefit from this study because they would find the lessons prepared by the researcher

relevant to the changing time, interesting and enjoyable.

*Teachers.* It would help educators to deliver method of instruction parallel to the needs and capabilities of 21st century learners. Enriching what the students ought to know would be a necessity for the continuity of concepts as deemed in a spiral progression approach.

*School Administrators.* It would serve as a factual basis in planning and strengthening the curriculum and instruction needed in the K to 12 Curriculum.

*Future Researchers.* The result of this study could be a stepping stone to develop other digital learning materials that would possibly reinforce and enrich the learner's conceptual understanding.

### 1.3 Scope and Limitations

This study was limited only on the use of interactive e-Learning Portal for enrichment of conceptual understanding of Grade 8 learners in Physics for the first quarter of Grade 8 Science School Year 2014 - 2015. Two groups were formed, the experimental group exposed to the treatment and the control group taught using traditional way of teaching. Both groups were composed of 45 students selected as respondents. Respondents were grouped using matching variables such as the average grade in Science 7 and the pre-test scores.

The study covered the first quarter using Unit 1: Force, Motion and Energy of the learning material and consisting of six (6) modules, viz: Forces and Motion; Work, Energy and Power; Heat and Temperature; Electricity; Sound and Colors of Light with their corresponding specific learning competencies. This study was conducted from June 2014 to August 2014 covering the first grading period.

## 2. On designing a well-defined e-learning experience

Constructivists view learning as a formation of abstract concepts in mind to represent reality. They posit that learning occurs when a learner constructs internal representations for his/her unique version of knowledge. Constructivism argues that interactive activities in which learners play active roles can engage and motivate learning more effectively than activities where learners are passive. Individuals are assumed to learn better when they discover things by themselves and when they control the pace of learning. Therefore, it is natural to expect that self-directed, interactive learning will improve learning outcome (Brandt, 2005).

Constructivists put more emphasis on engaging students in the process

of learning than on finding a correct answer. Many constructivists call for the richer learning environments that contrasted with the typical less interactive classroom environments relying on the instructors, textbooks, and lectures. Graphics, video, and other media could help by interesting and engaging learners. Brandt (2005) suggests that constructivism should be a basis for Web-based learning. Web-based education supported by constructivist theory should thus enable learners to engage in interactive and creative activities during knowledge construction.

E-Learning can cover a spectrum of activities from supporting learning, to blended learning (combination of traditional and e-learning practices), to learning that is delivered entirely online. Whatever the technology, however, learning is a vital element. E-learning is no longer simply associated with distance or remote learning, but forms part of a conscious choice of the best and most appropriate ways of promoting effective learning (Mohler, 2010).

It can be said that current educational researches have altered previous conceptions about learning and have shifted instructional focus to the importance of learning with understanding (Fink, 2003). He proposed that learning fosters change and lasting learning (i.e. significant learning that comes from understanding) is based on several specific kinds of learning that can be identified in taxonomy.

For example, in the Web-based application, it becomes apparent when a student lacks basic foundational knowledge while they are completing Web-based exercises that are individualized and transparent in the virtual environment. In contrast with classroom where individual students can hide and not reveal their weaknesses, Web-based learning makes student's work, including discussion of course content, available for scrutiny. Truly, conceptual understanding towards the subject would increase because of the integration of simulations paralleled with games, e-lectures, e-quizzes, among others.

Alzate (2013) maintains that the value of striving for application in a course (beyond the obvious cementing of knowledge) is that it allows learning to become useful. Applications of the course materials showed that students can use the new knowledge or important skills in new ways as a result of the course. Ruiz, Mintzer and Leipzig (2006) note that "by enabling learners to be more active participants, a well-designed e-learning experience can motivate them to become more engaged with the content and thus provide an avenue for deeper and wider conceptual understanding of the lessons.

### 3. Materials & Methods

This part includes locale of the study, research design, population and sampling, instrumentation, and data gathering procedures.

