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# Diversity in Utilization of IT Infrastructures among State Universities and Colleges (SUCS) and Employment Markets in CARAGA Administrative Region

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**ABSTRACT**

The paper focused on determining the extent how the students were taught the IT Infrastructures among SUC's and the extent to which the employment market used the IT Infrastructures in CARAGA administrative region. The respondents were the IT Teachers and Computer Course Students or IT Students of SUC's and IT Experts from the Industry of CARAGA region. They were made to answer the research-made instruments the contents of which were based on the variables of interest. The gathered data were statistically analyzed using both the descriptive and inferential statistical tools. The hypotheses were tested at a 5% margin of error. The study disclosed that the students were taught less from what the industry needs. The student claimed the highest was on the Website. The findings led to curriculum enhancement and thoroughly maintain monitoring.

***KEYWORDS:*** *IT Infrastructures, IT Instructors/Teachers, IT Students, Computer/IT Curriculum, IT Experts, IT Industry*

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## INTRODUCTION

Determining the fundamental constructs of contemporary and old version programming languages is a vital recipe for new sprout programmers (Sebesta, 2016). In Spain, Computer Science was integrated into K-12 education, due to the positive results obtained in the said research. It was recommended to implement the setting in 5th and 6th grade in primary (Sáez-López, et.al, 2016). There is one report that proposes developing a rigorous undergraduate curriculum for computer science and it intends to model not only for high-quality colleges and universities but also for larger universities with strong computer science programs in a liberal arts setting (Gibbs & Tucker, 1986). This leads to help teachers' introductory programming courses in choosing appropriate first languages and in helping students to overcome the challenges they face (Stefik & Siebert, 2013). The modern programming language industry now has a large variety of incompatible programming languages, each of which with unique syntax, semantics, toolsets, and often their standard libraries, lifetimes, and coasts (Stefik & Hanenberg, October 2014). The study also aims to evaluate the significant differences between the programming languages taught among SUC's in CARAGA and the programming languages being adopted by the employment market.

Programming is more than just coding, for it exposes students to computational thinking which involves problem-solving using computer science concepts like abstraction and decomposition (Lye & Koh, 2014). The dynamic and reflective features of programming languages are powerful constructs that programmers often mention as extremely useful (Callaú, Robbes, Tanter, & Röthlisberger, 2013). Sometimes debates on programming languages are more religious than scientific (Nanz & Furia, 2015). According to Cass, (2015), a question like "what are the most popular programming languages?" but the only honest answer, depends on what are you trying to land a job at hot mobile app startup, model electricity flows across a continent, or create an electronic art project. SUC's in the Philippines in Region VI integrate a framework for ICT-based development programs for teachers (Magallanes, 2014). According to Bringula, et.al., (2016), very few studies have been conducted in the Philippines to determine if the curriculum sufficiently addresses the needs of the industries.

On the other hand, difficulties faced by the students increase, and demotivation is common in many novice-programming students, who are not able to cope with natural difficulties associated with programming learning (Gomes & Mendes, 2014). The extremely dynamic features like JavaScript make it very difficult to define and detect errors in JavaScript applications (Bae, Cho, Lim, & Ryu, 2014). According to Lister, (2016), he does not claim that it is the only right position, the contrary he alludes to other philosophical position that is regarded as complementary to his own. Many claims and many do not claim, on what is the best programming languages, although others said it depends on the use the programmer itself should consider the updated programming language and the environment that it can be used for running it. In the Philippines, only a few among SUC's are seriously looking at the trends and how suitable a programming language is to a certain course subject.

A curriculum visit will be recommended to address the difficulties encountered by the students. It is relevant to revisit the curriculum especially the subject with laboratories related to computer programming. It should undergo and limit the difficulties by year level and align the programming language used from first to fourth-year level. The programming language to be used will undergo verification if the market needs it. The core foundation of a computer course should be taught aligning it with its originality and applying sustainable and attainable computer courses which are updated on the trends of digital computing.

**Theoretical Framework**

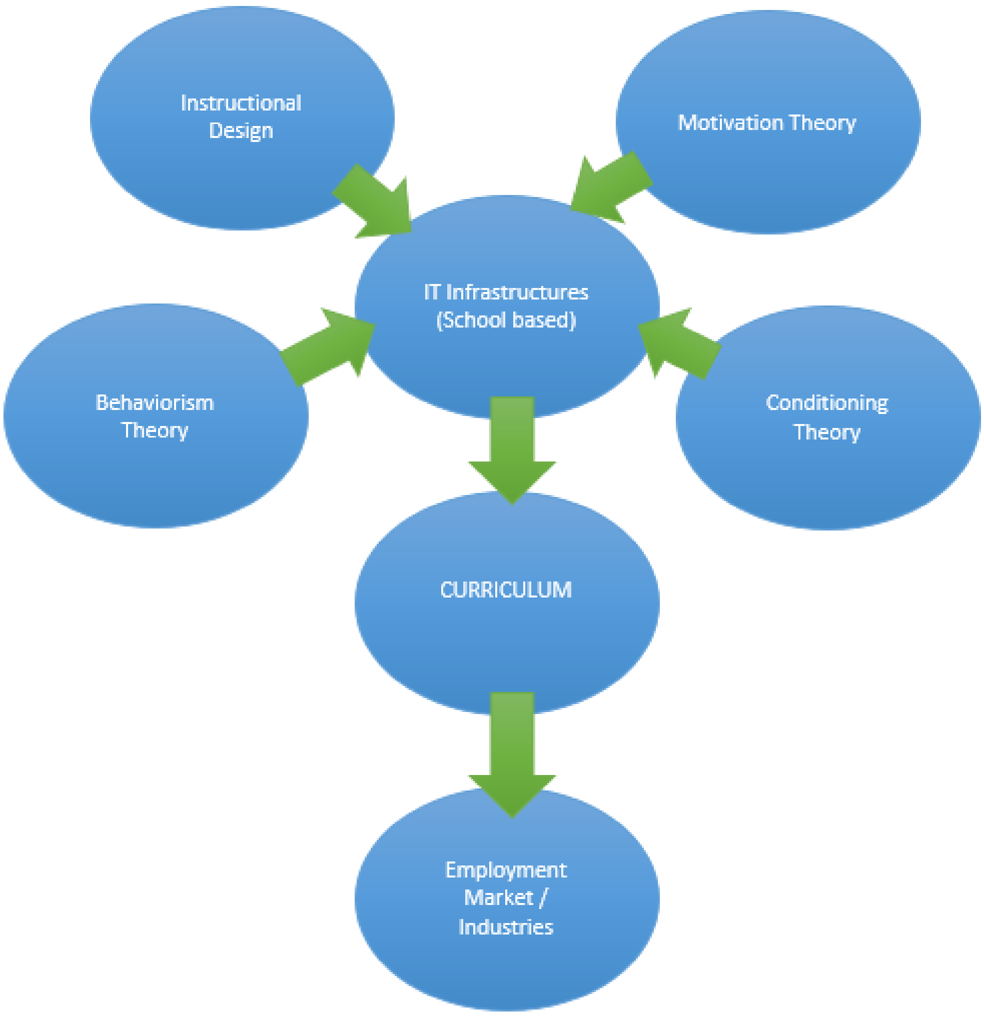


**Figure 1 Theoretical Model**

The present study underscores the learning theories that prod the formulation of the model of its interest. These theories guided the researcher in the restructuring of existing concepts and the formulation of problems of the present study. This theoretical model is anchored on the four (4) theories of instructional design theory, motivation theory, behaviorism theory, and conditioning theory as elucidated in Figure 1. These theories have their peculiarities when joined together and develop into another educational philosophy leading to the management of technology, which this investigation is designed to formulate.

