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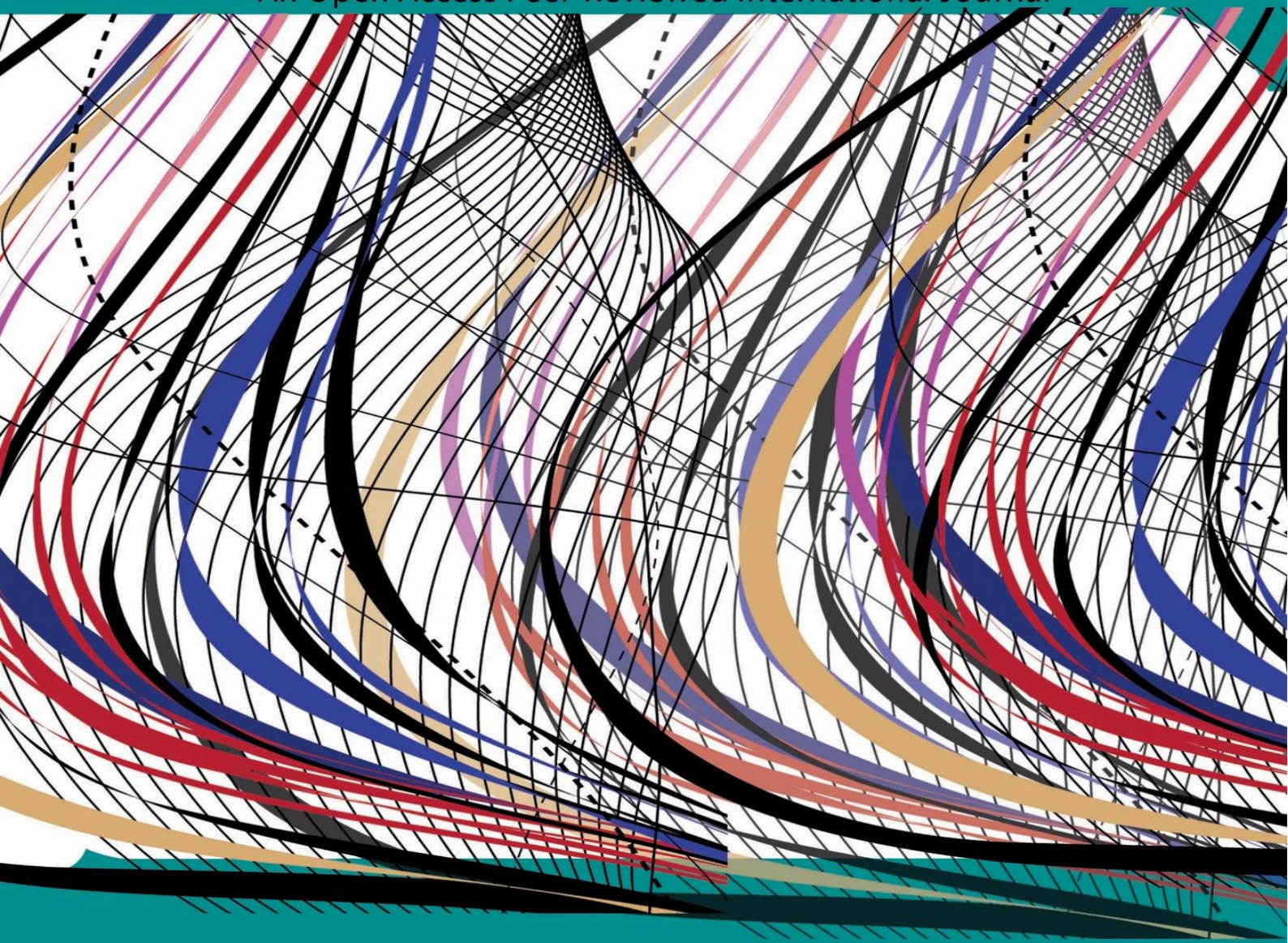

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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-9: September 2021 of "**International Journal of Advanced Engineering, Management and Science (IJAEMS) (ISSN: 2454-1311)",** an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Dinh Tran Ngoc Huy
Editor-in-Chief
October, 2021

Editorial Board/ Reviewer Board

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Clustering of Learners based on Readiness to Online Modality using K-Means Algorithm