This study was conducted in Luis Palad National High School where the researcher teaches at the time. The school is located at Brgy. Ipilan, Tayabas City 4327 and is considered to be the largest public secondary school in the division as to population size. At most, each section was composed of 45 students for School Year 2014 – 2015.

This study utilized experimental method of research employing the use of post-test control group design. Two groups were formed using matching variables such as their last year's scholastic achievement in Science and the result of the researcher's pre-test. The research design is shown below:

<b>Experimental Group</b>	R	X	O <sub>1</sub>
<b>Control Group</b>	R		O <sub>2</sub>

where: R = Random assignment  
 X = Interactive e-Learning Portal-based Instruction  
 O<sub>1</sub> = Experimental Post-test  
 O<sub>2</sub> = Control Post-test

After assigning the individual respondents, the experimental group used the developed interactive e-learning portal for enrichment purposes of the lessons while the control group made use of the traditional method of teaching. Both groups took the post-test. The conceptual understanding test was the instrument used to determine the effectiveness of the interactive e-Learning Portal as teaching tool for Grade 8 learners.

The study made use of random sampling from the middle heterogeneous classes of Grade 8 since they are considered as average classes and are ideal to reduce bias in the selection or samples. After careful consideration of factors involved, two groups were matched carefully using the average grade in Science 7 and their pre-test scores. Each group was composed of 45 students; so a total of 90 students participated in the study. On the other hand, the Science teachers were purposively chosen since all of the teachers in the specialization and in the said locale were selected.

As for the instrumentation, in order to develop an innovative ICT-based material in teaching Grade 8 Physics, the researcher employed the following procedures:

### 3.1 Preparation of the Conceptual Understanding Test

*3.1.1 Developing the Table of Specification (TOS).* An important aspect in the preparation of test was construction of the Table of Specifications (TOS). It contains learning competencies in the K to 12 Science Curriculum Guide. Test items were distributed by percentage of days to determine the number of test items per module. In connection, item placement was done based on the percentage of components namely Remembering, Understanding, Applying, Analyzing, Creating and Evaluating.

#### *3.1.2 Planning the Conceptual Understanding Test*

*3.1.2.1 Identifying the Learning Competencies.* The first step in planning the test was to identify learning competencies under Unit 1: Force, Motion and Energy.

*3.1.2.2 Selecting the Appropriate Item Format.* The researcher adapted a two-part test – a multiple choice and a practical type of tests. There were four options used in the multiple choice type of test and rubrics were applied for practical type of test. There were several sets of questions for each interactive e-learning session.

*3.1.3 Writing the Conceptual Understanding Test.* In this stage, the construction of test item would be based on TOS. The needed skills embedded in the learning competency were carefully identified for the development of the interactive e-learning portal. Upon finishing the initial draft, the researcher sought technical assistance from a Physics expert and a language critic to check the test content and construction.

*3.1.4 Conducting and Validating First Try-out of Test.* Initially, the test instrument was composed of 130 objective type questions. Only multiple choice type of test, mostly under knowledge (15%), process (25%) and understanding (30%) were used as bases for first trial run while the Product/Performance (30%) underwent face and content validation methods.

*3.1.5 Establishing the Item Analysis.* The multiple choice type of test underwent item analysis using difficulty and discrimination indices to find out the level of difficulty of the test questions as well as to determine the strengths and the weaknesses of the option used in the test. Only 96 items were left after

establishing item analysis. The respondents would be the last year's Grade 8 students chosen purposively.

*3.1.6 Revising the Final Draft.* After identifying the items to be revised, rejected or retained, this would be the time to take the necessary revisions of the test materials for the final draft.

*3.1.7 Comparing the Conceptual Understanding level based on scores.* The researcher compared the pre-test and posttest scores of the control and experimental groups in order to establish the increase in their conceptual understanding.