**Conceptual Framework**

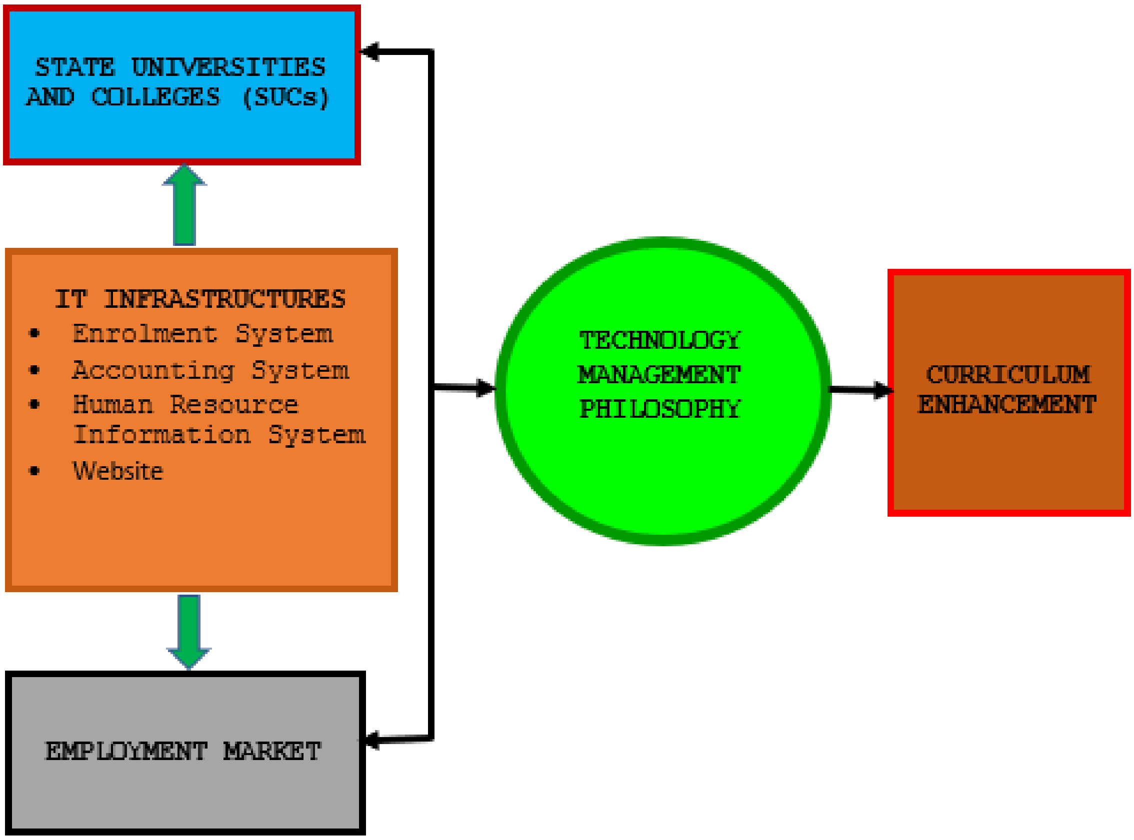


**Figure 2 Research Paradigm**

The structuring of concepts in this study is introduced in Figure 2. The Figure presents the five frames of concepts that show the interacting forces showing the possible match or mismatch between the IT infrastructures taught in school and also used in the employment markets. The flow of data analysis concentrates on the findings that lead to the formulation of a technology management philosophy that powers the development of curricular enhancement. Technology management philosophy serves as the potent force in the deeper examination of realities in the field based on data and a reference of technological innovation of curriculum.

## RESEARCH DESIGN AND METHODS

The descriptive survey research, inferential, and correlation design were used in this study. This was deemed appropriate as the study dealt with the IT infrastructures taught in selected SUC's and the IT infrastructures market demands.

The inferential design employing the differential was used to determine the presence or absence of significant difference among the ratings of respondents in the problems on the IT infrastructures taught in selected SUC's and the IT infrastructures market demands. In this design, the correlation method was used to determine the presence of a significant relationship between the problems on the IT infrastructures taught in selected SUC's and the IT infrastructures market demands.

### Research Environment

The study was conducted within the selected SUC's in CARAGA. There are four SUC's in CARAGA located in every province.

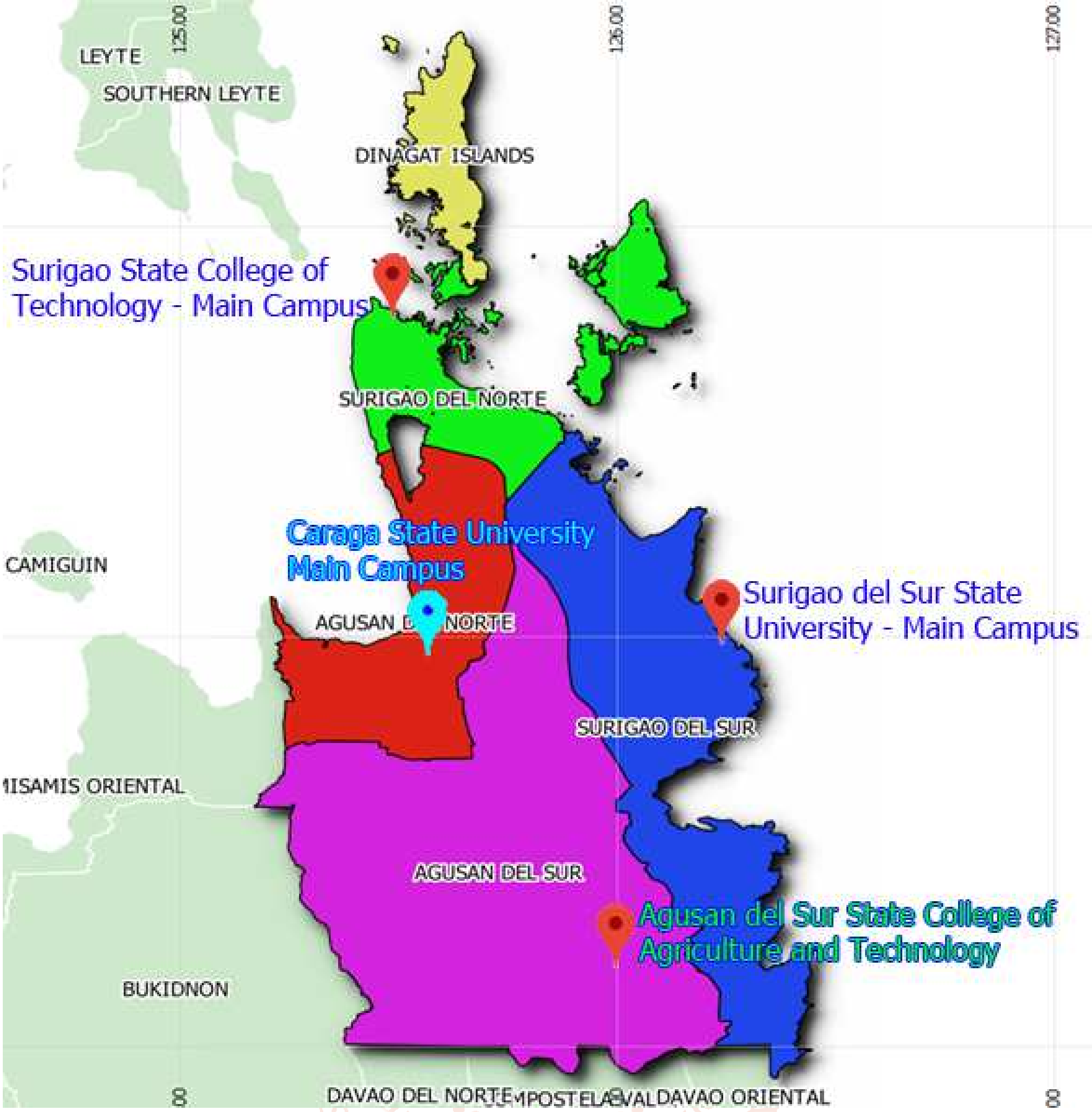


**Plate 1 Map of CARAGA**

**Research Instrument**

The researcher-made survey instrument was utilized as a tool for data gathering. There were three sets of instruments, one for the IT teachers (Appendix A), the second for IT Students (Appendix B), and the third will be for the IT heads and workers of the target employment markets (Appendix C). The questionnaire will be composed of three parts.

Part I dealt with information about the source of information as to school and the subject or grade level taught by the respondent. Part II has consisted of items that asked for the use of IT infrastructures taught in ICT courses.

**Validity**. The questionnaires were validated in terms of their content. A draft of the instrument was presented to the adviser and panel of experts for comments and suggestions and the refinement of the said questionnaire. Changes were made and followed, a dry run of the instrument was conducted among selected respondents. With a positive response from the dry run, reliability testing of the instrument followed.

**Reliability**. This process was initiated after the content validity was established. The researcher employed the run-rerun method where copies of the same instrument were conducted twice to the same respondents observing an hour interval. The reliability was established using the Pearson Product-Moment Correlation Coefficient and the result was shown in Appendix D.

**Respondents**

The respondents of this study were the students and Instructors/Professors of selected SUC's in CARAGA. In getting the sample size for the students the researcher utilized the lynch law. For the Instructors/Professors, the conventional method was used.