Daryl B. Valdez, Rey Anthony G. Godmalin

[1]BSCS Department, Bohol Island State University – Clarin Campus, Philippines

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Abstract— *Clustering is one of the important techniques in data mining. It is an unsupervised task of grouping similar data. It has been applied in various fields with high degree of success. This study aimed to determine the learner segments based on readiness to online learning modality using K-means algorithm. A dataset was collected, tabulated and pre-processed. Further, the values were scaled and transformed using t-distributed Stochastic Neighbor Embedding. Using elbow method and determining the silhouette score, the best K value was determined. Then clustering was conducted using the selected number of clusters. Results revealed three groups of learners; Moderate-signal mobile users, Low-signal mobile users, and mixed group of Low/moderate-signal mobile/broadband users. Students from the different clusters are more suited for flexible learning as opposed to online learning. Varied learning modalities can be catered for students from the different learner segments. Formulation and adoption of new policies are needed to offset the effect of the pandemic towards the students.*

Keywords— ***Clustering, K-means algorithm, data mining, online learning modality, learner's segmentation.***

I. INTRODUCTION

Clustering is an unsupervised task of dividing data points into a fixed number of groups wherein the data points of a group bears close similarity and are different from those in other groups (Syakur et al, 2018). K-means algorithm is one of the methods of clustering data. It is the most commonly used clustering method due to its speed and simplicity (Yuan et al, 2019). Clustering has a variety of applications in various fields including; market segmentation, medical imaging, social network analysis, image segmentation and anomaly detection. Not only that, recent studies revealed that it can also be useful in the field of academe.

A study was conducted and used clustering to classify learners according to learning style preferences (Pasina et al, 2019). Results of the study revealed student outliers which have different learning style from the rest allows instructors to properly address their concerns. Further, clusters of students with similar learning styles allows ease of work on class assignments.

Another study was also conducted using hierarchical clustering in grouping students according to learning style (Yotaman et al, 2020). The experimental results show that grouping students into seven clusters using the Euclidean distance function and the ward linkage criteria yields the highest efficiency in clustering. The resulting clusters can help identify the behaviors and learning skills of students which will enable teachers more options in selecting and using appropriate methods and teaching strategies.

Aside from segmenting learners, cluster analysis can also be used in the other aspects of the student-learning environment such as in determining groups of teachers according to some factors. In fact, a study was successfully conducted using clustering to group teachers. Further, the results were used as basis for evaluating teaching quality (Sangita et al, 2011).

Other studies involve clustering of educational aspects in the case of online learning. Studies were conducted using clustering algorithms in determining user groups and personalized intelligent tutoring. Clustering algorithm was modified by exploiting the use of minimum spanning tree. Results revealed increased performance over traditional clustering algorithms when used in online learning resources (Wu et al, 2016).

Another study was made to understand behaviors of learners in the context of online learning (Peach et al, 2019). The study made use of mathematical framework for the analysis of time-series of online learner engagement, which allows the identification of clusters of learners with similar online temporal behavior directly from the raw data without prescribing a priori subjective reference behaviors. The study revealed outliers and other significantly distinct patterns of student engagements between high-performing learners and low-performing learners.

A similar study was conducted in order to determine institutional blended learning adoption using data extracted from universities (Park et al, 2016). Latent Class Analysis was used. Results of the studies revealed four clusters out from 612 courses. The results were used as basis for developing a Learning Management System which served as a strategic tool.

The onset of the pandemic brought great impact and many changes in our society today. In the educational setting, both the teachers and students were greatly affected. The traditional learning process cannot be utilized as of late and most especially in areas under community quarantine. Therefore, other modes of learning should be adopted.

Further, it is important for learners to continue education despite the current situation. To this end, this study attempts to determine groups of learners and their readiness in accessing online and/or flexible learning. The significance of this study will help in the formulation and adoption of policies in the educational setting relevant to the current times.

II. METHODOLOGY

This study was conducted in Bohol Island State University – Clarin Campus located at Poblacion Norte, Clarin, Bohol. The Institution offers the following degree programs; Bachelor in Technology and Livelihood Education (BTLEd), Bachelor of Secondary Education (BSEd), Bachelor in Elementary Education (BEEd), Bachelor of Science in Computer Science (BSCS), Bachelor of Science in Environmental Science (BSES), Bachelor of Science in Hospitality Management (BSHM) and Bachelor of Hotel and Restaurant Service Technology (BHRST).

In order to achieve the objective of this study, clustering using K-means algorithm was conducted. Clustering is a process of grouping the data into clusters (Jain, 2010). It classifies the data instances into subsets that has the same characteristics and similarities (Celebi et al, 2013). The workflow used in this study is presented following the figure below.