### 3.2 Designing Interactive e-Learning Portal for Grade 8 Science-Physics

The different learning competencies for the module covered in Science were identified. The researcher used the First Grading Period Unit 1: Force, Motion and Energy with its six (6) modules namely: Forces & Motion; Work; Energy & Power; Heat & Temperature; Electricity; Sound and Colors of Light. Online resources such as e-books, images, videos, and an interactive macromedia Flash applications were used as part of the material. An expert computer programmer assisted the researcher to complete the design of the material. Content and face validation methods were done as to the design and other aspects of material to the researcher's adviser, experts in multimedia software and Physics expert for their comments, remarks, and suggestions as guide in revising or modifying some parts of interactive e-learning portal. The researcher patterned and modified the face validation form as well as questionnaires on the level of acceptability of K-12 Science teachers and the level of interest of the student-respondents from the work of Rosales (2014).

### 3.3 Developing Questionnaire on Level of Acceptability and Level of Interest

Another instrument in the form of questionnaire patterned and modified from the work of Rosales (2014) was administered at the end of the post-test to the experimental group to determine the level of acceptability of the e-material among Science teachers and their level of interest towards the interactive e-learning portal as teaching tool for Grade 8 Science.

### 3.4 Data Gathering Procedures

The researcher facilitated the administration of the conceptual understanding test to Grade 8 learners who were carefully matched. The test was composed of a two-part test: multiple choice and practical exam based

tests considering the learning competencies stipulated on the K-12 Science Curriculum Guide as cited by de Dios (2012) and the developed Table of Specifications (TOS) made by the researcher himself. It was administered to both experimental and control groups. From there, the experimental group was treated with the interactive e-learning portal as supplemental teaching tool to enrich the conceptual understanding in Physics, while the control group with traditional way of teaching.

The researcher utilized matched group sampling of student-respondents of Grade 8 learners. To gather data, both groups were given the pre-test. The post-test was given to both groups to determine the significant difference of their learning with and without the use of interactive e-learning portal for the enrichment of conceptual understanding in Physics. The pre-test and post-test of experimental group were compared to determine the effectiveness of the developed material as supplementary teaching tool. All data to be gathered during the process were tallied, tabulated, analyzed, interpreted and statistically treated thereafter.

#### **4. Results and Discussion**

This interactive portal (see Figure 1 for screenshots) is a jam-packed, learner-centered gateway to many forms of fun-filled learning genre especially designed for the 21st century learners. The content of the e-portal is specifically used to help learners increase the conceptual understanding of the essential concepts making them more independent to explore the world of Physics beyond its limits. Moreover, this innovative instructional material is composed of and developed with the following features: e-lectures, educational videos, Interactive games and simulations, e-quiz and e-glossary.

The use of interactive e-learning portal supplemental to learning resources would be significant to students in order to broaden their horizon of learning and deepen their conceptual understanding in Physics needed for spiraling on the context of the K12 curriculum. For educators, they could deliver method of instruction parallel to the needs and capabilities of 21st century learners. Enriching what the students ought to know would be a necessity for the continuity of concepts as deemed fit in a spiral progression approach. For administrators, this would serve as a factual basis in planning and strengthening the curriculum and instruction needed in the K to 12 Curriculum among educators.