**Table 1 Distribution of Respondents**

| State, Universities and Colleges | IT Teachers | IT Students | IT Heads of Industry/Agency | TOTAL |
|---|---|---|---|---|
| Surigao State College of Technology - Main (SSCT) | 8 | 93 | | **101** |
| Surigao del Sur State University – Main (SDSSU) | 8 | 49 | | **57** |
| Caraga State University – Main (CarSU) | 4 | 48 | | **52** |
| Agusan del Sur State College of Agriculture and Technology – Bunawan(ASSCAT) | 4 | 60 | | **64** |
| CARAGA Region | | | 11 | **11** |
| **TOTAL** | **24** | **250** | **11** | **285** |

**Ethics and Data Gathering Procedure**

Before the conduct of the study, the researcher asked permission from the President of every SUC in CARAGA (Appendix E). The letters were verified and noted by the Adviser. The request includes the process of establishing validity, reliability, and final conduct of the instrument for the study.

After the letter was approved by the President of the SUC in CARAGA the researcher personally conducted the survey instrument, stressing the purpose of the study to the respondents. After the survey instrument was answered by the respondents, the retrieval, collection, tallying, interpretation, and analysis followed.

**Data Analysis**

The data were analyzed and interpreted with the following statistical tools:

**Weighted Mean and Ordinal rank**. These were used to determine the extent to which the students are taught the IT infrastructures and the extent the employment market used the IT infrastructures.

**Pearson Product Moment Correlation** and **t-test**. These tools were employed to test if there is a significant difference in the application of IT infrastructures and a significant difference between what is taught in State Universities and Colleges and those used in employment markets.

**One-Way Analysis of Variance for Correlated Samples**. This tool was used to determine the significant difference among the faculty and student extent of teaching the IT infrastructures and the difference in the extent of utilization of the IT infrastructures.

**Scheffé Post-Hoc Test**. This tool was used to determine which among the factor yielded the significant difference.

**RESULTS AND DISCUSSIONS**

**Extent of Teaching the IT Infrastructure**

The answers to the sub-problem on the extent the IT faculty taught their students on the IT infrastructure are presented though the data and discussions in this section. The data to base the answers are reflected in Tables 4 to 7.

**Teacher Ratings**. The IT faculty ratings on the extent to which they taught their students on IT infrastructure are introduced in the data of Tables 4 and 5.

1. ***Enrolment System***. The data in Table 4 showed that the IT faculty taught their students the highest on "cabling" as marked by the overall mean of 1.72, and which was evaluated at "high" extent of teaching. This rating covered the teaching "Cat5" with the mean of 1.88, at "high" extent, then followed by the "Cat6" that got the mean of 1.83, also at "high" extent. The least taught in cabling infrastructure was the "fiber optic" that obtained the mean of 1.46, claimed at "low" extent of teaching.

**Table 4 Teacher Ratings on the Extent of Teaching their Students of IT Infrastructure on Enrolment and Accounting Systems**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Enrolment System** | | | |
| 1. **Server** | | | |
| 1.1 Tower Server | 1.67 | High | 1 |
| 1.2 Rack Server | 1.04 | Low | 2 |
| 1.3 Blade Server | 0.88 | Low | 3 |
| ***Overall Mean*** | ***1.19*** | ***Low*** | ***(3)*** |

| | | | |
|---|---|---|---|
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.88 | High | 1 |
| 2.2 Cat6 | 1.83 | High | 2 |
| 2.3 Fiber optic | 1.46 | Low | 3 |
| ***Overall Mean*** | ***1.72*** | ***High*** | ***(1)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.58 | High | 2 |
| 3.2 10/100/1000 | 1.83 | High | 1 |
| ***Overall Mean*** | ***1.71*** | ***High*** | ***(2)*** |
| ***GRAND MEAN*** | ***1.54*** | ***High*** | ***-*** |
| **B. Accounting System** | | | |
| 1. **Server** | | | |
| 1.1 Tower Server | 1.54 | High | 1 |
| 1.2 Rack Server | 0.83 | Low | 2 |
| 1.3 Blade Server | 0.75 | Low | 3 |
| ***Overall Mean*** | ***1.04*** | Low | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.75 | High | 2 |
| 2.2 Cat6 | 1.79 | High | 1 |
| 2.3 Fiber optic | 1.25 | Low | 3 |
| ***Overall Mean*** | ***1.60*** | High | ***(1.5)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.54 | High | 2 |
| 3.2 10/100/1000 | 1.67 | High | 1 |
| ***Overall Mean*** | ***1.60*** | High | ***(1.5)*** |
| ***GRAND MEAN*** | ***1.41*** | ***High*** | ***-*** |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

The second extent of teaching the IT infrastructure went to "switch" with the overall mean of 1.71 to stand for the "high" extent of teaching. It embraced the teaching of "10/100/1000" that got the mean of 1.83, then the "10/100" with the mean of 1.58, where both were evaluated at "high" extent of teaching.

The third in rank that marked the overall mean of 1.19, and evaluated at "low" extent of teaching was on the "server". It constituted the teaching of "tower server" that had the mean of 1.67 and evaluated as "high" extent of teaching, then followed by the "rack server" with the mean of 1.04, at "low" extent, then the least was on "blade server" that obtained the mean of 0.88, described as "low" extent of teaching.

The teaching of IT infrastructure on enrollment system was found at "high" extent as supported by the obtained grand mean of 1.54. This stresses the notion that the students were not taught at optimal level in this system. This led to the concept that the students are insufficient of their knowledge and skills on this system.

Software development and maintenance are costly endeavor (Flanagan, C.et.al, 2013). Many State Universities and Colleges are suffering because of the outsource programmers or industry that develop a system to provide system. An aid coming from outsource programmers or industries is hard to maintain. After deploying the system provided by the programmers or industries they certainly give free maintenance at first but after a months this provider will demand additional payments for software maintenance and hardware maintenance. In the long run, the provider is like taking the SUC's as a hostage that it cannot say no to what they are demanding.

If the provider itself is the user or the SUC's has built a team of programmers with the composition of the faculty and student of IT, SUC's will never be a hostage by some scrupulous industries. The impact in this composition will hit to the core. Teaching the students with full blast of knowledge about enrollment system and other system which can be use inside the school premises.

***2. Accounting System***. From the same data in Table 4, the IT faculty yielded their answers that their highest went to both "Cabling" and "Switch" as marked by the overall mean of 1.60, and which was evaluated at "high" extent of teaching. This rating covered the teaching "Cat6" and "10/100/1000" with the mean of 1.79 and 1.67, at "high" extent, then followed by the "Cat5" and "10/100" that got the mean of 1.75 and 1.54, also at "high" extent. The least taught in cabling infrastructure was the "fiber optic" that obtained the mean of 1.25, claimed at "low" extent of teaching.

The third in rank that marked the overall mean of 1.04, and evaluated at "low" extent of teaching was on the "server". It constituted the teaching of "tower server" that had the mean of 1.54 and evaluated as "high" extent of teaching, then followed by the "rack server" with the mean of 0.83, at "low" extent, then the least was on "blade server" that obtained the mean of 0.75, described as "low" extent of teaching.

The teaching of IT infrastructure on accounting system was found at "high" extent as supported by the obtained grand mean of 1.41. This stresses the notion that the students were not taught at optimal level in this system. This led to the concept that the students are insufficient of their knowledge and skills on this system.

***3. Human Resource Information System***. The data to serve the bases in determining the extent how the teachers taught their students on the IT infrastructure on human resource information system are presented in Table 5.

**Table 5 Teacher Ratings on the Extent of Teaching their Students of IT Infrastructure on Human Resource Information Systems and Website**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Human Resource Information System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.54 | High | 1 |
| 1.2 Rack Server | 0.92 | Low | 2 |
| 1.3 Blade Server | 0.88 | Low | 3 |
| ***Overall Mean*** | ***1.11*** | ***Low*** | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.67 | High | 2 |
| 2.2 Cat6 | 1.92 | High | 1 |
| 2.3 Fiber optic | 1.17 | Low | 3 |
| ***Overall Mean*** | ***1.58*** | High | ***(2)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.79 | High | 1 |
| 3.2 10/100/1000 | 1.63 | High | 2 |
| ***Overall Mean*** | ***1.71*** | High | ***(1)*** |
| ***GRAND MEAN*** | ***1.47*** | ***High*** | **-** |
| **B. Website** | | | |
| 1. Domain | 1.88 | High | - |
| ***Overall Mean*** | ***1.88*** | High | |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

The teachers claimed their highest extent on the "switch" that got the overall mean of 1.71, described being at "high" extent. It covered the teaching of "10/100" with the mean of 1.79 and the "10/100/1000" with the mean of 1.79. Both of which were claimed having been taught at "high" extent to the students.

