E-Learning Materials: Its Effectiveness on the Academic Performance of Grade 10 Students in Computer System Servicing National Certificate II

Rollen D. Pineda, Benedict Rabut

Information and Technology, Sultan Kudarat State University

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ABSTRACT

This study examined the effectiveness of CSS NC II E-Learning Materials on the academic performance of Grade 10 students in Information and Communication Technology, compared to conventional teaching methods. Utilizing an experimental research design, specifically the Pretest-Posttest Control Group design at King's College of Isulan, the research revealed that students initially performed poorly, as indicated by their pretest scores. Post-experiment results demonstrated that students using CSS NC II E-Learning materials achieved a higher mean score of 28.70, compared to 24.25 for those taught via traditional methods. Additionally, the assessment of the e-learning system indicated favorable ratings in perceived usefulness, ease of use, accuracy, and content quality, with students deeming it efficient and beneficial for their learning. The findings suggest that the CSS NC II E-learning approach is more effective than conventional teaching. Recommendations include adapting the e-learning system for other subjects, enhancing instructional effectiveness through technology integration in classrooms.

INTRODUCTION

In today's rapidly evolving technological landscape, the integration of digital technologies in education has become increasingly vital. Among these innovations, e-learning platforms have captured significant attention, especially in technical and vocational education, due to their potential to enhance learning outcomes.

E-learning is the use of digital resources to deliver educational content and it has gained popularity for its flexibility, accessibility, and support for self-paced learning (Encarnacion et al., 2021). Particularly in technical fields where hands-on skills are crucial, e-learning offers creative ways to bridge the gap between theoretical knowledge and practical experience.

In addition, e-learning means an approach where teachers and learners are separated by space, time, or both, e-learning leverages technologies such as the Internet and other digital tools to maintain communication and interaction (Wacas, 2024). Recent studies reveal that e-learning not only boosts student performance but also increases engagement with online platforms (Hellin et al., 2023).

As educational methods continue to evolve, blended learning models, which combine traditional classroom instruction with online learning, have also emerged. Full online delivery models promote greater student independence, with options for both individual and collaborative learning through synchronous and asynchronous methods (Daskan, 2020).

In the field of Information Technology, particularly for students aiming to earn their Computer System Servicing NC II (CSS NCII) certification, these innovations have proven critical. Traditionally taught through face-to-face sessions combining lectures and hands-on training, CSS NCII education was significantly impacted by the COVID-19 pandemic. The crisis accelerated the transition to virtual environments, creating an urgent need for e-learning tools that can simulate practical experiences (Wacas, 2024).

Despite e-learning advantages, it also presents unique challenges, such as time management, access to IT resources, learner motivation, and resistance to digital training, and must be addressed for successful implementation (Lee, 2023). Schools and training centers must provide the necessary support systems, from equipping trainers with digital skills to fostering learner motivation, to ensure that e-learning initiatives are effective and inclusive.

Given these developments and challenges, it becomes crucial to examine how e-learning impacts the academic performance of students in technical-vocational education, particularly in programs like CSS NCII. Thus, this study was realized, to explore the effectiveness of e-learning in supporting skill development, identifying both its strengths and the areas that require strategic improvement. Through this study, it seeks to contribute valuable insights into the evolving practices of digital education in technical fields, offering recommendations for enhancing e-learning experiences for future learners.

The researcher developed a CSS NCII E-learning Material focused on technical skills in Computer Systems Servicing NC II as an innovation. The effectiveness, usability, and accuracy of the material were ensured by gathering information from existing systems and published studies, which served as the foundation for refining and improving the project. The system underwent pilot testing to identify and address any issues before full implementation.

This developed e-learning material aims to offer valuable insights into the effectiveness of a new strategy in the digital learning environment, particularly in enhancing young students' motivation to learn. Specifically, it seeks to benefit Computer Teachers by providing an alternative approach to boost learners' motivation, satisfaction, and achievement—critical factors in today's 21st-century educational landscape where technology plays a central role in learning.

Theoretical Framework of the Study

According to Jean Piaget's constructivism theory (1952), students are more actively involved in the process of learning than they are passive recipients of knowledge. Process of teaching and learning. To make sense of what they are learning, learners draw from past experiences. Students are more engaged in the process of generating meaning and knowledge. This results in a more learner-centered strategy where the student directs his or her learning. The central tenet of constructivism is that knowledge is created by learners and that human learning is constructed. Based on prior knowledge. This past knowledge informs what updated or novel information a person will build from fresh educational encounters. While understanding cannot be passively acquired because it must come from experience, information can from creating insightful links between existing knowledge, fresh information, and the progressions involved in learning.

Constructivism Theory (1952) was developed to gain an understanding of the new online, or e-learning, learning environment. This research study assumed that the purpose of e-learning is to generate and create a meaningful atmosphere that fosters communication, creativity, teamwork, and critical thinking. With the use of new digital technology tools, knowledge may now be created by learners through deeper insight. Students get a higher understanding and comprehension through learning groups and other interactions with their online classmates because of the chances to be exposed to a variety of viewpoints and interpretations. After that, each learner integrates and interprets assimilating the new information into their experience (McLeod, 2019).

Mothibi (2015) states that in higher education settings, e-learning is becoming more and more popular as an effective teaching approach since internet technologies are used in education on a large scale. E-learning uses information and communication technology (ICT) to improve and streamline teaching and learning. It has dominantly become an effective mechanism in professional training as well as teaching and learning at the tertiary level due to its speed, convenience, and efficiency in accessing and processing information via web systems.

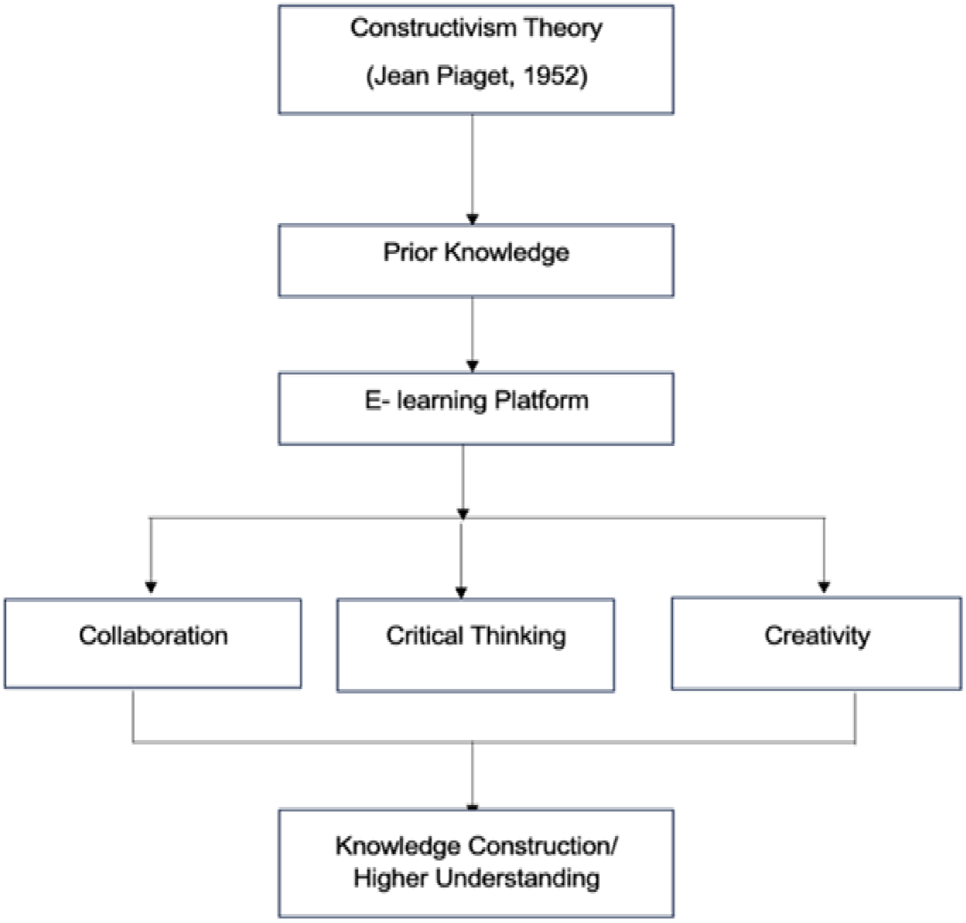

Figure 1. Theoretical Framework of the Study (SKSU, 2024)