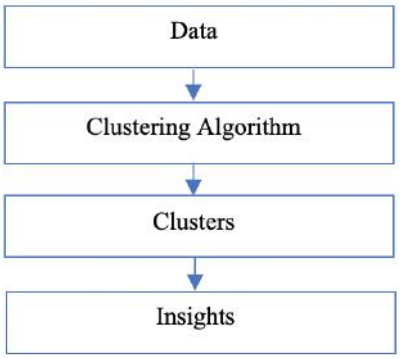

Fig. 1: Stages of the clustering pipeline

First, data was collected from the students using survey method through the use of online media such as Google Form and Facebook messaging Then, the data were recorded and stored as a dataset in a comma-separated value file. Next, data processing and cleaning stage was conducted to ensure the relevance and validity of the dataset. The table below describes the dataset.

Table 1. Dataset metadata

Data	**Description**
Degree Program	Current enrolled degree program
Address	Permanent address of the student
Gadgets Used	Device used to access the internet
Internet Access	Preferred mode of access
Signal Efficiency	Strength of the internet

Prior to the clustering task, the dataset was loaded as a pandas dataframe and null value checks and outlier detection were then conducted. After ensuring that there were no outliers and null values, each column was assigned numeric values and scaled. Then the resulting scaled values was then fed to t-distributed Stochastic Neighbor Embedding (t-SNE) algorithm. Since the dataset values are nonlinear, the t-SNE algorithm was used as a non-linear dimensionality reduction to fit and transform the scaled dataset values.

Using the transformed dataset values, clustering was then performed. We conducted experiments using different K-values ranged from 2 to 9. Using each K-value, K-means algorithm was performed and the inertia and silhouette coefficient were measured and recorded. The results were then plotted and analyzed to select the optimal K-value that best fits the given dataset using the Elbow

method. Then using the selected optimal K-value, K-means algorithm was re-run and the findings were analyzed and interpreted. The presentation of results and insights are presented in the next section.

III. RESULTS AND DISCUSSIONS

We collected and recorded the survey data. Then, the data was pre-processed and scaled to fit before feeding it to the K-means clustering algorithm. Then, experiments were conducted to select the best value for K. Results of the experiment are presented and discussed herein.

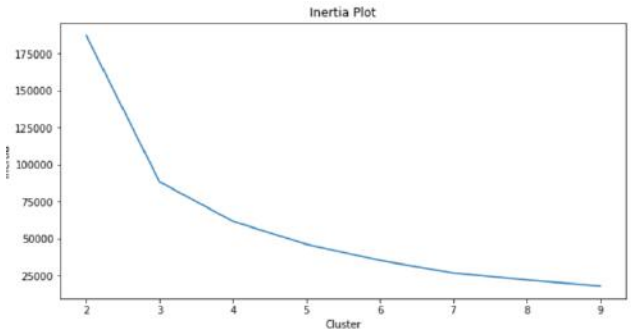

Fig. 2: Inertia Plot

The K-means algorithm clusters data by trying to separate samples into *k* groups of equal variances which optimizes a criterion known as the inertia (within-cluster sum-of-squares). Inertia can be recognized as a measure of how internally coherent clusters are. However, choosing the value for K will affect the inertia. Thus, this requires, careful observation and analysis.

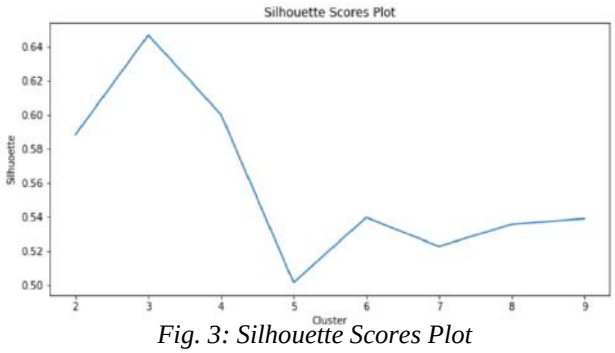

Fig. 3: Silhouette Scores Plot

Based on Fig. 2, the with-in cluster sum of squares (inertia) from K = 2 to 9 follows a downward trend. Starting at K = 2 with a value of 187355, it steadily decreased to 18122 at K = 9. Based on the analysis, the best K value is found at K =3, forming the elbow where there is sharp decline of inertia. However, using the inertia plot is not enough. Therefore, we also recorded and checked the Silhouette coefficient during the experiments. Results of the experiments are displayed in the next figure.

Silhouette score was used to evaluate the quality of clusters. This score describes how similar a sample is to its cluster as compared to samples from other clusters. This value is ranged from -1 to 1, but it is understood that the closer the score to 1, the better the clustered data points are in terms of cluster cohesion and separation.

Fig. 3 shows the results of the silhouettes scores for every value of K during the experiment. Based on the plot, the K where the silhouette score capped the highest was determined to be the best K value for the number of clusters in the dataset. The K value found in the figure is also the same K value found using the Elbow method discussed earlier. Thus, the K value of 3 was used as the number of clusters in the K-means algorithm. After clustering, the results are visualized and shown in the next figure.