The second was on teaching "cabling" infrastructure that obtained the overall mean of 1.58 to stand for being taught at "high" extent to the It students. This constituted the teaching of "Cat6" that got the mean of 1.92, and which was evaluated at "high" extent, then followed by the "cat5" with the mean of 1.67, at "high" extent, then the least was on "fiber optic" that obtained the mean of 1.17, described as "low" extent of teaching.

The third in rank that marked the overall mean of 1.11, and evaluated at "low" extent of teaching was on the "server". It constituted the teaching of "tower server" that had the mean of 1.54 and evaluated as "high" extent of teaching, then followed by the "rack server" with the mean of 0.92, at "low" extent, then the least was on "blade server" that obtained the mean of 0.88, described as "low" extent of teaching.

The obtained grand mean for the extent of teaching this human resource information system was 1.47 to stress that the IT faculty were teaching their students at "low" extent in this system.

It is worth noting that these difference affects arising from language design are tremendously dominated by the process factors such as project size, team size, and commit size (Ray, B. et. Al., 2014). With this teaching human resource management system will gain notable effects arising from the students. In terms of handling different types of data. But, if the students lack the skill like this it might be a punch on the face of the student, because human resource management system is the basic system in every office not just in school set up but in every work station. Handling Human Resource Management System or HRMS would give the office of the Human Resource Management uplift in there transactions.

***4. Website***. From the same Table 5, the IT faculty responded that they taught their students at "high" extent as supported by the obtained mean of 1.88. This stresses a claim that the students were not taught at optimal level in this system. This led to the concept that the students are insufficient of their knowledge and skills on this field.

To fully understand, why need to fully instruct the website? Of course website is very essential to teach, because most of the offices and others were relying on social Medias and that were the website teaching. There is an in-field activity on an indigenous culture course of elementary school with a formative assessment-based learning strategy was conducted to investigate the possible negative effects of mobile learning by analyzing the students' cognitive load and learning achievement (Chu, H.C., 2014). Facebook, Twitter, Youtube, emails, and other social media use frequently were based on website. If the student lack skill in website the opportunities to find job online and online development will be difficult to achieve.

**Student Ratings.** This section presents the data and discussion on the extent the student rate the extent they were taught by their IT faculty on the infrastructure on enrolment, accounting, human resource information, and website systems. The data in Tables 6 to 7 are offered for this purpose.

***1. Enrolment System***. The data in Table 6 disclosed that the students claimed their highest on "switch" as marked by the overall mean of 1.20, and which was evaluated at "low" extent of being taught. This this rating covered the teaching both "10/100" and "10/100/100" that got similar mean of 1.2, evaluated at "low" extent of teaching.

The second extent of being taught the IT infrastructure went to "cabling" with the overall mean of 1.19 to stand for the "low" extent of being taught. It embraced being taught by "fiber optic" that got the mean of 1.33, then the "cat5" with the mean of 1.17, to stand for the "low" and "cat6" with the mean of 1.08, to stand for the "low" extent of being taught.

***2. Accounting System***. Analyzed from the same Table 6, the students declared their highest on "cabling" as marked by the overall mean of 1.16, and which was evaluated at "low" extent of being taught. This rating covered being taught "fiber optic" with the mean of 1.29, a "high" extent, then followed by the "cat6" that got the mean of 1.11, at "low" extent. The least taught in cabling infrastructure was the "cat5" that obtained the mean of 1.08, claimed at "low" extent of being taught.

The second extent of being taught the IT infrastructure went to "switch" with the overall mean of 1.11 to stand for the "low" extent of being taught. It embraced that it is being taught by "10/100/1000" that got the mean of 1.14, then the "10/100" with the mean of 1.08, where booth were evaluated at "low" extent of being taught.

The third in rank that marked the overall mean of 0.98, and evaluated at "low" extent of being taught was on the "server". It constituted that it is being taught the "tower server" that had the mean 0f 1.09 and evaluate as "low" extent of being taught, then followed by the "rack server" and "blade server" with the similar mean of 0.96, described as "low" extent of being taught.

The extent of being taught of IT infrastructure on accounting system was found "low" extent as supported by the obtained grand mean of 1.08. This stress the notion that the students were not taught at optimal level in this system. This led to the concept that the students are insufficient of their knowledge and skills on this system.

**Table 6 Student Ratings on the Extent their IT Faculty Taught them IT Infrastructure on Enrolment and Accounting Systems**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Enrolment System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.09 | Low | 1 |
| 1.2 Rack Server | 1.06 | Low | 2 |
| 1.3 Blade Server | 0.96 | Low | 3 |
| ***Overall Mean*** | ***1.04*** | Low | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.17 | Low | 2 |
| 2.2 Cat6 | 1.08 | Low | 3 |
| 2.3 Fiber optic | 1.33 | Low | 1 |
| ***Overall Mean*** | ***1.19*** | Low | ***(2)*** |

| | | | |
|---|---|---|---|
| **3. Switch** | | | |
| 3.1 10/100 | 1.20 | Low | 1.5 |
| 3.2 10/100/1000 | 1.20 | Low | 1.5 |
| ***Overall Mean*** | ***1.20*** | Low | *(1)* |
| ***GRAND MEAN*** | ***1.14*** | ***Low*** | - |
| **B. Accounting System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.01 | Low | 1 |
| 1.2 Rack Server | 0.96 | Low | 2.5 |
| 1.3 Blade Server | 0.96 | Low | 2.5 |
| ***Overall Mean*** | ***0.98*** | Low | *(3)* |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.08 | Low | 3 |
| 2.2 Cat6 | 1.11 | Low | 2 |
| 2.3 Fiber optic | 1.29 | Low | 1 |
| ***Overall Mean*** | ***1.16*** | Low | *(1)* |
| **3. Switch** | | | |
| 3.1 10/100 | 1.08 | Low | 2 |
| 3.2 10/100/1000 | 1.14 | Low | 1 |
| ***Overall Mean*** | ***1.11*** | Low | *(2)* |
| ***GRAND MEAN*** | ***1.08*** | ***Low*** | - |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

***3. Human Resource Information System***. The data in Table 7 displayed the bases on the extent the students rate themselves being taught by the IT faculty on this infrastructure.

The students claimed their highest extent of being taught on the "cabling" that got the overall mean of 1.12, described being at "low" extent. It covered that it is being taught of "fiber optic" with the mean of 1.20 and the "cat5" with the mean of 1.08, and the "cat6" with the mean of 1.07. All of them in cabling claimed having being taught at "low" extent to the students.

The second was on "switch" infrastructure that obtained the overall mean of 1.07 to stand for being taught at "high" extent to the IT students. This constituted the teaching of "10/100/1000" that got the mean of 1.11, and which was evaluated at "high" extent, then the least was on "10/100" that obtained the mean of 1.07, described as "low" extent of being taught.

The third in rank that marked the overall mean of 1.00, and evaluated at "low" extent of being taught was on the "server. It constituted the teaching of "rack server" that had the mean of 1.05 and evaluated as "low" extent, then followed by the "tower server" with the mean of 1.04, at "low" extent, then the least was on "blade server" that obtained the mean of 0.90, described as "low" extent of being taught.

**Table 7 Student Ratings on the Extent their IT Faculty Taught them IT Infrastructure on Human Resource Information Systems and Website**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Human Resource Information System** | | | |
| 1. **Server** | | | |
| 1.1 Tower Server | 1.04 | Low | 2 |
| 1.2 Rack Server | 1.05 | Low | 1 |
| 1.3 Blade Server | 0.90 | Low | 3 |
| ***Overall Mean*** | ***1.00*** | Low | *(3)* |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.08 | Low | 2 |
| 2.2 Cat6 | 1.07 | Low | 3 |
| 2.3 Fiber optic | 1.20 | Low | 1 |
| ***Overall Mean*** | ***1.12*** | Low | *(1)* |

| | | | |
|---|---|---|---|
| **3. Switch** | | | |
| 3.1 10/100 | 1.07 | Low | 2 |
| 3.2 10/100/1000 | 1.11 | Low | 1 |
| ***Overall Mean*** | ***1.09*** | Low | ***(2)*** |
| ***GRAND MEAN*** | ***1.07*** | ***Low*** | **-** |
| **B. Website** | | | |
| 1. Domain | 1.66 | High | - |
| ***Overall Mean*** | ***1.66*** | High | |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

The obtained grand mean for the extent of being taught this human resource information system was 1.07 to stress that the IT faulty were teaching their students at "low" extent in this system.