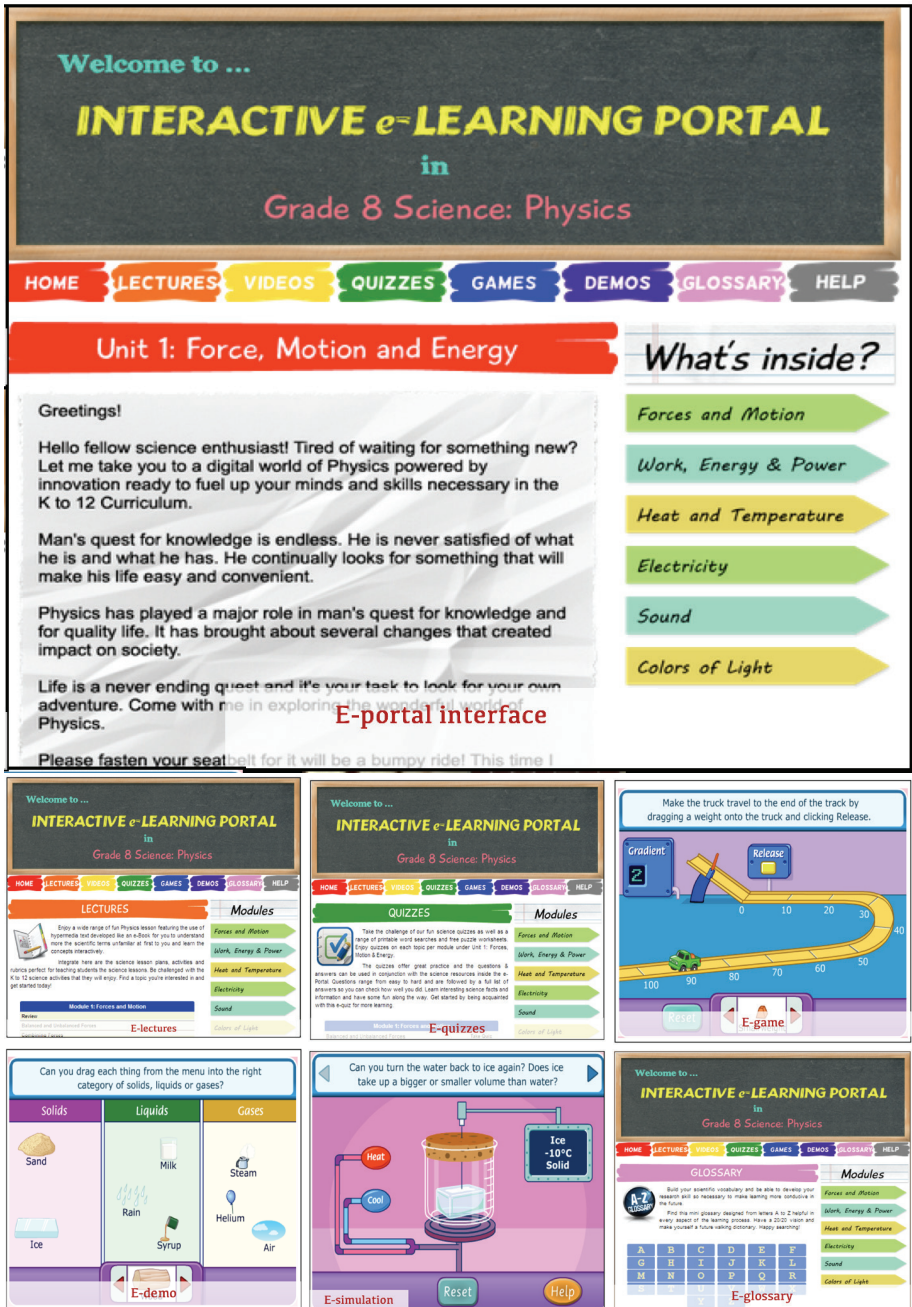


Fig. 1. Screenshots of the developed interactive e-learning portal (To see the colored version, please visit Volume 9, Issue 2 at <http://tilamsik.slsucas.net>)

Table 1. Comparison of Grade 8 learners' experimental and control groups' average grade in Science 7 and the pre-test scores

Matching Variables	Group	N	Mean	Standard Deviation (SD)	Mean Difference	t-value	Sig.(2-tailed) <sup>1</sup>
Average Grade in Science 7	Control	45	79.77	2.61	0.09	0.136	0.892
	Experimental	45	79.68	3.53			
Pre-test Scores	Control	45	29.52	6.76	0.00	-0.017	0.986
	Experimental	45	29.52	6.76			

<sup>1</sup>Level of Significance at 0.05

As to their average grade in Science 7, Table 1 shows that the control group obtained a mean score of 79.77 and standard deviation of 2.61 while the experimental group gained a mean of 79.68 and a standard deviation of 3.53. Since the p-value of 0.892 is greater than 0.05, it only shows that there is no significant difference between the average grades of the control and the experimental groups in Grade 7 Science. Thus, the two groups are equivalent as to their average grade in Science 7.