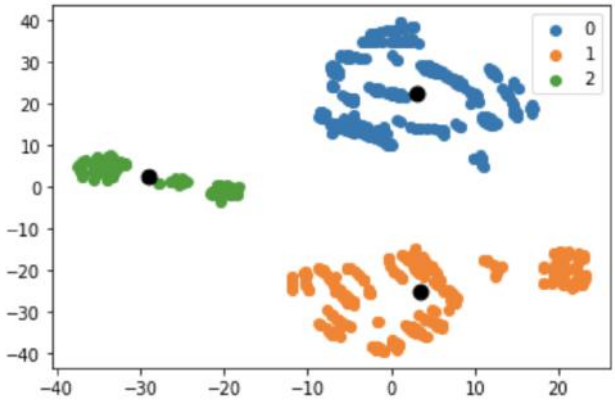

Fig. 4: Clusters Visualization

Based on the figure, the algorithm was able to distinguish three distinct groups of students. The centroid for each cluster is also plotted in the figure, which shows a healthy distance between data points within each cluster. On the other hand, the distance between each cluster are also far, thus, indicating good clusters. However, this does not describe the insights for each cluster. Thus, we inspected the data points belonging to each cluster and indicators were observed. The summary is shown in the following table.

Table 2. Cluster Descriptions

Cluster	Name
1	Moderate-signal mobile users
2	Low-signal mobile users
3	Low/moderate-signal mobile/broadband users

Cluster 1 refers to students having smartphones with access to moderate signal and prepaid data. This cluster has 306 students. Since majority of the students in this cluster own smartphones and have access to moderate prepaid data, they are most likely to have easy access to online learning resources (Fig. 5).

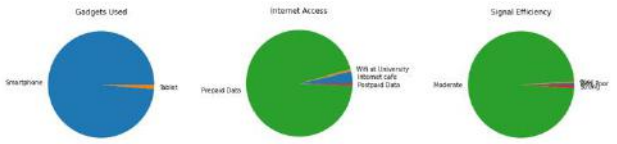

Fig. 5: Cluster 1

Students from Cluster 2 are mostly situated in areas where cell sites are available. On the other hand, Cluster 2 refers to students having smartphones with access to low-very low signal and prepaid mobile data. This cluster has 308 students located in the outskirts of the different municipalities.

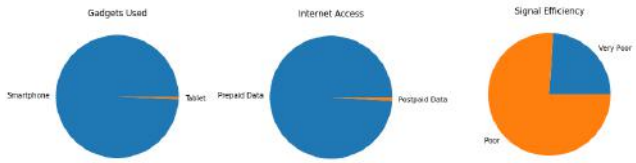

Fig. 6: Cluster 2

As can be seen in Fig. 6, students belonging to this cluster will most likely to have difficulty in accessing online learning resources. Moreover, access to learning management systems, knowledge databases and search engines are severely limited barring interventions from the Institution.

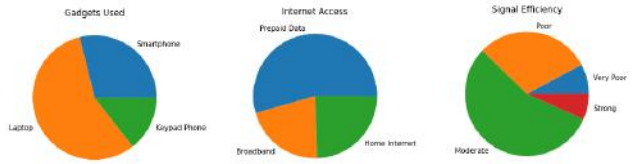

Fig. 7: Cluster 3

Lastly, Cluster 3 is a mixed group of students which own smartphones and/or laptops with access to low to high internet speeds using prepaid data or broadband home internet. This group is comprised of 90 students typically located near the municipalities where there is availability of home/wired broadband internet.

Based on the discovered clusters, three different groups of students were found to have varied usage of devices for learning, as well as access to internet, and signal efficiency. However, in order to get a much better understanding of the clusters, we also analyzed the degree program composition per cluster in an attempt to discover patterns that would be helpful in tailor-fitting the learning modalities.

Table 3 Cluster composition by degree

CLUSTER	BTLED (%)	BSED (%)	BEED (%)	CS (%)	ES (%)	HM (%)	HRST (%)
1	9	6	12	15	27	19	10
2	6	10	14	15	23	19	14
3	19	3	16	34	16	10	2

As shown in the table, for each cluster, there is no uniform distribution of students per degree program. However, Cluster 1 and 2 are predominantly consisted of BSES and BSHM students while the rest of the percentages of students from other courses are scattered across the results. Cluster 3 on the other hand, are predominantly comprised of CS students. As can be seen for each cluster, all courses cut across all programs have been represented. Policy interventions can be formulated for each learner segments which are helpful on the part of the students.