It is worth noting as cited in faculty rating in human resource information system that every office there's an office called human resource management office. So learning about human resource management information system is crucial to acquired work after finishing the course.

***4. Website***. The data in same Table 7 disclosed that the students were taught of this infrastructure at "high" extent as claimed by the mean of 1.66. It suggests the idea that the student were not taught at optimal level in this field. This led to the concept that the students are insufficient of their knowledge skills in this field.

**Utilization of IT Infrastructure**

The extent to which the employment markets utilized the IT infrastructure on enrolment, accounting, human resource information, and website systems are contained in this portion.

***1. Enrolment System***. The data in Table 9 unfolded that the highest was on "switch" as marked by the overall mean of 1.59 and which was evaluated at "high" extent of utilization. This rating covered the utilization "10/100/1000" with the mean of 1.73, at "high" extent. The least utilized in switch infrastructure was the "10/100"that obtained the mean of 1.45, claimed at "low" extent of utilization.

The second extent of utilization the IT infrastructure went to "cabling" with the overall mean of 1.33 to stand for the "low" extent of utilization. It embraced the utilization of "cat6" that got the mean of 1.91, at "high" extent, then the "cat5" with the mean of 1.18, at "low" extent. The least utilization in cabling infrastructure was the "fiber optic" that obtained the mean of 0.91, claimed at "low" extent of utilization.

The third in rank that marked the overall mea of 1.15, and evaluated at "low" extent of utilization was on the "server". It constituted the utilization of "tower server" that had the mean of 1.64 and evaluated as "high" extent of utilization, then followed by "rack server" with the mean of 1.36, at "low" extent, then the least was on "blade server" that obtained the mean of 0.45, described as "not at all" extent of utilization.

The utilization of IT infrastructure on enrollment system was found at "low" extent as supported by the obtained grand mean of 1.36. This stress the notion that the industry were not utilizing at optimal level in this system.

**2. Accounting System**. From the same data in Table 9, it disclosed that the highest was on "switch" as marked by the overall mean of 1.68, and which was evaluated at "high" extent of utilization. This rating covered the utilization "10/100" with the mean of 1.73, at "high" extent. The least utilized in switch infrastructure was the "10/100/1000" that obtained the mean of 1.64, claimed at "high" extent of utilization.

The second in rank that marked the overall mean of 1.30, and evaluated at "low" extent of utilization was on the "cabling". It constituted the utilization of "cat6" and evaluated as "high" extent, then followed by the "cat5" with the mean of 1.18, at "low" extent, then the least was on "fiber optic" that obtained the mean of 1.00, described as "low" extent in utilization.

The third in rank that marked the overall mean of 1.06, and evaluated at "low" extent of utilization was on the "server". It constituted the teaching of "rack server" that had the mean of 1.45 and evaluated as "high" extent in utilization, then followed by the "tower server" with the mean of 1.09, at "low" extent, then the least was on "blade server" that obtained the mean of 0.64, described as "not at all" extent in utilization.

The utilization of IT infrastructure on accounting system was found at "low" extent as supported by the obtained grand mean of 1.35. This stress the notion that the industry is not at optimal level in this system utilization.

***3. Human Resource Information System***. The data in Table 10 reflected the extent to which the employment markets rate the extent they used the IT infrastructures. They claimed the highest on the "switch" that got the overall mean of 1.55, described being at "high" extent. It covered the utilization of "10/100/1000" with the mean of 1.73, and which was evaluated at "high" extent to the utilization, then the least was on "10/100" that obtained the mean of 1.36, described as "low" extent in utilization.

**Table 9 Extent the Employment Markets Utilized the IT Infrastructures on Enrolment and Accounting Systems**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Enrolment System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.64 | High | 1 |
| 1.2 Rack Server | 1.36 | Low | 2 |
| 1.3 Blade Server | 0.45 | None at All | 3 |
| ***Overall Mean*** | ***1.15*** | ***Low*** | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.18 | Low | 2 |
| 2.2 Cat6 | 1.91 | High | 1 |
| 2.3 Fiber optic | 0.91 | Low | 3 |
| ***Overall Mean*** | ***1.33*** | ***Low*** | ***(2)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.45 | Low | 2 |
| 3.2 10/100/1000 | 1.73 | High | 1 |
| ***Overall Mean*** | ***1.59*** | ***High*** | ***(1)*** |
| ***GRAND MEAN*** | ***1.36*** | ***Low*** | |
| **B. Accounting System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.09 | Low | 2 |
| 1.2 Rack Server | 1.45 | Low | 1 |
| 1.3 Blade Server | 0.64 | Low | 3 |
| ***Overall Mean*** | ***1.06*** | ***Low*** | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 1.18 | Low | 2 |
| 2.2 Cat6 | 1.73 | High | 1 |
| 2.3 Fiber optic | 1.00 | Low | 3 |
| ***Overall Mean*** | ***1.30*** | ***Low*** | ***(2)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.73 | High | 1 |
| 3.2 10/100/1000 | 1.64 | High | 2 |
| ***Overall Mean*** | ***1.68*** | High | ***(1)*** |
| ***GRAND MEAN*** | ***1.35*** | ***Low*** | |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

The second was on "cabling" infrastructure that obtained the overall mean of 1.27 to stand for being utilized at "low" extent of utilization. This constituted the utilization of "cat6"that got the mean of 1.91, and which was evaluated at "high" extent, then followed by the "fiber optic" with the mean of 1.09, at "low" extent, then the least was on "cat5" that obtained the mean of 0.82, described as "low" extent of utilization.

The third in rank that marked the overall mean of 1.12, and evaluated at "low" extent of utilization was on the "server". It constituted the utilization of "tower server" that had the mean of 1.45 and evaluated as "low" extent in utilization, then followed by the "rack server" with the mean of 1.27, at "low" extent, then the least was on "blade server" that obtained the mean of 0.64, described as "low" extent of utilization.

The obtained grand mean for the extent of utilization this human resource information system was 1.31 to stress that the industry were utilized by their office at "high" extent in this system.

**Table 10 Extent the Employment Markets Utilized the IT Infrastructures on Human Resource Information Systems and Website**

| Descriptors | Mean | Evaluation | Rank |
|---|---|---|---|
| **A. Human Resource Information System** | | | |
| **1. Server** | | | |
| 1.1 Tower Server | 1.45 | Low | 1 |
| 1.2 Rack Server | 1.27 | Low | 2 |
| 1.3 Blade Server | 0.64 | Low | 3 |
| ***Overall Mean*** | ***1.12*** | ***Low*** | ***(3)*** |
| **2. Cabling** | | | |
| 2.1 Cat5 | 0.82 | Low | 3 |
| 2.2 Cat6 | 1.91 | High | 1 |
| 2.3 Fiber optic | 1.09 | Low | 2 |
| ***Overall Mean*** | ***1.27*** | ***Low*** | ***(2)*** |
| **3. Switch** | | | |
| 3.1 10/100 | 1.36 | Low | 2 |
| 3.2 10/100/1000 | 1.73 | High | 1 |
| ***Overall Mean*** | ***1.55*** | ***High*** | ***(1)*** |
| ***GRAND MEAN*** | ***1.31*** | ***High*** | ***-*** |
| **B. Website** | | | |
| 1. Domain | 2.73 | Very High | - |
| ***Overall Mean*** | ***2.73*** | ***Very High*** | ***-*** |

**Legend: 2.51-3.00 Very High, 1.50-2.50 High, 0.50-1.49 Low, 0.00-0.49 None at All**

**4. Website.** The same data in Table 10 revealed that they utilized at "Very High" extent as supported by the obtained mean of 2.73. This stresses a claim that the industry were optimal level in utilization in this system.

**Difference in Extent of Teaching IT Infrastructure**

The data in Table 12 unlocked the bases of investigating the possible presence or absence of significant difference between the ratings of the IT faculty and students on the extent of teaching the IT infrastructure in terms of enrolment system, accounting system, human resource information system, and website.

**Enrolment System**. The data disclosed no significant difference between the ratings of the IT faculty and students on extent of teaching the "server" as the computed t-value was lesser than the required critical $t_{.05}$-value of 1.96 at 272 degrees of freedom. Here, the null hypothesis was accepted. On the other side, there were significant differences in their ratings along the extent of teaching the "cabling" and "switch". The obtained t-values of 2.45 and 2.31 went beyond the minimal required critical $t_{.05}$-value of 1.96, thus led to the non-acceptance of the attached null hypotheses.