Conceptual Framework of the Study

The conceptual framework of the study is presented in Figure 1. It illustrates how teaching methods influence the academic achievement of Information and Communication Technology (ICT) students. In the control group, the conventional teaching method was employed, whereas in the experimental group, the teacher utilized the CSS NCII E-learning approach. In this study, the teaching method serves as the independent variable, while the level of academic achievement is the dependent variable.

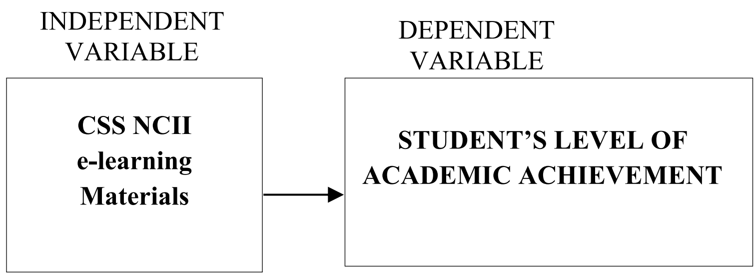

Figure 2. Conceptual Framework of the Study (SKSU, 2024)

General Objective

This study developed a CSS NCII e-learning material and determined its effect on the level of academic achievement of students in getting a National Certificate II for computer System Servicing.

Specifically, this study aims to:

1. Determine the pretest scores of students in control and experimental groups;
2. Determine the significant difference in pretest scores of the students in:
   2.1 Control group and
   2.2 Experimental group;
3. Determine the significant difference in post-test scores of the students in:
   3.1 Control group and
   3.2 Experimental group;
4. Evaluate the developed system in terms of:
   4.1 Perceived usefulness;
   4.2 Perceived ease of use; and
   4.3 Perceived Accuracy

Hypotheses

a. There is no significant difference in the pretest scores of the students in the control and experimental groups.
b. There is no significant difference in the post-test scores of the students in the control and experimental groups.

Significance of the Study

In this study, the researcher considered many things to help both the trainer and students improve their daily routine in providing quality instructions to the learners, and the students improve their level of achievement. Thus, this study is significant to the following:

For the Trainer

The trainer is no longer required to conduct lectures or demonstrate lessons. The CSS NCII e-learning system already includes assessment tools such as pretests, post-tests, and end-of-lesson activities, both for individual lessons and entire units of competency. The trainer's role is simply to launch the CSS NCII e-learning system, which then guides the learning process automatically. The system handles the administration and evaluation of assessments, generating accurate results and summaries of student performance. Consequently, the trainer can focus on other responsibilities, as the time and effort needed for lesson preparation and assessment development are significantly reduced.

For the Learners

Students no longer need to worry about keeping up with the lessons or tracking their progress. They can review lessons individually, allowing them to connect previous topics with current ones more effectively. The CSS NCII e-learning system also supports academic improvement by providing access to individual class lessons. Moreover, students can study ahead and actively participate in the e-learning process at their own pace.

For the Institution

This study will benefit the institution, particularly King's College of Isulan. The CSS NCII e-learning material will be utilized by both faculty and students who aim to obtain an NCII certification. Additionally, it serves as a form of promotion for the school, enhancing its educational offerings and visibility.

For the Researcher

This study allows the researcher to demonstrate preparedness for future academic or professional pursuits by conducting meaningful research that contributes to the institution, students, faculty, and future researchers.

For Future Researchers

This study may serve as a valuable guide or reference in conducting their own research projects.

Scope and Delimitation

The proposed study is intended for Junior High School students enrolled in the Information and Communication Technology (ICT) strand who wish to obtain the National Certificate in Computer System Servicing (NCII). The lessons encompass all four (4) units of competency required for the CSS NCII, under the Training Regulations (TR) set by TESDA. The assessment tools for both the pretest and post-test consist of multiple-choice questions.

The CSS NCII e-learning material is accessible online via a web browser through a link provided by the teacher. Twenty (20) internet-connected computers are designated for the 20 students in the experimental group, ensuring each student has individual access. Upon connection, the trainer logs into the system, and students create their accounts to begin using the platform. The trainer provides instructions and guidance on how to operate the CSS NCII e-learning material.

Students begin by taking the pretest, with results available immediately upon completion. They then return to the dashboard to access the introductory content. Ample time is provided for reading and exploring the topics. Following this, students proceed through all the lessons and e-learning activities available in the system. Once they complete these, they take the post-test, which serves as their final evaluation. At this point, students can no longer access the pretest or post-test again.

Students can view a summary of their scores, which is also accessible to the teacher. The objectives outlined in this study define its scope and areas of focus.

Furthermore, the CSS NCII e-learning material was developed in September 2024 and pilot-tested during the second semester of the school year 2024–2025.

Operational Definition of Key Terms

To make the study more understandable, the following key terms are operationally defined:

Accuracy is the ability of the system to provide or generate test results and summary of scores of students with no errors and with utmost reliability.

Assessment Tools are prepared pretest and post-test embedded in the system taken by the students.

Computer System Servicing NCII is the target qualification of the system to test and evaluate the CSS NCII e-learning in Information and Communication Technology (ICT) students and professionals. It is also a qualification where the researcher is currently a trainer/Assessor and even the respondents of the study.

Ease of Use A degree to which an individual thinks that utilizing an E-learning Material would be effortless.

E-learning is a type of electronic media that is developed to be used in CSS NC II.

Information and Communication Technology is the strand of the respondents of these studies. It is a broad term that refers to a variety of technological resources and tools.

Technical Skills are the specialized knowledge and expertise needed to perform specific tasks and use specific tools and programs in real-world situations.

Usefulness is a user's belief that using an E-Learning Material would enhance their academic performance.

METHODOLOGY

Project Development Description

Materials

Tables 1 and 2 show the minimum hardware and software requirements, respectively, that were used in developing the system.

Table 1. Minimum Hardware Requirements.

HARDWARE	SPECIFICATIONS
Processor	Intel corei7
Memory	4GB DDR3
Hard Disk Drive	1TB
Power Supply	ATX Casing w/ PS 600W
Monitor	15.6 LED Monitor
Printer	Epson

Table 2. Minimum Software Requirements.

SOFTWARE	SPECIFICATIONS
Database Application	MS Access 2007
Operating System	Windows 10
Programming language	Hypertext Preprocessor (PHP)
Database	MYSQL

Methods Used in Developing the Proposed System

A System Development Life Cycle was developed to ensure that the requirements of the existing CSS NCII e-learning were met. It served as a methodological framework to ensure that the designed system followed a user-friendly interface, logical approaches, and technical standards.