As to the result obtained from the pre-test scores, the respondents from the control group obtained a mean score of 29.33 and a standard deviation of 5.36. On the other hand, the experimental group obtained a mean score of 29.36 and a standard deviation of 6.76. Since the p-value of 0.986 is greater than 0.05, there is no significant difference in pre-test scores of experimental and control groups. Thus, the two groups are equivalent in terms of obtained pre-test scores before the conduct of the study.

Figure 2 (on the next page) shows the comparison between the pre-test and the posttest scores of control and experimental groups with and without the use of the interactive e-learning portal. The control group's lowest score is 25 while the highest is 55 as compared to the experimental group's lowest score which is 30 and highest, 73. The mean scores of the learners both in the control and experimental groups are 29.52 with standard deviations of 6.76. On the other hand, the mean score of posttest for the experimental group is 53.71 with a standard deviation of 7.59 while the mean score of control group is 40.11 with a standard deviation of 9.96. The difference between the mean scores is 13.60 in favor of the experimental group. The p-value between experimental and control group post-test obtained is 0.001 which is lower than 0.05. The result demonstrates that respondents in the experimental group

had higher conceptual understanding than those in the control group. Further, it indicates that the experimental group attained higher success after the experimental application compared to that in the control group.

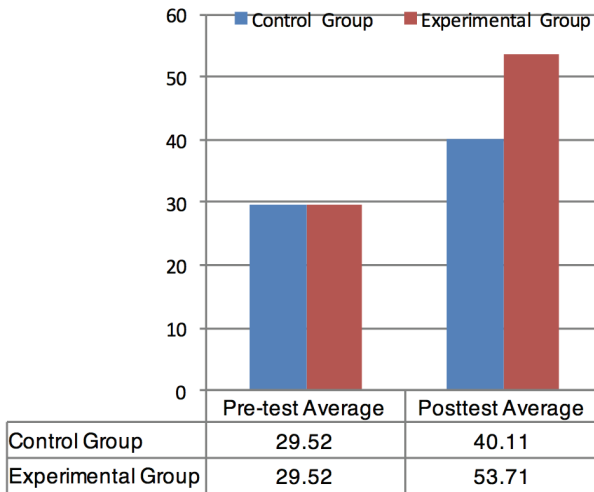


Fig. 2. Comparison between the pre-test and posttest scores of Grade 8 learners in the control and the experimental groups with and without the use of the Interactive E-learning Portal

Alzate (2013) maintains that the value of striving for application in a course (beyond the obvious cementing of knowledge) is that it allows learning to become useful. Applications of the course materials showed that students can use the new knowledge or important skills in new ways as a result of the course. Ruiz, Mintzer and Leipzig (2006) noted that “by enabling learners to be more active participants, a well-designed e-learning experience can motivate them to become more engaged with the content and thus provide an avenue for deeper and wider conceptual understanding of the lessons.

## 5. Conclusions and Recommendations

The findings showed that the interactive e-learning portal containing the hyperlinked lectures, interactive games, e-quizzes with rubrics and readily available answers, an e-dictionary in Physics, and the simulated demonstrations is innovative instructional material Grade 8 learners in Physics. The profile of the grade 8 learners-respondents are classified as to average grade in Science 7, whereas the respondents in control group obtained a mean score of 79.77 with standard deviation of 2.61 while experimental group gained a mean score of 79.68 with standard deviation of 3.53 which shows no significant difference as indicated by the p-value of 0.892. On the other hand, as to the pre-test

score, both the control and experimental groups obtained a mean score of 29.52 with standard deviation of 6.76 which indicate that the two groups were of the same level before the start of the experimentation. Lastly, a difference of 13.60 in the post-test mean scores yielded a p-value of 0.001 at 0.05 level of significance indicating that the experimental group attained higher success after experimental application compared to the control group.