**Table 12 Difference in the Rating of Faculty and Students on Extent of Teaching IT Infrastructure**

| Between Ratings of IT Faculty and Students on: (df = 272 & $t_{.05}$ = 1.96) | t-value | Decision on Ho | Conclusion |
|---|---|---|---|
| **A. Enrolment System** | | | |
| 1. Server | 0.78 | Accepted | Not Significant |
| 2. Cabling: ($\bar{x}_f$= 1.72) & ($\bar{x}_s$ = 1.19) | 2.45 | ***Rejected*** | ***Significant*** |
| 3. Switch : ($\bar{x}_f$= 1.71) & ($\bar{x}_s$ = 1.20) | 2.31 | ***Rejected*** | ***Significant*** |
| **B. Accounting System** | | | |
| 1. Server : | 0.31 | Accepted | Not Significant |
| 2. Cabling: ($\bar{x}_f$= 1.60) & ($\bar{x}_s$ = 1.16) | 2.12 | ***Rejected*** | ***Significant*** |
| 3. Switch : ($\bar{x}_f$= 1.60) & ($\bar{x}_s$ = 1.11) | 2.33 | ***Rejected*** | ***Significant*** |
| **C. Human Resource Information System** | | | |
| 1. Server | 0.55 | Accepted | Not Significant |
| 2. Cabling: ($\bar{x}_f$= 1.58) & ($\bar{x}_s$ = 1.12) | 2.24 | ***Rejected*** | ***Significant*** |
| 3. Switch : ($\bar{x}_f$= 1.71) & ($\bar{x}_s$ = 1.09) | 2.79 | ***Rejected*** | ***Significant*** |
| **D. Website** | 0.86 | Accepted | Not Significant |

A deeper analysis of the respective mean of these two groups of respondents, the IT faculty claimed higher extents *($\bar{X}_f$= 1.72 and $\bar{X}_f$= 1.71)* of teaching these aspects to which the students significantly declared otherwise. The students had the mean ratings *($\bar{X}_s$ = 1.19 and $\bar{X}_s$ = 1.20)* that were remarkably lower than those meant by their IT teachers.

The study interposes a knowledge that there are areas in the IT infrastructure that need in-depth reconciliatory efforts on the extent of teaching and the degrees of learning which the students acquired. Hence, revisiting the IT curriculum in this aspect in terms of implementation is desired.

**Accounting System**. Examined from the same data in Table 12, there was no significant difference between the ratings of the IT faculty and students on extent of teaching the "server" component of infrastructure. The arrived t-value of 0.31 did not reach the required critical t.05-value of 1.96 at 272 degrees of freedom.

However, along the aspects of "cabling" and "switch" the computed t-values of 2.12 and 2.31 exceeded the said required critical t.05-value. The corresponding null hypotheses were all rejected. With reference to the claimed means of each group of respondents, it appeared that the teachers claimed higher extents *($\bar{X}_f$= 1.60)* of teaching these aspects which the students significantly opposed. The students had the mean ratings *($\bar{X}_s$ = 1.16 and $\bar{X}_s$ = 1.11)* that were remarkably lower than those declared by their IT teachers.

The findings asserted that the IT faculty may have exerted a certain extent of facilitating learning in these areas but the students were not able to learn the competencies as desired. Hence, there is still a need for the clearing of clogged areas in the IT infrastructure on accounting system along cabling and switch aspect.

**Human Resource Information System.** Examined from the same data in Table 12, there was no significant difference between the ratings of the IT faculty and students on extent of teaching the "server" component of infrastructure. The arrived t-value of 0.55 did not reach the required critical t.05-value of 1.96 at 272 degrees of freedom.

However, along the aspects of "cabling" and "switch" the computed t-values of 2.24 and 2.79 exceeded the said required critical t.05-value. The corresponding null hypotheses were all rejected. With reference to the claimed means of each group of respondents, it appeared that the teachers claimed higher extents *($\bar{X}_f$= 1.58 and $\bar{X}_f$= 1.71)* of teaching these aspects which the students significantly opposed. The students had the mean ratings *($\bar{X}_s$ = 1.12 and $\bar{X}_s$ = 1.09)* that were remarkably lower than those declared by their IT teachers.

The findings asserted that the IT faculty may have exerted a certain extent of facilitating learning in these areas but the students were not able to learn the competencies as desired. Hence, there is still a need for the clearing of clogged areas in the IT infrastructure on human resource information system along cabling and switch aspect.

**Website.** Examined from the same data in Table 12, there was no significant difference between the ratings of the IT faculty and students on extent of teaching the "website" component of infrastructure. The arrived t-value of 0.86 did not reach the required critical t.05-value of 1.96 at 272 degrees of freedom.

**Difference in Extent of Utilization the IT Infrastructure**

The data in Table 14 unlocked the bases of investigating the possible presence presence or absence of significant different between the rating of the Employment Market and Students on the extent of utilization the IT infrastructure in terms enrolment system, accounting system, human resource information system, and website.

**Table 14 Difference between the Ratings of Students in Extent of Teaching and Extent of Employment Market Utilization on IT Infrastructure**

| Between Ratings of IT Faculty and Employment Market on: *($df = 259$ & $t_{.05} = 1.96$)* | t-value | Decision on Ho | Conclusion |
|---|---|---|---|
| **A. Enrolment System** | | | |
| 1. Server | 0.40 | Accepted | Not Significant |
| 2. Cabling | 0.46 | Accepted | Not Significant |
| 3. Switch | 1.22 | Accepted | Not Significant |
| **B. Accounting System** | | | |
| 1. Server | 0.28 | Accepted | Not Significant |
| 2. Cabling | 0.49 | Accepted | Not Significant |
| 3. Switch | 1.88 | Accepted | Not Significant |

| C. Human Resource Information System | | | |
|---|---|---|---|
| 1. Server | 0.42 | Accepted | Not Significant |
| 2. Cabling | 0.53 | Accepted | Not Significant |
| 3. Switch | 1.44 | Accepted | Not Significant |
| **D. Website** *($\bar{x}_e$= 2.73) & ($\bar{x}_s$ = 1.66)* | 3.07 | ***Rejected*** | ***Significant*** |

**Enrollment System**. The data disclosed no significant difference between the ratings of the Employment Market and Students on extent of Utilization the "server", "cabling", and "switch" as the computed t-value was lesser than the required critical $t_{.05}$-value of 1.96 at 259 degrees of freedom. Here, the null hypotheses was accepted.

The study show that the areas in IT infrastructure were good on the extent of utilization and the degree of learning which the students acquired. Hence, maintain monitoring the IT curriculum in this aspect in terms of implementation is desired.

**Accounting System**. The data disclosed no significant difference between the ratings of the Employment Market and Students on extent of Utilization the "server", "cabling", and "switch" as the computed t-value was lesser than the required critical $t_{.05}$-value of 1.96 at 259 degrees of freedom. Here, the null hypotheses was accepted.

The study show that the areas in IT infrastructure were good on the extent of utilization and the degree of learning which the students acquired. Hence, maintain monitoring the IT curriculum in this aspect in terms of implementation is desired.

**Human Resource Information System**. The data disclosed no significant difference between the ratings of the Employment Market and Students on extent of Utilization the "server", "cabling", and "switch" as the computed t-value was lesser than the required critical $t_{.05}$-value of 1.96 at 259 degrees of freedom. Here, the null hypotheses was accepted.

The study show that the areas in IT infrastructure were good on the extent of utilization and the degree of learning which the students acquired. Hence, maintain monitoring the IT curriculum in this aspect in terms of implementation is desired.

**Website**. The data disclosed a significant difference between the ratings of the Employment Market and Students on the extent of utilization website. The obtained t-values of 3.07 went beyond the minimal required critical $t_{.05}$-value of 1.96, thus led to the non-acceptance of the attached null hypothesis.

A deeper analysis of the respective mean of these two groups of respondents, the Employment Market claimed higher extent (*$\bar{x}_e$= 2.73*) of utilization these aspect to which the students significantly declared otherwise. The students had the mean rating (*$\bar{x}_s$= 1.66*) that were remarkably lower than those meant by the Employment Market.

The study interposes a knowledge that these area in the IT infrastructure that needed in-depth reconciliatory efforts on the extent of utilization and the degrees of learning which the students acquired. Hence, revisiting the IT curriculum in this aspect in terms of implementation is desired.

## TECHNOLOGY MANAGEMENT PHILOSOPHY

### Marketable and Employable Curriculum in Computer Courses

"The relevance of Technology is established with a match between learning institutions and employment Markets".

In the first oval (left), the researcher was trying to cite the GAPS in Teaching-Learning between the learning institution and the employment markets. Trends in industries and quality tools in the programming language.