The figure below shows the five (5) phases of the System Development Life Cycle which was used in developing the system.

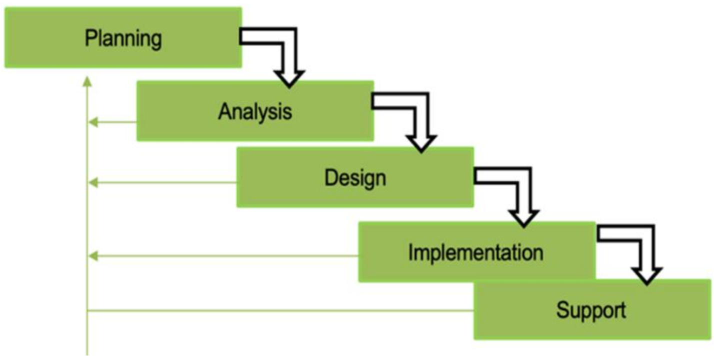

Figure 3. System Development Life Cycle with the Waterfall Strategy Model

The sets of related activities were organized into phases:(1) Planning Phase; (2) Analysis Phase; (3) Design Phase; (4) Implementation Phase; and (5) Support Phase.

A. Planning Phase

In this phase, the researcher identified the scope of the project development and ensured that the project was feasible. The researcher also defined what problems were encountered and proposed solutions, confirming the project's feasibility. The researcher finalized the project title, objectives, scope, duration, and resources needed.

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According to Pressman (2014), the planning phase of the SDLC is crucial as it establishes the foundation for the entire project by defining objectives, feasibility, and resource allocation.

Project Schedule of the Study

Table 3. Gantt Chart.

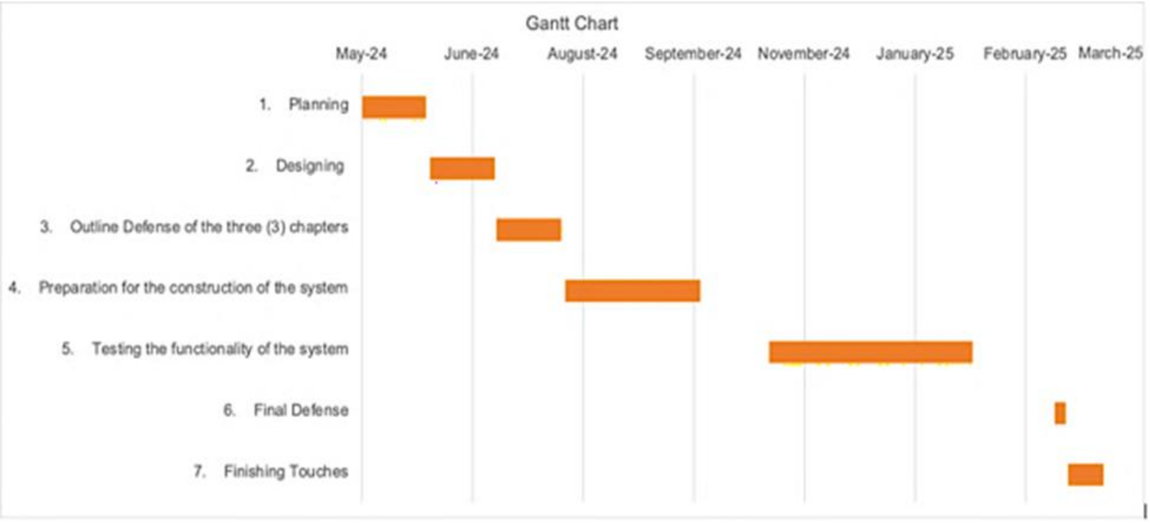

Table 3 presents the scheduled activities of the study, the tasks that were completed, and the corresponding months in which they were carried out.

B. Analysis Phase

In this phase, the researcher discussed system requirements through interviews, observation, and online research. Problems in the conventional system were identified, and necessary improvements for teachers in preparing lessons and assessment tools were determined. A cost-benefit analysis was conducted to outline plans for acquiring necessary hardware and systems. According to Sommerville (2015), the analysis phase involves requirement gathering, system modeling, and feasibility analysis to ensure that the system meets user and business needs.

C. Design Phase

In this phase, the researcher developed software programs and finalized the design output of the proposed study. The project was designed using Hypertext Preprocessor (PHP) for programming and MySQL Database for data management. A prototype of the CSS NCII e-learning system was utilized to achieve a more specific output and a better understanding of the system's flow. According to Kendall and Kendall (2019), the design phase transforms requirements into system specifications, detailing architecture, database design, and user interfaces.

The Context Diagram

The CSS NCII e-learning material is accessible online through a browser using the link provided by the teacher. Twenty (20) computers are available for the twenty (20) students in the experimental group, all connected to the internet to access the system link. Once connected, the trainer logs in, and the students create accounts to access the system. The trainer instructs and guides them in operating the CSS NCII e-learning material.

The students take the pretest, and once completed, the results are immediately available. They then return to the dashboard and access the introduction to the topics. They are given enough time to read and explore the topics. Afterward, they can access all the lessons and e-learning materials provided by the system.

Once they finish the lessons and e-learning activities, the students take the post-test, which serves as their final evaluation. At this stage, they can no longer access the same pretest and post-test. The students can view their summary of scores, which is also accessible in the teacher's account.

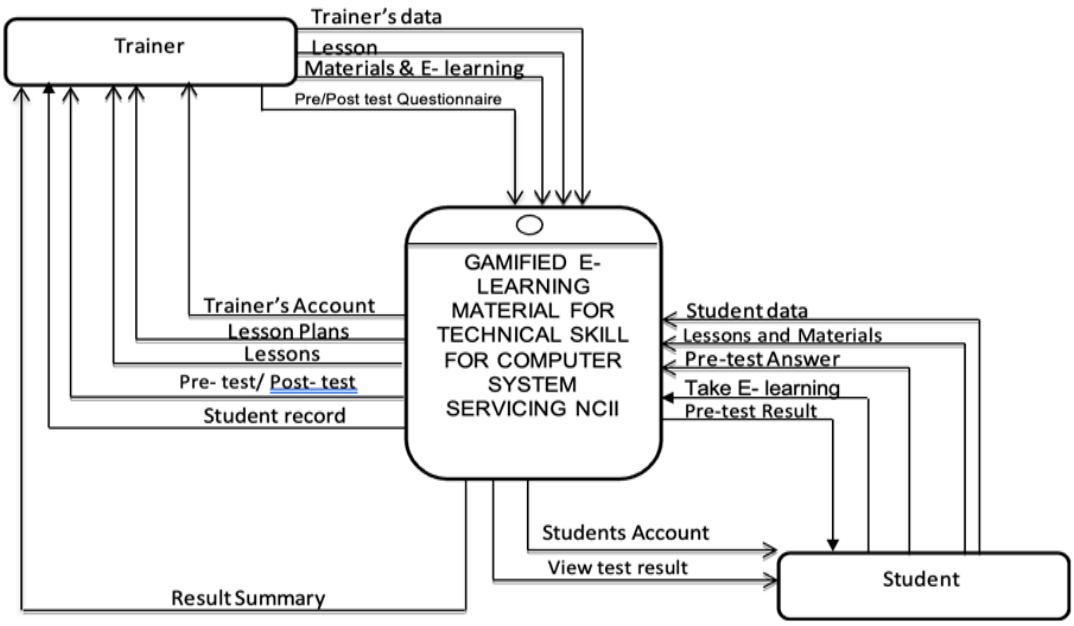

Figure 4. The Context Diagram of CSS NCII E-Learning Material for Technical Skill for Computer System Servicing NCII