IV. CONCLUSIONS

Using K-means algorithm, we were able to successfully determine the different learner segments from the dataset according to gadgets used, internet access and signal efficiency. There were three clusters obtained; Moderate-signal mobile phone users, Poor-signal mobile phone users, and mixed group of Low-Strong mobile/broadband users. Overall, students from the different clusters are more suited for flexible learning modalities rather than online learning. This confirms that some interventions have to be formulated and implemented.

V. RECOMMENDATIONS

A Based on the conclusions, we recommend the adoption of and creation of new normal policies to cater the needs of the different learner segments. The University may consider allocating pocket WIFI and load allowances to the students. Further, flexible learning methods may be adopted for students in Cluster 1 and 3, while printed modules are recommended for students in Cluster 2. Lastly, creation of new policies such as a new grading system, student monitoring/advising mechanisms and online services are also recommended. This is to ensure

that a holistic approach to education is provided to the students to offset the effect of the pandemic.

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A Review of PMS systems and How Can be Implemented in Al-Qassim Municipality Roads

Fawaz Alharbi

Department of Civil Engineering, College of Engineering, Qassim University, Buraydah, 51452, Saudi Arabia

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Abstract— *In recent years, a pavement management system (PMS) has been widely used by highway agencies to manage their roads effectively, especially with significant increases in traffic loadings, limited budget, aging of pavement network, and improper road design and construction. AL-Qassim region, Saudi Arabia, is facing enormous challenges in dealing with pavement networks because the current pavement management system is not capable to maintain the pavement network at desirable condition, leading them to taking improper decisions regarding maintenance and rehabilitation activities. Therefore, it is important to maintain the current roads at an acceptable level of service by coordinating the maintenance works and evaluating the pavement condition periodically to reduce the deterioration rate. The goal of this paper is to review the practiced PMS and study how it can be implemented in Al-Qassim roads with some adjustments. The proposed PMS will assist the decision-makers in Al-Qassim municipality in planning the maintenance and rehabilitation works during the roads design life.*

Keywords— ***Municipalities, Pavement, PMS, Roads, Saudi Arabia.***

I. INTRODUCTION

The PMS has been applied widely by highway agencies to manage the pavement network and assist engineers and decision-makers. The decision-makers can rely on the PMS to select the optimum strategies and schedule maintenance activities for preserving the pavement network at the desired level of services based on cost-effective analysis and the available funds. The main task of a PMS is to provide the highest pavement quality with limited resources [1]. The pavement is a complex structure to deal with as it is influenced by various factors such as environment, materials, and traffic loads [2]. The American Association of State Highway and Transportation Officials (AASHTO) defined the PMS as "a set of tools or methods that assist decision-makers in finding optimum strategies for providing, evaluating, and maintaining pavements in a serviceable condition over a period of time" [3]. An effective PMS requires data from different sources which include data related to pavement performance, section description, historical, policy, geometry, environment, and cost [4]. The implementation of applying an effective PMS should be done through the several steps which are: pavement condition survey, pavement assessment, life cycle cost analysis, and defining the alternative strategies for maintenance [5].

Although the concepts of PMS began in the early 1970s, and the effects of PMS have been proven, many highway agencies have not applied these concepts for maintaining their road networks. Therefore, there is a need to explain and simplify the PMS concepts and their impact on road conditions, especially with limited funds.

In Al-Qassim region, the municipality engineers use their judgments for evaluating pavements and maintenance decisions. Therefore, it is necessary to introduce the concepts of pavement management and initiate the PMS for Al-Qassim municipality. This paper can help and simplify the concept of PMS and its implementation in Al-Qassim cities for managing their roads networks.

The main goal of this paper is to review the PMS and improving the current practice of pavement management in Al-Qassim region, Saudi Arabia, by clarification the required data that should be collected for the inventory and the required steps for establishing the modern PMS.

II. PROBLEM STATEMENT

Al-Qassim region is located in the center of Saudi Arabia as one of the thirteen administrative regions of the kingdom as shown in Fig. 1. The current population of Al-Qassim is around 1,455,693 living in an area of 58,046 km^2 [6]. Two major highways pass through the Al-Qassim region; Highway 65 connects from south to north of the kingdom, and Highway 60 connects from west to east.

Fig. 1: Map of Saudi Arabia with Al-Qassim region outlined [7]

In July 2020, the Saudi Council of Ministries approved that the jurisdiction of the executed and future roads within the urban boundary of the Ministry of Municipal and Rural Affairs and within its responsibilities, and the jurisdiction of the executed and future roads outside the bounder of the urban area of the Ministry of Transport and Logistic Services and within its responsibilities. The total lengths of roads that are under the Ministry of Transport and Logistic Services are around 71,500 km and they have been designed and built based on a high level of standards specifications [8]. In 2018, the Ministry of Transport and Logistic Services built 1,721 km in the kingdom as new roads, of which 77.12 km were in the Al-Qassim region, moreover, there were 67,027 km in the kingdom, of which 6,492 km were in the Al-Qassim region [9]. In 2019, the Ministry of Transport and Logistic Services spent $1.15 billion (4.3 billion Riyals) on highway maintenance activities for three years from 2019 to 2022 [10].