In the second oval (center), the researcher proposed an intervention program to hit the minimum requirements of the employment markets in accepting applicants in their respected offices.

In the third oval (right), the researcher was trying to compensate the researchers' proposed intervention to do curriculum enhancement based on the updates taken from pieces of training and seminar-workshop attended.

**Figure 3. Philosophy of Technology Management for Marketable and Employable Curriculum in Computer Courses**

| Key Result Area | Goal | Objectives | Strategies | Key Performance Indicators | Time Frames AY 2019-2020 | | Time Frames AY 2020-2021 | | Responsible Person | Source of Fund |
|---|---|---|---|---|---|---|---|---|---|---|
| Curriculum and Instruction | Provide and assured level of education anchored on the demands matches of the industries needs | 1. Strengthen the instruction in the following area: cabling; switch; Website; and Open Source | 1.1 Conduct in-house trainings and seminar-workshop on Cabling, Switch, website and Open Source | Capacitated faculty, Certificate of Completion of Trainings and Seminar-workshop | 1st Semester | | 1st Semester | | VP of Academic Affairs, Dean and Program Chair | Faculty Development |
| | | | 1.2 Send Faculty to trainings and seminars-workshop more in regional, national and international level. | Skills in Cabling, Switch, Website and Open Source, Certificates of Completion of the Seminar-Workshop | | 2nd Semester | | 2nd Semester | Human Resource Officer, VP for Academic Affairs and Dean / Program Chair | Faculty Development |
| | | 2. Retool faculty on differentiated instruction or contemporary approaches in teaching and learning Cabling, Switch, Website and Open Source especially in planning and preparation of the lesson and assessment of students' learning. | 2.1 Determine training needs of faculty in facilitating teaching and learning processes with Cabling, Switch, Website and Open Source | Training needs Analysis basis for the seminar-workshop | 1st Semester | | 1st Semester | | Human Resources Officer, VP for Academic Affairs and Dean / Program Chair | Faculty Development |
| | | | 2.2 Provide seminar-workshop to faculty on contemporary approaches in teaching and learning processes with Cabling, Switch, Website and Open Source. | Competent faculty, Certificate of Completion of the seminar-workshop | 1st Sem | | 1st Sem | | Dean / Program Chair | Faculty Development |
| | | | 2.3 Send faculty to relevance seminar-workshop more in regional, national and international level | Proficient faculty, Certificate of Completion of the seminar-workshop | | 2nd Semester | | 2nd Semester | VP for Academic Affairs and Dean | Faculty Development |
| | | 3. Improve delivery of teaching and learning processes with Cabling, Switch, Website and Open Source to match the industry needs with respect to their learning modalities. | 3.1 Prepare supervisory plan as a guide in monitoring and evaluating faculty performance | Supervisory Plan | 1st Semester | | 1st Semester | | VP for Academic Affairs | Faculty Development |
| | | | 3.2 Conduct classroom observation based on the supervisory plan. | Classroom Observation Report to monitor effectiveness | 1st Semester | 2nd Semester | 1st Semester | 2nd Semester | Dean / Program Chair | Faculty Development |
| | | | 3.3 Conduct a post conference with the faculty right after classroom | Post Conference Report / Classroom Observation Feed Backing | 1st Semester | 2nd Semester | 1st Semester | 2nd Semester | Dean / Program Chair | Faculty Development |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | observation for feed backing. | | | | | | | |
| | | 4. Conduct monitoring and evaluation on the effectiveness of the faculty development program. | 4.1 Prepare the monitoring and evaluation instrument. | Monitoring and Evaluation Instrument | | 2nd Semester | | 2nd Semester | VP for Academic Affairs and Dean | Faculty Development |
| | | | 4.2 Administer the monitoring and evaluation instrument to the faculty. | Answered Monitoring and Evaluation Instrument | | 2nd Semester | | 2nd Semester | Dean / Program Chair | Faculty Development |
| | | | 4.3 Determine the effectiveness of the faculty development program | Result of the Monitoring and Evaluation | | 2nd Semester | | 2nd Semester | Dean / Program Chair | Faculty Development |
| | | | 4.4 Use the result of monitoring and evaluation for continual improvement. | Recommendations / inputs for the training development program | | 2nd Semester | | 2nd Semester | VP for Academic Affairs and Dean | Faculty Development |

## CONCLUSIONS

Teaching appropriate It infrastructures ready for a job is the best. In general, some findings need to be revisit and enhanced and there are some also that only need maintain monitoring.

Precisely, the findings of the study led to the following conclusions:

1. The SUC's need to re-visit the curriculum and monitor the teachers if they are following the curriculum syllabus to acquire quality graduates.
2. The SUC's must consider the most used IT infrastructures in the employment market. In the findings it reveals that the SUC's were not totally teaching their students to become more employment in their field, thus the student might work not in-line to the course they graduated.
3. The SUC's must equip their product (course curriculum) to acquire employable graduates.
4. The SUC's just focus on the field of the website to change the significant difference between the way they taught their students and on what is the demand by the employment markets.

## RECOMMENDATIONS

Thorough and periodic monitoring of the curriculum and implementing in a syllabus in teaching IT infrastructures.

Explicitly, the following actions are recommended:

**School Administrators**. They are urged to pattern their leadership to re-visit the curriculum that suits the needs of the industry. Attending seminars, trainings, and other specifics helps the course evolve to make highly competitive graduates.

**Professors**. As the direct providers of the services to their clients, they are encouraged to be always dynamic, industrious, and goal seekers. They are requested to communicate their needs openly to their superiors on the opportunities for advancement in their lines of work.

**Students**. They are advised to present their suggestions to the school authority through the client's Suggestion/Feedback box purposely for the improvement of services. They are likewise encouraged to keep open communication with the school personnel to avoid misunderstanding the school policies while studying. Knowledge sharing and feedbacks on trends and experiences are expected from them on matters that may help improve the school.

**Researchers**. They are challenged to conduct a replicate or another kind of study with a focus on other factors related to the present study about the extent of teaching and the extent of use in the industry. They are encouraged to use the findings as part of their conceptual framework and as a further reference in future investigations.

## REFERENCES CITED

[1] Bae, S., Cho, H., Lim, I., & Ryu, S. (2014, November). SAFEWAPI: web API misuse detector for web applications. In *Proceedings of the 22nd ACM SIGSOFT International Symposium on Foundations of Software Engineering* (pp. 507-517). ACM. Retrieved December 11, 2018. Retrieved from https://goo.gl/2BNQdt

[2] Barr, E. T., Harman, M., McMinn, P., Shahbaz, M., & Yoo, S. (2015). The oracle problem in software testing: A survey. *IEEE transactions on software engineering*, *41*(5), 507-525. Retrieved December 13, 2018. Retrieved from https://goo.gl/vwY1Lq

[3] Benhase, M. T., Gupta, L. M., Mellgren, C. S., & Sanchez, A. E. (2014). *U.S. Patent No. 8,719,529*. Washington, DC: U.S. Patent and Trademark Office. Retrieved December 16, 2018. Retrieved from https://goo.gl/KLa9zJ

[4] Blikstein, P. (2013, April). Multimodal learning analytics. In *Proceedings of the third international conference on learning analytics and knowledge* (pp. 102-106). ACM. Retrieved December 16, 2018. Retrieved from https://goo.gl/cY3Gci

[5] Bracha, G., & Ungar, D. (2015). OOPSLA 2004: mirrors: design principles for meta-level facilities of object-oriented programming languages. *ACM SIGPLAN Notices*, *50*(8), 35-48. Retrieved December 13, 2018. Retrieved from https://goo.gl/prfGjN

[6] Bringula, R. P., Balcoba, A. C., & Basa, R. S. (2016, May). Employable Skills of Information Technology Graduates in the Philippines: Do Industry Practitioners and Educators have the Same View?. In *Proceedings of the 21st Western Canadian Conference on Computing Education* (p. 10). ACM. Retrieved December 06, 2018. Retrieved from https://goo.gl/cEtZ3w

[7] Brown, N. C., Sentance, S., Crick, T., & Humphreys, S. (2014). Restart: The resurgence of computer science in UK schools. *ACM Transactions on Computing Education (TOCE)*, *14*(2), 9. Retrieved December 13, 2018. Retrieved from https://goo.gl/TdPH3c

[8] Callaú, O., Robbes, R., Tanter, É., & Röthlisberger, D. (2013). How (and why) developers use the dynamic features of programming languages: the case of smalltalk. *Empirical Software Engineering*, *18*(6), 1156-1194. Retrieved December 06, 2018. Retrieved from https://goo.gl/5md9Dr