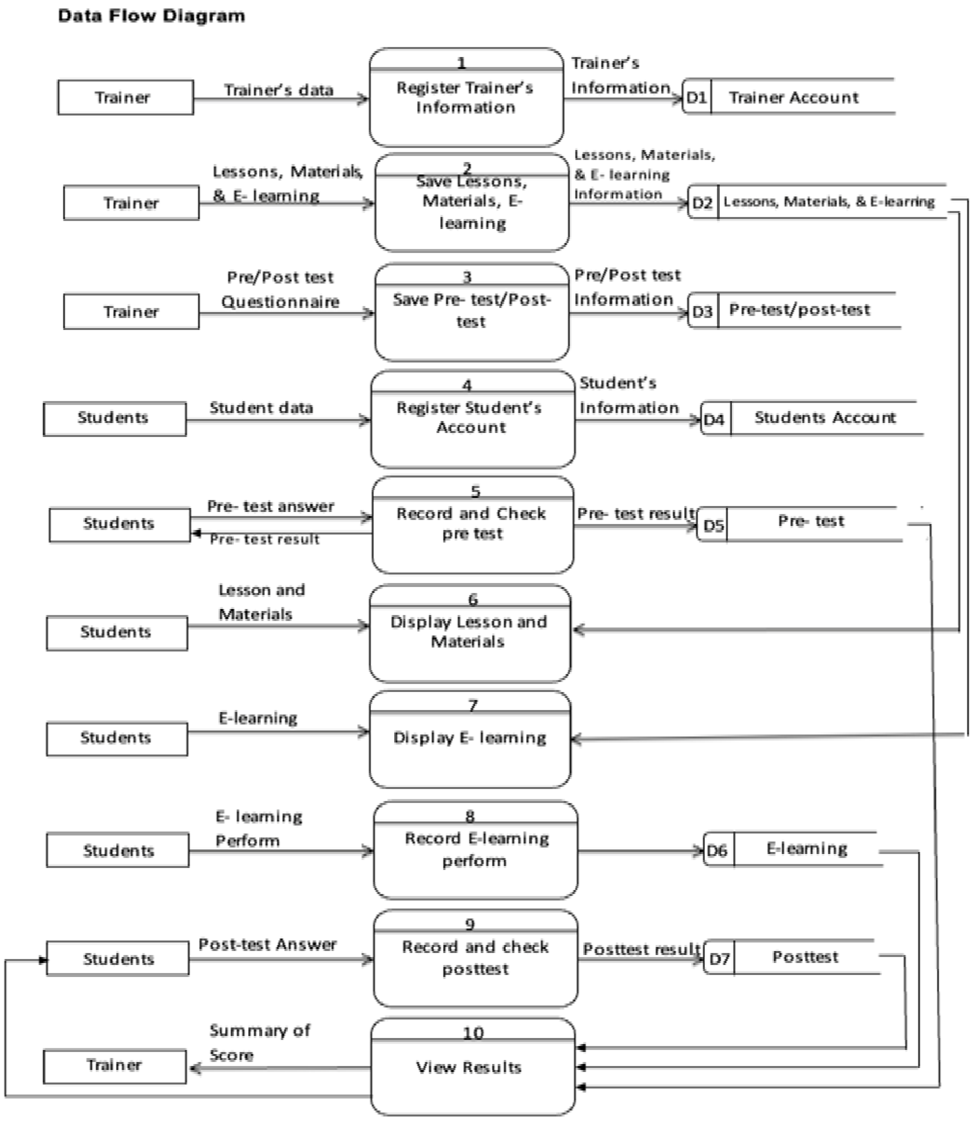

Figure 5. The Data Flow Diagram of CSS NCII E-Learning Material for Technical Skill for Computer System Servicing NCII

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Entity Relation Diagram

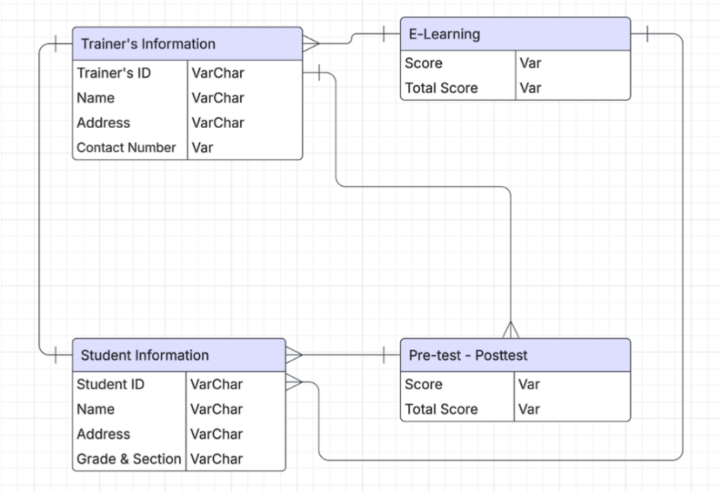

Figure 6. The Entity Relationship Diagram of CSS NCII E-Learning Material for Technical Skill for Computer System Servicing NCII

D. Implementation Phase

This phase ensured that the project was implemented, tested multiple times, and installed correctly. The researcher conducted final testing and observed for any errors or problems to ensure smooth operation. Users were trained on proper system usage, and the system was evaluated in this phase. According to Balaji and Murugaiyan (2012), the implementation phase involves coding, integration, testing, and deployment, ensuring the system functions as intended.

E. Support Phase

In this phase, to ensure the project continued running after deployment, the researcher provided support to end users, including administration, students, and trainers, through a help desk. The project was maintained and enhanced for future improvements based on updates to training regulations. According to Larman (2016), the support or maintenance phase involves bug fixes, system updates, and user support to enhance functionality and security.

Research Design

This study employed an experimental research design, specifically a pretest-post-test control group design for data collection. This research approach helped achieve the study's objectives by evaluating whether there is a significant difference between the conventional method and the proposed system based on students' achievement levels in the pretest and post-test.

Locale of the Study

Figure 7. The Map of King's College of Isulan

The study was conducted at King's College of Isulan, Kalawag I, Isulan, Sultan Kudarat, specifically for Junior High School Grade 10 students in the ICT subject. The researcher conducted classes using e-learning for the experimental group and the conventional method of teaching for the control group.

Because the institution is one of the TESDA-accredited Training and Assessment Centers for Computer System Servicing NC II in Sultan Kudarat, the researcher, who is an accredited trainer and assessor for this qualification, found it appropriate to study the effectiveness of e-learning at this grade level. The study aimed to determine whether e-learning could significantly enhance students' achievement levels. This method was deemed suitable as students in the current generation are 21st-century learners, eager to engage with technology in their education.

Additionally, under DepEd Order 06, Series of 2023, which provides guidelines on implementing the Joint Delivery Voucher Program for Senior High School Technical-Vocational-Livelihood (JDVP SHS-TVL) specializations for the 2022-2023 school year, Grade 10 students were required to undergo training to help them choose their strand in Senior High School.