Al-Qassim municipality is responsible for existing roads with lengths of 11,216.7 km, 667.8 km under construction, 1408.8 km proposed for the building, and 5 bridges up to the end of 2019 [11]. By the end of 2020, Al-Qassim municipality has maintained and rehabilitated around 163888 m^2 of Al-Qassim roads [11]. The total lengths of roads that were exposed to maintenance and rehabilitation process in 2016 were 34 km of major roads and 8.3 km for local road [12]. The increasing of actual executed roads' length, under construction roads' length, and proposed roads' length are shown in Fig. 2. After applying the aforementioned legislation, the Al-Qassim municipality will be responsible for all roads within cities such as the ring road of Buraydah (the capital of Al-Qassim region) with 73 km and 18 bridges, moreover, the 31 km internal ring road. Therefore, these roads should be managed and maintained in a proper method to improve their conditions and serviceability. The proposed PMS should be able to generate comprehensive, simple, and valuable reports that can be relied on by the decision-makers.

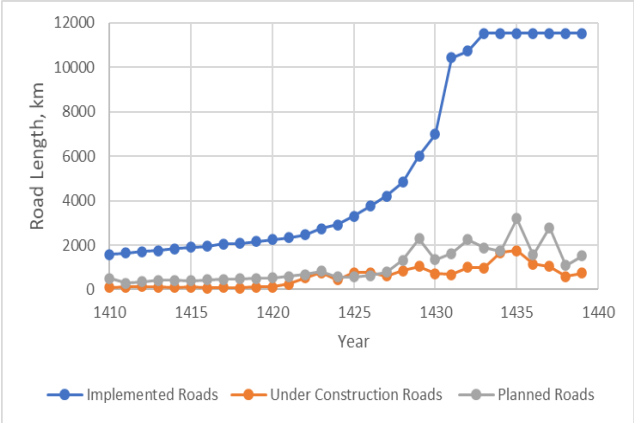

Fig 2: lengths of implemented, under construction, and planned roads in Al-Qassim region

Nowadays, governments across the world are facing a dilemma as a result of the COVAID-19 pandemic, so they are increasing spending on certain sectors such as health care, small and medium enterprises, and logistics, also, they cut some commitment infrastructure spending to stimulate their economies. Therefore, highway administrations should adopt an effective tool to distribute the reduced budget on their roads based on systemic methods.

III. THE PMS REQUIRED STEPS

The main objective of this research is to provide simple and effective guidelines for applying the PMS for Al-Qassim municipality. Before applying the PMS, a new department or committee should be forming containing several pavement engineers, Geographic Information System (GIS) operator, statistical analyzer, and Information Technology (IT) technician. The responsibilities of the recommended department are making sure the PMS working as planned, modifying the PMS to meet the municipality's needs, and generating reports and recommendations.

The elements of proposed PMS are collecting pavement condition data, establishing criteria for pavement assessment, prediction models to predict pavement performance, and establishing strategies for pavement maintenance. The proposed PMS for Al-Qassim municipality is presented in Fig. 3.

The proposed PMS includes all basic steps of PMSs that have been applied by highway agencies. The steps of the proposed PMSs are defined in the following sections.