[9] Cass, S. (2015). The 2015 top ten programming languages. *IEEE Spectrum, July*, *20*. Retrieved December 06, 2018. Retrieved from https://goo.gl/B2njJZ

[10] Chu, H. C. (2014). Potential Negative Effects of Mobile Learning on Students' Learning Achievement and Cognitive Load--A Format Assessment Perspective. *Journal of Educational Technology & Society*, *17*(1). Retrieved December 16, 2018. Retrieved from https://goo.gl/pGSZG9

[11] Dudgeon, K. B., Reed, D. C., Rios, E., & Smith, M. D. (2014). *U.S. Patent No. 8,880,837*. Washington, DC: U.S. Patent and Trademark Office. Retrieved December 16, 2018. Retrieved from https://goo.gl/XJvQ3Q

[12] Fessakis, G., Gouli, E., & Mavroudi, E. (2013). Problem solving by 5–6 years old kindergarten children in a computer programming environment: A case study. *Computers & Education*, *63*, 87-97. Retrieved December 13, 2018. Retrieved from https://goo.gl/DRMT1Z

[13] Flanagan, C., Leino, K. R. M., Lillibridge, M., Nelson, G., Saxe, J. B., & Stata, R. (2013). PLDI 2002: Extended static checking for Java. *ACM Sigplan Notices*, *48*(4S), 22-33. Retrieved December 16, 2018. Retrieved from https://goo.gl/CE67fS

[14] Ghahramani, Z. (2015). Probabilistic machine learning and artificial intelligence. *Nature*, *521*(7553), 452. Retrieved December 13, 2018. Retrieved from https://goo.gl/iwvxaz

[15] Gibbs, N. E., & Tucker, A. B. (1986). A model curriculum for a liberal arts degree in computer science. *Communications of the ACM*, *29*(3), 202-210. Retrieve December 05, 2018. Retrieve from https://goo.gl/yQeRF4

[16] Gomes, A., & Mendes, A. (2014, October). A teacher's view about introductory programming teaching and learning: Difficulties, strategies and motivations. In *Frontiers in Education Conference (FIE), 2014 IEEE* (pp. 1-8). IEEE. Retrieved December 11, 2018. Retrieved from https://goo.gl/3HUwTd

[17] Grover, S., & Pea, R. (2013). Computational thinking in K–12: A review of the state of the field. *Educational Researcher*, *42*(1), 38-43. Retrieved December 16, 2018. Retrieved from https://goo.gl/NQqAAU

[18] Harman, M., Jia, Y., & Zhang, Y. (2015, April). Achievements, open problems and challenges for search based software testing. In *Software Testing, Verification and Validation (ICST), 2015 IEEE 8th International Conference on* (pp. 1-12). IEEE. Retrieved December 13, 2018. Retrieved from https://goo.gl/K3t2uN

[19] Ibáñez, M. B., Di-Serio, A., & Delgado-Kloos, C. (2014). Gamification for engaging computer

science students in learning activities: A case study. *IEEE Transactions on learning technologies*, *7*(3), 291-301. Retrieved December 16, 2018. Retrieved from https://goo.gl/fBqSWe

[20] Kafai, Y., Fields, D., & Searle, K. (2014). Electronic textiles as disruptive designs: Supporting and challenging maker activities in schools. *Harvard Educational Review*, *84*(4), 532-556. Retrieved December 13, 2018. Retrieved from https://goo.gl/aWcv37

[21] KALELIOĞLU, F., & Gülbahar, Y. (2014). The Effects of Teaching Programming via Scratch on Problem Solving Skills: A Discussion from Learners' Perspective. *Informatics in Education*, *13*(1). Retrieved December 13, 2018. Retrieved from https://goo.gl/XZMsxm

[22] Kazakoff, E. R., Sullivan, A., & Bers, M. U. (2013). The effect of a classroom-based intensive robotics and programming workshop on sequencing ability in early childhood. *Early Childhood Education Journal*, *41*(4), 245-255. Retrieved December 16, 2018. Retrieved from https://goo.gl/gyafZe

[23] Lamport, L. (2016). Specifying concurrent program modules. *ACM Transactions on Programming Languages and systems*. Retrieved December 13, 2018. Retrieved from https://goo.gl/GqpZPx

[24] Lierler, Y. (2014). Relating constraint answer set programming languages and algorithms. *Artificial Intelligence*, *207*, 1-22. Retrieved December 13, 2018. Retrieved from https://goo.gl/CGfQ5s

[25] Lister, R. (2016, October). Toward a developmental epistemology of computer programming. In *Proceedings of the 11th workshop in primary and secondary computing education* (pp. 5-16). ACM. Retrieved December 13, 2018. Retrieved from https://goo.gl/LcCpya

[26] Lye, S. Y., & Koh, J. H. L. (2014). Review on teaching and learning of computational thinking through programming: What is next for K-12?. *Computers in Human Behavior*, *41*, 51-61. Retrieved December 06, 2018. Retrieved from https://goo.gl/FzBbfn

[27] Magallanes, A. L. (2014). A Framework for an ICT-based Development Program for Science Teachers in State Universities and Colleges in Region VI. *Universal Journal of Educational Research*, *2*(9), 659-668. Retrieved December 06, 2018. Retrieved from https://goo.gl/bNuz6P

[28] Merelli, I., Pérez-Sánchez, H., Gesing, S., & D'Agostino, D. (2014). Managing, analysing, and integrating big data in medical bioinformatics: open problems and future perspectives. *BioMed research international*, *2014*. Retrieved December 13, 2018. Retrieved from https://goo.gl/xQ6cqF

[29] Meyerovich, L. A., & Rabkin, A. S. (2013). Empirical analysis of programming language adoption. *ACM SIGPLAN Notices*, *48*(10), 1-18. Retrieve December 15, 2018. Retrieved from https://goo.gl/WiL17R

[30] Nanz, S., & Furia, C. A. (2015, May). A comparative study of programming languages in Rosetta Code. In *Software Engineering (ICSE), 2015 IEEE/ACM 37th IEEE International Conference on* (Vol. 1, pp. 778-788). IEEE. Retrieve December 06, 2018. Retrieve from https://goo.gl/74nhDV

[31] Park, C. J., & Hyun, J. S. (2014, December). Effects of abstract thinking and familiarity with programming languages on computer programming ability in high schools. In *Teaching, Assessment and Learning (TALE), 2014 International Conference on* (pp. 468-473). IEEE. Retrieve December 13, 2018. Retrieved from https://goo.gl/L7fPXh

[32] Ray, B., Posnett, D., Filkov, V., & Devanbu, P. (2014, November). A large scale study of programming languages and code quality in github. In *Proceedings of the 22nd ACM SIGSOFT International Symposium on Foundations of Software Engineering* (pp. 155-165). ACM. Retrieved December 13, 2018. Retrieved from https://goo.gl/2BviSQ

[33] Sáez-López, J. M., Román-González, M., & Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school: A two year case study using "Scratch" in five schools. *Computers & Education*, *97*, 129-141. Retrieve December 04, 2018. Retrieve from https://goo.gl/CbN1UY

[34] Sebesta, R. W. (2016). *Concepts of programming languages*. Retrieve December 03, 2018. Retrieve from https://goo.gl/aEPNGv

[35] Shaw, R. S. (2013). The relationships among group size, participation, and performance of programming language learning supported with online forums. *Computers & Education*, *62*,

196-207. Retrieved December 16, 2018. Retrieved from https://goo.gl/7rsHTL

[36] Stefik, A., & Siebert, S. (2013). An empirical investigation into programming language syntax. *ACM Transactions on Computing Education (TOCE)*, *13*(4), 19. Retrieved December 05, 2018. Retrieved from https://goo.gl/Knxg47

[37] Stefik, A., & Hanenberg, S. (2014, October). The programming language wars: Questions and responsibilities for the programming language community. In *Proceedings of the 2014 ACM International Symposium on New Ideas, New Paradigms, and Reflections on Programming & Software* (pp. 283-299). ACM. Retrieved December 05, 2018. Retrieved from https://goo.gl/U1kHWb

[38] Trois, C., Del Fabro, M. D., de Bona, L. C., & Martinello, M. (2016). A survey on SDN programming languages: Toward a taxonomy. *IEEE Communications Surveys & Tutorials*, *18*(4), 2687-2712. Retrieved December 13, 2018. Retrieved from https://goo.gl/V52Rrj

[39] Vee, A. (2013). Understanding computer programming as a literacy. *Literacy in Composition Studies*, *1*(2), 42-64. Retrieved December 13, 2018. Retrieved from https://goo.gl/wJPfr1