King's College of Isulan caters to students from Kindergarten to College, offering degree programs such as Bachelor of Secondary Education and Bachelor of Elementary Education. The school also provides TESDA-accredited Tech-Voc courses, including Automotive Servicing and Computer System Servicing.

Respondents of the Study

The study selected one (1) section of Grade 10 students, comprising 40 Information and Communication Technology (ICT) students from King's College of Isulan. The students were divided into two (2) batches: Batch 1 (20 students) and Batch 2 (20 students). Using clustered sampling, Batch 2 was designated as the Experimental Group, while Batch 1 served as the Control Group.

Sampling Design

This study employed a cluster sampling technique specifically aimed at Grade 10 Junior High School students who are taking the Information and Communication Technology (ICT) subject. This method was selected for its practicality and effectiveness in educational research, especially when working with established groups like class sections (Creswell & Creswell, 2018). Rather than choosing individual students from various sections, entire class sections were randomly chosen to create the control and experimental groups. This strategy ensured that students within each group experienced similar learning environments, reducing external factors such as differences in teaching styles or schedules. Additionally, cluster sampling makes it easier to conduct pretests and post-tests, facilitating a more organized and systematic research process (Fraenkel, Wallen, & Hyun, 2019).

Data Gathering Procedure

The researcher obtained permission from the Principal of the Junior High School at King's College of Isulan through official letters to carry out the study. As noted by Creswell and Creswell (2018), acquiring institutional authorization is a vital aspect of ethical research practices. To ensure content validity, the researcher prepared and validated pretests and post-tests that were aligned with the units of competency, as advised by Fraenkel, Wallen, and Hyun (2019).

The materials were uploaded in PDF format, while the trainer entered the lessons into the system and integrated them into the CSS NCII E-Learning Materials. Assessment tools, including pretests and post-tests, were also incorporated into the system to categorize the test items appropriately.

Once the CSS NCII E-Learning Material for Technical Skills in Computer System Servicing NCII was developed, it was tested with the Experimental Group. The researcher, who also served as the trainer for Computer System Servicing NCII, guided the Experimental Group in utilizing the system. A Pretest was conducted before introducing the students to the lessons in the system to establish a baseline for future improvement (Gay, Mills, & Airasian, 2012). Following the Pretest, the lesson itself was delivered. Upon completing the lesson, a post-test was administered to evaluate the student's level of achievement.

The researcher gathered the data from the pretests and post-tests to assess whether there was a notable difference between the CSS NCII E-Learning Material and the traditional teaching method. The outcomes from both approaches, particularly concerning the pretests and post-tests, were then analyzed for comparison. Data collection for the research was conducted from September 2024 to March 2025.

Instrumentation

The researcher devised a survey questionnaire to determine the effectiveness, accuracy, and usability of the CSS NCII E-Learning Materials. The survey questionnaire was adapted from the Technology Acceptance Model (TAM) by Davis (1989). Data and responses were gathered from Junior High School students at King's College of Isulan to evaluate the system. The adapted survey questionnaire was used to assess the level of effectiveness, accuracy, and usability of the system.

To test and evaluate the accuracy of the outputs, such as pretests, post-tests, and the summary of results, the study utilized a discovery approach to testing. A correct set of pretest and post-test answer keys was prepared before starting the evaluation process. These answer keys were carefully determined and approved to ensure accuracy and the absence of errors, serving as the control output. Another set of outputs was then generated using the developed system, and any identified errors were compared against the control output. Errors were corrected by reviewing the formula and source code of the program, and this process was repeated until reliable data was obtained.

A validation of the pretest and post-test was conducted through a pilot test with Grade 11 Information and Communication Technology students at King's College of Isulan, Isulan, Sultan Kudarat since the actual respondents of the study were Junior High School ICT students. The results were statistically analyzed to determine the validated questions to be embedded in the system by calculating the index of difficulty and index of discrimination.

The researcher used the validated pretests and post-tests based on the unit of competency embedded in the system. Junior High School students took the Pretests before the lesson proper and the post-tests after completing the lessons. The system displayed a summary of the pretest and post-test results, which provided data to assess the students' level of achievement.

Statistical Treatment

To determine the pretest scores of students in the control and experimental groups, descriptive statistics such as the mean, standard deviation, minimum, and maximum scores were used. These statistical tools summarized thestudents' academic performance before the intervention using the CSS NC II e-learning material.

To determine whether there were significant differences in the pretest and post-test scores between the control and experimental groups an independent samples t-test was applied. This test was used to assess whether the two groups differed significantly in terms of their initial performance (pretest) and to measure the effectiveness of the e-learning intervention based on their performance after its use (post-test). Additionally, within-group comparisons were made to analyze improvements in each group over time, a paired samples t-test was used to determine the significance of changes from the pretest to the post-test within the same group.

To determine the level of perceived usefulness, perceived ease of use, and perceived accuracy of the developed e-learning system, descriptive statistics, specifically the weighted mean and standard deviation, were employed. The data were gathered through an adapted Technology Acceptance Model (TAM) Questionnaire. Results were interpreted using a seven-point scale with the corresponding qualitative descriptions as shown in Table 4.

Table 4. Adapted Technology Acceptance Model (TAM) Questionnaire Scale to Determine the Level of Perceived Usefulness, Perceived Ease of Use, and Perceived Accuracy of the CSS NCII E-Learning Materials.

Scale	Perceived Usefulness	Perceived ease of use	Perceived Accuracy
6.01- 7.00	Extremely Useful	Very easy to use	Extremely Accurate

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5.01- 6.00	Quite Useful	Quite easy to use	Quite Accurate
4.01- 5.00	Slightly Useful	Slightly easy to use	Slightly Accurate
3.01- 4.00	Neither	Neither	Neither
2.01- 3.00	Slightly Unuseful	Slightly not easy to use	Slightly inaccurate
1.01- 2.00	Quite Unuseful	Quite not easy to use	Quite inaccurate
0.00- 1.00	Extremely Unuseful	Extremely not easy to use	Extremely inaccurate

This chapter presents the results, interpretation, and analysis of the data gathered during the study. The findings are displayed in the following tables, accompanied by corresponding discussions and explanations. Additionally, this chapter addresses the specific research questions outlined in the previous chapters.

The results below reveal the perceived usefulness, perceived ease of use, and perceived accuracy of the E-learning materials. It also shows the level of achievement through its mean gain scores of both the conventional method and E-learning materials in terms of pretest and post-test. Additionally, the significant difference between the conventional method and E-learning materials in terms of pretest and post-test is presented as a basis for a reliable research study.

Pretest Scores of Students in the Control and Experimental Groups

Table 5. Comparison of the Mean Gain Score Between Control and Experimental Groups Based on Pretest Results.

Descriptive Statistics			
	n	Mean	Std. Deviation
CG Gain Score	20	13.00	1.589
EG Gain Score	20	14.40	4.160

Table 5 shows the mean gain score of both the Conventional Method and e-learning in terms of Pretest. Based on the results, the mean gain score of the control group using the conventional method in the Pretest is 13.00. On the other hand, the mean gain score of the experimental group using e-learning materials in the Pretest is 14.40. Comparing the mean scores of the two (2) methods in terms of the increase in student scores, Table 1 shows that the mean score of students who used E-learning is higher than that of students who were taught using the Conventional Method.

A study by Holley (2017) reported that students participating in e-learning achieved better grades than those who studied through traditional approaches. Thus, it implies that e-learning strategies can enhance student learning outcomes more effectively than conventional teaching methods.