Thus, it can be concluded that the developed interactive e-learning portal is a valid tool for enriching the conceptual understanding of Grade 8, and is ready for adoption to curricular instruction. The grade 8 learners that were subjected as the control and experimental groups initially had the same level of knowledge and skills in Science. The interactive e-learning portal as supplement to Grade 8 Learner's Material activities can enrich the conceptual understanding of the students in Grade 8 Physics. Moreover, it can aid learners with the abstract concepts in Physics since it is informative, understandable, attractive and unique. In addition, the results indicate that the portal promotes student-centered learning since it is innovative, interactive, and engaging.

The following is therefore recommended that: (1) the Science teachers may adopt the use of the e-learning portal not only in other lessons in Physics but also in Biology, Chemistry and Earth Science; (2) further modification of interactive e-learning portal may be done by providing add-ons aside from the features in the material to promote an ICT-based form of classroom instruction; (3) parallel and similar studies using other locales and bigger population may be conducted to further validate the results of the study; and (4) acceptability level of the e-learning portal may be further evaluated based on its authenticity, significance and helpfulness.

### Endnote

<sup>1</sup> I wish to extend my heartfelt gratitude for the help offered by the people behind the completion of this paper. To Prof. Daisy M. Galleno, research adviser, for giving her valuable time and effort in giving comments, suggestions and constructive criticisms to the thesis and whose encouragements and motivation led the researcher to pursue this topic. To Dr. Teresita V. de la Cruz, chairperson of the education program at the SLSU Graduate School, for the undying support and encouragement since the beginning of the study. To Dr. Leonisa O. Bernardo and Prof. Rosenda T. Nombrefia, panel members, for their valuable suggestions and comments towards the completion of this research. To the colleagues of the researcher in the academe who in one way or another provided moral support as well as to the student-respondents who cooperatively worked with the researcher. And to the anonymous editors, readers, and reviewers who provided valuable feedback for the improvement of this paper, your priceless support and kindness will forever be etched in my heart.

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*Tilamsik*

**THE SOUTHERN LUZON JOURNAL  
OF ARTS AND SCIENCES**

Volume 10 | August 2018  
ISSN: 1656-1953 (Print); 2467-6209 (Online)

*Published by:*

Southern Luzon State University-College of Arts and Sciences  
Research and Publications Office  
Jose Rizal Building, Southern Luzon State University-Main Campus  
Lucban, Quezon, Philippines 4328



# T I L A M S I K

The Southern Luzon Journal of Arts and Sciences

Volume 10, August 2018

ISSN: 1656-1953 (Print); 2467-6209 (Online)

Proudly indexed in, and published online by



<http://www.ejournals.ph>

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**SLSU-CAS Research and Publications Office**

Jose Rizal Building, College of Arts and Sciences  
Southern Luzon State University, Lucban, Quezon  
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Website: <http://tilamsik.slsucas.net>

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Abstract (composed of not more than 200 words, with a maximum of five keywords)

Introduction (consisting of a short background of the study, objectives, a

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- short discussion of significance, and a short discussion of the study's scope and limitations)
  - Framework of the Study (short discussion of the Theoretical and Conceptual framework/Research Paradigm)
  - Methodology (short discussion of the research design, instrumentation [if any], and procedures)
  - Results and Discussion (important findings; can have up to three levels of sub-heading [e.g., 4.1.1]. Each table and/or figure that will take up to ½ of the page shall be equivalent to 250 words, to be counted towards the overall word count.)
  - Conclusions (and Recommendations, if any)
  - References (include only the ones cited in the body of the text)

For qualitative studies, Discussion may be subdivided into several subheadings as answer to each research problem.

Citations must comply with the latest APA Referencing format (i.e. - 6th Edition). Note: see <https://owl.english.purdue.edu/owl/resource/664/1/> for a simple yet comprehensive guide on the APA style.

The journal adopts the modern outlining/ numbering method in indicating section headings (i.e. - 1.0, 1.1, 1.2, 2.0, etc...)

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