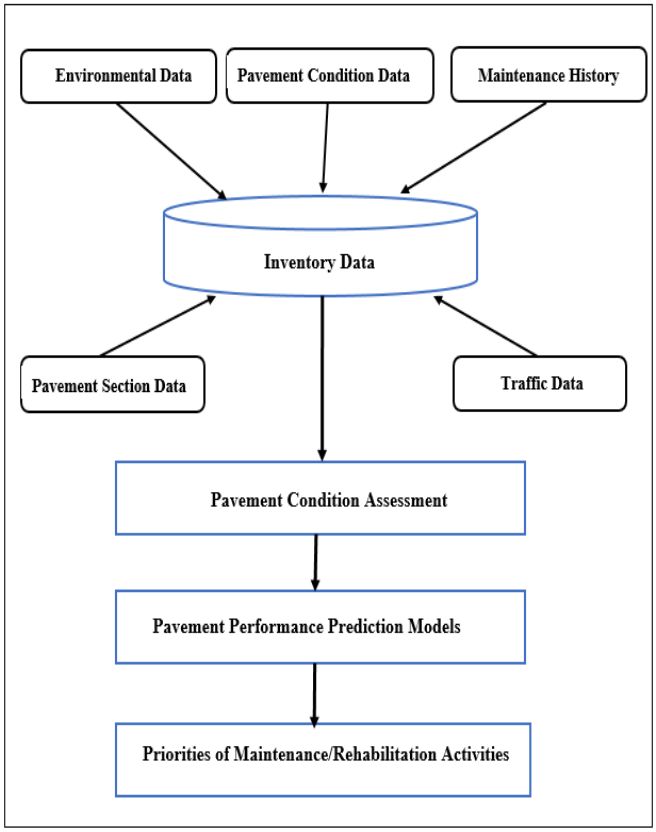

Fig.3: Proposed framework for Al-Qassim PMS

A. *Inventory Data*

The first step of the PMS process is collecting all data relevant to the management of the pavement network. Inventory data are a very important step in any PMS because the inventory data include data of environment, traffic loads, pavement condition, maintenance, and geometric data. The following sections contain the required data for having an effective PMS.

1) *Pavement Section Data*

The inventory data should cover the entire pavement network by dividing the roads into sections, and each section must be identified by beginning and ending stations, and each section is referenced through a Global Positioning System (GPS). AASHTO (2012) recommended that each pavement segment in inventory should include: segment length and location (beginning and ending points), road functional classification, pavement and shoulder type, number of lanes, drainage information, pavement age, and layer thicknesses [13].

2) *Traffic Data*

Traffic data is a fundamental factor in any PMS for predicting pavement performance, and the traffic data is collected as average annual daily traffic, truck percent, traffic growth or Equivalent Single Axle Loads (ESALs) [4]. Collecting accurate traffic data leads to knowing the priorities of maintenance activities which can be used to allocate the available budget of maintenance [5]. The magnitude of loading, axle configuration, and the number of load repetitions have a large influence on pavement performance and significant factors that can cause damage to the pavement [14].

3) *Environmental Data*

Including the environmental data into the PMS can assist decision-makers in predicting pavement performance and selecting the proper maintenance action. Minimum temperature, maximum temperature, freeze-thaw cycle, and seasonal rainfall impact on pavement deterioration rate by changing the material properties of pavement surface and sublayers, therefore, the environmental factors should be included in the inventory data. The National Cooperative Highway Research Program (2004) reported that the strength of all layers including the asphalt layer, unbounded materials, and subgrade are significantly impacted by the environmental factors [15].

4) *Pavement Condition Data*

Pavement condition data is a significant component of data inventory for PMS because it is used to compare pavement sections in the network to find the best solutions option for applying the maintenance action. Most of the highway agencies conduct periodic pavement condition surveys usually every two years, and the collected data should be in reasonable detail based on the available budget and tools [16]. For asphalt pavement, the collected data are roughness, rut depth, transverse cracking, fatigue, non-load-related cracking, shoving, potholes, bleeding, raveling, and polishing [17]. The two common ways to determine the pavement condition are International Roughness Index (IRI) which measures the irregularities in the pavement surface and the Pavement Condition Index (PCI) which mainly includes most pavement distresses [1]. Hass (1994) explained the relationship between the level of detailed data and types of decisions in the process of pavement management as shown in Fig. 4 [4].