Table 6. Significant Difference between the Pretest Using the Conventional Method and E-learning Materials.

Variables	t- statistic	Degree of freedom	p-value (2-tailed)	Decision	Interpretation
Pretest of Conventional Method and E-learning Material	-1.406	38	.168	Do not reject the Null Hypothesis	There is no significant difference.

Table 6 shows the pretest results of the experimental group with a mean score of 14.40 and a standard deviation of 4.160, while the control group obtained a mean score of 13.00 and a standard deviation of 1.589. Using an independent samples t-test, the computed p-value was 0.168, which is greater than the 0.05 level of significance. This indicates that there is no significant difference between the pretest scores of students who used the conventional method and those who used the e-learning materials. This result implies that both groups had comparable levels of prior knowledge before the intervention, thereby establishing a fair baseline. This supports the validity of any differences observed in the post-test scores, as they can be attributed more confidently to the use of the e-learning material rather than to initial differences in ability.

This aligns with Means et al. (2010), who assert that baseline equivalency between control and experimental groups must be established to confidently attribute post-intervention improvements to the teaching method, not pre-existing differences.

Table 7. Significant Difference Between the Post-test of Conventional Methods and E-learning Material.

Variables	t- statistic	Degree of freedom	p-value (2-tailed)	Decision	Interpretation
Post-test of Conventional Method and E-Learning Material	-4.126	38	.000	Reject Null Hypothesis	There is a significant difference

Table 7 shows that since the computed p-value is greater than the α, there is enough evidence to reject the test null hypothesis. It can, therefore, be interpreted that there is a significant difference between the post-test results using the conventional method and the post-test results using E-Learning Material.

This aligns with the findings of Bernard et al. (2014) and Sun and Rueda (2012), which highlight the benefits of technology-enhanced learning in improving student engagement and academic performance. The results reinforce the effectiveness of e-learning in fostering higher achievement levels compared to traditional instructional approaches, as supported by recent studies showing significant improvements in motivation, and academic outcomes when technology is integrated into educational environments.

Perceived Usefulness of the E-learning Materials for the CSS NC II System

Perceived usefulness is the degree to which a person thinks that utilizing a system would improve their performance (Davis, 1989). Users are more inclined to embrace and use technology if the users believe that it will benefit them and will increase productivity, efficiency, or results. According to Davis' research, people are more likely to employ tools that offer obvious benefits in their jobs, making Perceived usefulness one of the best indicators of technology adoption (Venkatesh & Davis, 2000).

Table 8. Perceived Usefulness of the E-learning Materials for the CSS NC II System.

Indicator	Mean	SD	Verbal description
1. The e-learning materials help me understand lessons better.	6.05	0.759	Extremely Useful
2. Using the e-learning materials improves my academic performance.	6.05	1.050	Extremely Useful
3. The e-learning materials make learning more efficient and effective.	6.15	1.182	Extremely Useful
4. I can complete my schoolwork more quickly using e-learning materials.	6.30	0.979	Extremely Useful
5. The e-learning materials help me retain information longer.	5.90	0.968	Quite Useful
Overall Mean	**6.10**	**0.1683**	**Extremely Useful**

Table 8 presents the evaluation results of the Perceived usefulness of the developed software. The e-learning system effectively helps students understand lessons, obtaining an average mean of 6.05 and a standard deviation of 0.759, which is interpreted as "Extremely Useful."

The use of e-learning materials also improves students' academic performance, with an average mean of 6.05 and a standard deviation of 1.050, interpreted as "Extremely Likely." Additionally, e-learning makes learning more efficient and effective, with an average mean of 6.15 and a standard deviation of 1.182, also interpreted as "Extremely Useful."

Furthermore, e-learning helps students complete their schoolwork more quickly, as reflected in an average mean of 6.30 and a standard deviation of 0.968, interpreted as "Extremely Likely." It also aids in information retention, with an average mean of 5.90 and a standard deviation of 0.968, interpreted as "Quite Useful."

The CSS NC II E-learning Materials were "Extremely Useful" in enhancing students' academic performance and learning experience, as evidenced by the overall mean score of 6.10 and standard deviation of 0.1683. As Sun, et al. (2008) stressed out, e-learning offers self-paced, interactive, and flexible learning options that improve student engagement and retention.

Perceived Ease of Use of the E-learning Materials for the CSS NC II System

Perceived ease of use, refers to the degree to which a person thinks that using a system will be straightforward (Davis, 1989). Users are more likely to accept a system if it is user-friendly and requires minimal effort to grasp. Davis noted that a user's willingness to engage with technology is significantly affected by how easy it is to use, since systems that are complex or difficult may impede their adoption (Venkatesh & Davis, 2000).

Table 9. Perceived Ease of Use of the E-learning Materials for the CSS NC II System.

Indicator	**Mean**	**SD**	**Verbal description**
1. The e-learning materials are easy to navigate and understand.	6.15	0.933	Very easy to use
2. I can quickly learn how to use the e-learning materials without much effort.	6.00	1.076	Very easy to use
3. The instructions and explanations in the materials are clear.	6.35	0.745	Very easy to use
4. The layout and design of the e-learning materials make learning easy.	6.45	0.686	Very easy to use
5. I feel comfortable using the e-learning materials on my own.	6.50	0.688	Very easy to use
Overall Mean	**6.33**	**0.225**	**Very easy to use**

Table 9 presents the evaluation results indicating that the e-learning material was easy to navigate and understand, with a mean score of 6.15 and a standard deviation of 0.933, corresponding to the interpretation "Very Easy to Use."

Students quickly understood how to use the e-learning materials, obtaining an average mean of 6.00 and a standard deviation of 1.076, also interpreted as "Extremely Likely." The instructions and explanations embedded in the system were clear and easy to understand, with an average mean of 6.35 and a standard deviation of 0.745, interpreted as "Very easy to use."

The system's layout and design were found to be learner-friendly, achieving an average mean of 6.45 and a standard deviation of 0.686, interpreted as "Extremely Likely." Additionally, students felt comfortable using the E-learning material, as reflected in an average mean of 6.50 and a standard deviation of 0.688, also interpreted as “Very easy to use.”

The average score of 6.33, along with a standard deviation of 0.225, confirms that the CSS NC II e-learning materials were considered “Very Easy to Use.” This study aligns with the findings of Al-Fraihat, et al. (2020), which emphasized, that well-structured e-learning platforms enhance user experience through improved system clarity and accessibility, which in turn fosters greater learner engagement and effectiveness.

Perceived Accuracy of the E-learning Materials for the CSS NC II System

Perceived accuracy was added to the Technology Acceptance Model (TAM) by Wixom and Todd (2005) as extra variables influencing technology adoption. It was stressed that the information is correct and the content is pertinent and well-organized, the users more likely to trust and embrace the system. This demonstrates that information quality and trustworthiness impact user satisfaction and technology adoption in addition to usefulness and ease of use (DeLone & McLean, 2003).

Table 10. Perceived Accuracy of Content of the E-learning Materials for the CSS NC II System.

Indicator	Mean	SD	Verbal description
11. The information in the e-learning materials is correct and reliable.	6.00	1.026	Extremely Accurate
12. The examples and explanations provided are relevant and accurate.	6.10	0.788	Extremely Accurate
13. The e-learning materials provide up-to-date and factual content.	5.90	0.788	Quite Accurate
14. The activities and exercises match what I need to learn in my subject.	6.25	0.716	Extremely Accurate
15. The assessments (quizzes, tests) in the materials reflect my understanding accurately.	6.25	0.851	Extremely Accurate
Overall Mean	**6.13**	**0.166**	**Extremely Accurate**

Table 10 presents the results of the evaluation of the perceived accuracy of the CSS NC II E-learning material. The e-learning material contained correct and reliable data, as evidenced by an average mean of 6.00 and a standard deviation of 1.026, interpreted as “Extremely Accurate.”

The examples and explanations embedded in the system were relevant and accurate, with an average mean of 6.10 and a standard deviation of 0.788, also interpreted as “Extremely Accurate.” Additionally, the content provided updated and factual information necessary for students, achieving an average mean of 5.90 and a standard deviation of 0.788.

The activities and exercises aligned with the lessons discussed in the system, obtaining an average mean of 6.25 and a standard deviation of 0.716, interpreted as “Quite Accurate.” The assessments, such as quizzes and tests, accurately reflected the lessons learned in the system, with an average mean of 6.25 and a standard deviation of 0.851, interpreted as “Extremely Accurate.”

Furthermore, students felt comfortable using the E-learning material, which received an average mean of 6.50 and a standard deviation of 0.688, interpreted as “Extremely Accurate.”

The results aligned with the study of Al-Fraihat, et al. (2020), which emphasized, that top-notch educational content enhances student involvement, retention of knowledge, and overall satisfaction, ultimately leading to increased success in e-learning.

CONCLUSION, AND RECOMMENDATION

Conclusion

Based on the summary of findings, the following conclusions are drawn:

1. Students who used e-learning materials demonstrated a marginally higher baseline knowledge level compared to those taught through traditional methods.

2. Both the conventional method and the e-learning are equivalent at baseline in terms of their initial knowledge of the CSS subject.

3. Students utilizing e-learning resources demonstrated significantly higher performance compared to those taught through conventional methods.

4. CSS NC II e-learning materials are highly effective, user-friendly, and contain reliable information making them a valuable resource for enhancing learning outcomes.

Recommendations

Based on the summary of findings and conclusions derived from this study, the following recommendations are suggested:

1. Educators should explore and maximize the most effective e-learning features to enhance student performance. Adapting digital tools to different learning styles can help optimize their benefits.

2. Long-term studies should assess the sustained impact of e-learning, including student motivation and engagement. Additional factors influencing learning outcomes should also be considered.

3. Educators should integrate e-learning into their teaching methods, ensuring proper training for effective implementation. Schools should support teachers in adapting to digital learning environments.

4. E-learning materials should be regularly updated based on student feedback to enhance engagement. Adding interactive elements such as gamification and multimedia can further improve learning experiences. It should also be maintained while improving accessibility. Providing tutorials or guides can help ensure all students benefit from digital resources. The content should be regularly reviewed and updated to maintain accuracy and relevance. Collaborating with experts and incorporating real-world applications can further enhance instructional quality.

5. Future studies aiming at boosting educational techniques and further improving the caliber of digital learning experiences can be built upon the e-learning platform.

REFERENCES

1. Arcas, P., et al., (2022, July). The motivational power of mobile CSS NCII exercise apps.Cuadernos de Gestion 23(2). DOI: 10.5295/cdg.211629pb p
2. Aguilos, V., Fuchs, K., (2022, July 6). The Perceived Usefulness of CSS NCII E
3. Learning: A Study of Undergraduate Students With Implications for Higher Education. Frontiers Media S.A. Volume 7 - 2022 | https://doi.org/10.3389/feduc.2022.945536
4. Alsadoon, E., Alkhawajah, A., et al., (2022, August) Effects of a CSS NCII Learning Environment on Students' Achievement, Motivations, and Satisfaction. Science Direct. https://doi.org/10.1016/j.heliyon.2022.e10249
5. Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating e-learning systems success: An empirical study. Computers in Human Behavior, 102, 67-86.

6. Al-Rahmi, W. M., Yahaya, N., Alamri, M. M., Aljeraiwi, A. A., & Kamin, Y. B. (2018). How effective is e-learning in higher education? Empirical evidence from learning management systems. Education and Information Technologies, 23(6), 2763–2797.
7. Al-Qahtani, A. A., & Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. Journal of Computer Assisted Learning, 29(3), 220–234. https://doi.org/10.1111/jcal.12022
8. Balaji, S., & Murugaiyan, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. International Journal of Information Technology and Business Management, 2(1), 26–30.
9. Bautista, R., & Lim, M. (2021). Adoption of e-learning strategies in Technical Vocational-Livelihood education in the Philippines: Online modules, video tutorials, and simulations in Computer System Servicing (CSS) NC II. Journal of Vocational Education and Training, 45(3), 78-90.
10. Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, P. C. (2014). A Meta-analysis of blended learning and technology use in higher education: From the general to the applied. Journal of Computing in Higher Education, 26(1), 87–122. https://doi.org/10.1007/s12528-013-9077-3.
11. Bernardo, A. (2020). Effects of digital learning modules on ICT high school students. Philippine Journal of Educational Technology, 25(1), 45–58.
12. Burcu, F. (2023, August). Role of the Students' Styles on Motivation and Perception towards CSS NCII Learning Process. Journal of Learning and Teaching in Digital Age. DOI: 0.53850/joltida.1293970
13. Clark, R. C., & Mayer, R. E. (2016). E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning (4th ed.). Wiley.
14. Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). SAGE Publications.
15. Daskan, A., & Yildiz, Y. (2020). Blended learning: A potential approach to promote learning outcomes. International Journal of Social Sciences & Educational Studies, 7(4), 103–108. https://doi.org/10.23918/ijsses.v7i4p103
16. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008
17. DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. Journal of Management Information Systems, 19(4), 9-30.
18. Delos Santos, K. R. (2022). Multimedia and academic performance in vocational programs: A meta-analysis. Journal of Technical Education, 34(2), 67–75.
19. Department of Education. (2023). DepEd Order No. 6, s. 2023: Guidelines on the implementation of the Joint Delivery Voucher Program for Senior High School Technical-Vocational-Livelihood (JDVP SHS-TVL) specializations for School Year 2022-2023. https://www.deped.gov.ph
20. Encarnacion, R. E., Galang, A. D., & Hallar, B. A. (2021). The impact and effectiveness of e-learning on teaching and learning. International Journal of Computing Sciences Research, 5(1), 383-397. doi: 10.25147/ijcsr.2017.001.1.47
21. Fan, J., & Wang, Z. (2020, July). The impact of CSS NCII interaction on mobile learning APP user's learning performance: the moderating effect of users' learning style. Behavior and Information Technology. DOI: 10.1080/0144929X.2020.1787516
22. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). How to Design and Evaluate Research in Education (10th ed.). McGraw-Hill.
23. Gay, L. R., Mills, G. E., & Airasian, P. (2012). Educational Research: Competencies for Analysis and Applications (10th ed.). Pearson.
24. Gaw, R., & Pasa, M. (2021). Blended learning effectiveness in TVL strand during the pandemic. Journal of Philippine Education, 40(3), 120–130.

25. Hellin, C., Esteban, F., et al., (2023, September 24) Enhancing Student Motivation and Engagement through a CSS NCII Learning Environment. Computer Science Department, University of Alcala, 28801 Alcala de Henares, Spain.Sustainability 2023, 15(19),14119; https://doi.org/10.3390/su151914119
26. Holley, D. (2017). E-learning effectiveness: Comparing online and traditional learning outcomes. Journal of Educational Research and Practice, 7(1), 34–42.
27. Kendall, K. E., & Kendall, J. E. (2019). Systems analysis and design (10th ed.). Pearson.
28. Larman, C. (2016). Applying UML and patterns: An introduction to object-oriented analysis and design and iterative development (3rd ed.). Pearson Education.
29. Lazarenko, S., & Hapchuk, V. (2023). AI-driven tools and immersive technologies in education: Personalizing instruction and enhancing student engagement in Germany and Austria. Journal of Educational Innovation, 34(2), 45-60.
30. Lim, C. Y., & Tan, W. H. (2023). E-learning in vocational education: An Asian perspective. Journal of Educational Research and Innovation, 20(2), 90–103.
31. Lee, Y. H. (2018). Effects of Gamification on Student Motivation in Online Learning. Journal of Educational Technology & Society, 21(1), 310-322
32. Manalo, F. D., Santos, M. E., & De Guzman, R. A. (2020). Self-paced learning through digital platforms and its impact on student performance in technical-vocational courses. Philippine Journal of Educational Technology, 7(2), 55–68.
33. Manalo, J., & de Leon, K. (2022). Digital modules and academic engagement in Region IV-A. TVL Education Quarterly, 18(4), 55–63.
34. Mateo, J. (2020, August 2). Tech woes among top concerns for distance learning. The Philippine Star. https://www.philstar.com/headlines/2020/08/02/2032336/tech-woes among-topconcerns-distance-learning
35. Mayer, R. E. (2020). Multimedia learning (3rd ed.). Cambridge University Press.
36. McLeod, S. (2019). Constructivism as a theory for teaching and learning. Simply Psychology. https://www.simplypsychology.org/constructivism.html
37. Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). Evaluation of Evidence-based practices in online learning: A meta-analysis and review of online learning studies. U.S. Department of Education. Retrieved from https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf
38. Mothibi, G. (2015). A meta-analysis of the relationship between e-learning and students' academic achievement in higher education. Journal of Education and Practice, 6(9), 6–9. https://eric.ed.gov/?id=EJ1082408
39. National University. (2022). Challenges in online education: Teacher preparedness and institutional readiness. National University Press.
40. Nicolaidou, I., et al. (2019, July). Development and usability of a CSS NCII app to help children manage stress: an evaluation study. DOI: 10.17471/2499 4324/1050
41. Osadcha, O., Osadchyi, V., & Spirin, A. (2021). Adoption of e-learning models in Chinese universities: Blended learning, micro-learning, and mobile platforms. Journal of Educational Technology, 29(4), 112-125.
42. Pacheco, J. A. (2020, November 24). The “new normal” in education. Springer.https://link.springer.com/article/10.1007/s11125-020-09521-x#citeas
43. Pappas, C. (2021). A guide to successful evaluation of online learning materials. E-learning Studio. Retrieved from https://flearningstudio.com/a-guide-to successful-evaluation-ofonline-learning-materials
44. Piaget, J. (1952). The origins of intelligence in children. Norton.

45. Pressman, R. S. (2014). Software engineering: A practitioner's approach (8th ed.). McGraw-Hill Education.
46. Pyae, A. (2023, May). Empowering Student Learning: A Human-centered CSS NCII system to alleviate procrastination.
47. Reyes, A., & Alvarez, J. (2021). Barriers to e-learning in rural vocational schools. Philippine Journal of Educational Development, 28(1), 88–99.
48. Rivera, L. J., & Corpuz, M. A. (2022). The effectiveness of integrated e-learning platforms in improving assessment performance of technical-vocational students. Journal of Technical Education and Training, 10(1), 44–59.
49. Santos, K. D., & Reyes, A. M. (2023). Enhancing learning outcomes through multimedia-based modules in Computer System Servicing NC II. TESDA Research and Development Journal, 11(3), 31–46.
50. Saprikis, V., et al., (2020, September). CSS NCII Mobile APPS in Health and Fitness. Conference: XIV Balkan Conference on Operations Research (Virtual Balcor 2020)At: Thessaloniki, Greece. Retrieved from:https://www.researchgate.net/publication/357900477_CSSNCII_MOBIE_APPS_IN_HEALTH_AND_FITNESS
51. Sommerville, I. (2015). Software engineering (10th ed.). Pearson Education.
52. Strmečki, D., Bernik, A., & Radošević, D., (2018, February 19), Gamification in E Learning: Introducing CSS NCII Design Elements into E-Learning Systems. Journal of Computer Sciences 2015, 11 (12): 1108.1117 DOI: 10.3844/jcssp.2015.1108.1117
53. Subiyantoro, S., et al., (2024, January). Developing CSS NCII Learning Management Systems to increase students engagement in online learning environments. International Journal of Information. DOI: 10.18178/ijiet.2024.14.1.2020
54. Sun, J. C. Y., & Rueda, R. (2012). Situational interest, computer self-efficacy, and self-regulation: Their impact on student engagement in distance education. British Journal of Educational Technology, 43(2), 191–204. https://doi.org/10.1111/j.14678535.2010.01157.x
55. Sun, P., Tsai, R. J., Finger, G., Chen, Y., & Yeh, D. (2008). What drives a successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education, 50(4), 1183-1202.
56. TESDA. (2022). Blended learning strategies in Technical-Vocational-Livelihood education: Enhancing both theoretical knowledge and hands-on skills. Technical Education and Skills Development Authority.
57. Torres, D., & Lim, S. (2021). E-learning and practical performance of CSS NC II students. TVET Journal of the Philippines, 10(2), 77–86.
58. U.S. Department of Education. (2010). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. Retrieved from https://www.ed.gov
59. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 46(2), 186-204.
60. Villanueva, P. R., & Santos, M. J. (2021). Blended learning and academic performance of senior high school students in technical-vocational tracks. Asian Journal of Educational Research, 8(4), 88–101.
61. Vohra, S., et al. (2022, January). Engaging Students with CSS NCII Learning Apps: The Role of Teacher Intervention. In book: Mobility for Smart Cities and Regional Development - Challenges for Higher Education. DOI: 10.1007/978-3-030 93904-5_72
62. Wacas, R. U. (2024). Effectiveness of e-learning in the new normal: A quasi-experimental approach. https://fliphtml5.com/lynzw/lsjf/Research/
63. Wacas, R. U. (2020). Effectiveness of e-learning technology on the performance of the CSS NC II trainees (Computer Systems Servicing) of TESDA accredited training centers in TESDA-Kalinga.

International Journal of English Literature and Social Sciences (IJELS), 5(6), 2398–2405. https://doi.org/10.22161/ijels.56.77

64. Wixom, B. H., & Todd, P. A. (2005). A Theoretical Integration of User Satisfaction and Technology Acceptance. Information Systems Research, 16(1), 85-102.https://doi.org/10.1287/isre.1050.0042
65. Zecri, E., et al., (2023, November). A CSS NCII e-learning model based on the one-size-fits-all model and the static and dynamic adaption model. Journal of Theoretical and Applied Information. Retrieved from: https://www.researchgate.net/publication/378261569_A_CSSNCII_e-learning_model_based_on_the_one-size-fits all_model_and_the_static_and_dynamic_adaptation_model
66. Zheng, E., & Wang, Q. (2023, September). Effectiveness of Online Collaborative Learning in CSS NCII Environments. International Journal of Emerging Technology. DOI: 10.3991/ijet.v18i17.42851