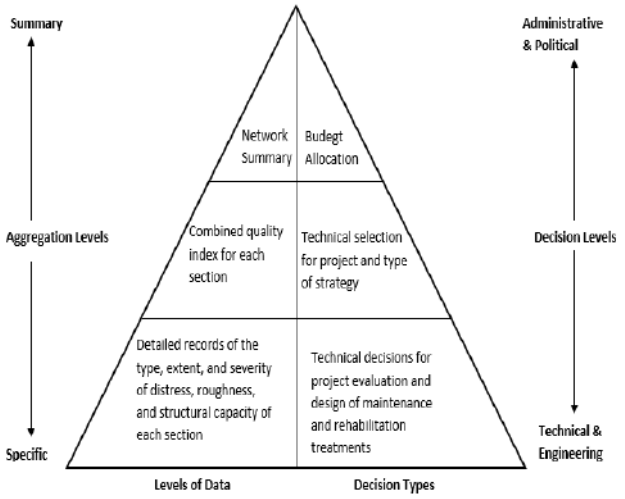

Fig.4: Level of data aggregation and decisions

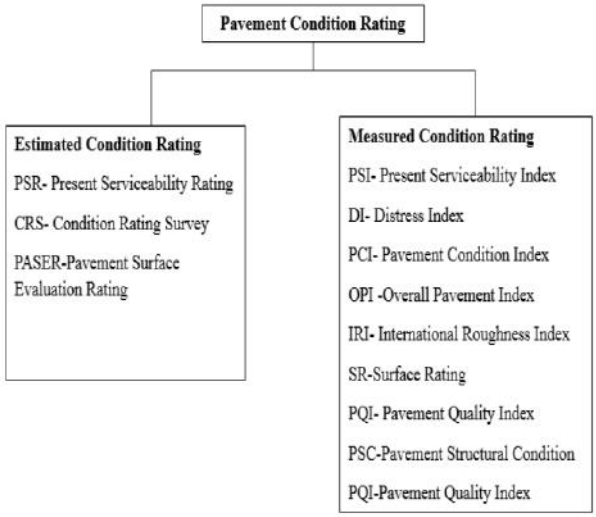

Fig.5: Pavement evaluation systems

5) Maintenance History

Maintenance data include information on all maintenance and rehabilitation types and their effects on pavement performance. Also, knowing the history of performed maintenance with associated cost provides a clear indicator of the effectiveness of each maintenance activity for calculating life cycle cost analysis. Collecting periodic maintenance data over time is necessary to fulfill the PMS purpose because the maintenance action can greatly affect the reliability of performance prediction models [18].

B. Pavement Condition Assessment

The main reason for collecting the pavement condition data is for reporting the pavement conditions of all pavement sections. The combination of the individual measures is sufficient for indicating the overall quality of pavement conditions to be used for communications between engineers, the public, and administrators. Accurate evaluation of pavement conditions leads to proper decisions for maintenance and rehabilitation activities. The pavement assessment tools range from visual inspections to sophisticated processes, such as video and image analysis [19]. However, the critical task is how to convert the collected data into overall pavement condition indices that include the extent and severity of ride quality, pavement distresses, structural capacity, and skid resistance. Fig. 5 represents the examples of rating systems either as measured or estimated approaches [20].

C. Pavement Performance Prediction Models

The concept of pavement performance means that the ability of pavement structure to serve under-considered traffic loadings and climate factors [3]. Pavement performance prediction models consider a critical element of any PMS, and reliable prediction models are needed for having an effective PMS, therefore, highway agencies should develop resilient prediction models for their roads to predict the future performance of pavements under traffic and environmental factors. The prediction models can assist road engineers and decision-makers to identify when, where, and what treatment actions should be taken. Moreover, AASHTO (2012) reported that pavement prediction models can play important role in terms of estimating future pavement conditions, identifying the suitable time for applying maintenance, analyzing the cost-effectiveness of each treatment for pavement network, and establishing criteria for warranty contracts and performance specifications [13]. Hence, the performance of each pavement section is illustrated to demonstrate the future performance of existing pavements and the rehabilitation alternatives in the needs year as shown in Fig. 6.

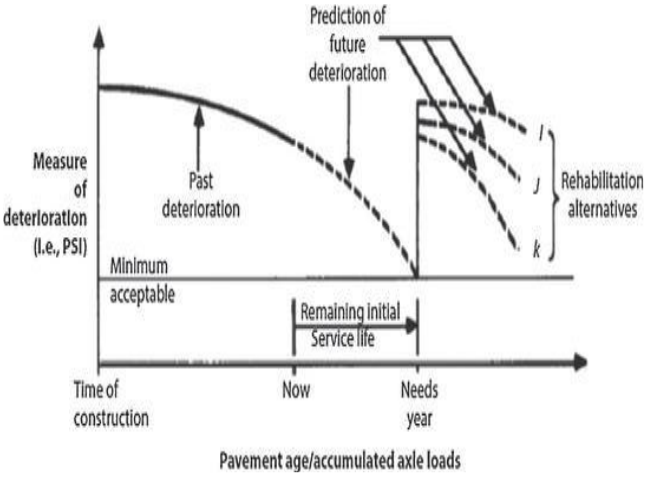

Fig.6: Pavement performance curve over time [4]

The typical pavement performance prediction models relate a performance indicator to one or more significant variables affecting the pavement performance such as traffic loadings, environmental factors, pavement structure, and material properties. The common pavement performance indicators are pavement condition index (PCI), present serviceability index (PSI), and international roughness index (IRI) [21]. Currently, the performance prediction models are classified into empirical, mechanistic-empirical models and their applications are based on the availability and quality of data [22].

D. Priorities of Maintenance/Rehabilitation Activities

The major output of PMS is applying the best treatment for the pavement sections which leads to optimizing the roadway network. Therefore, planning and prioritizing the pavement maintenance and rehabilitation activities can enhance the roadway network by extending the pavement service life, improving riding quality, and reducing vehicle operating costs. Different factors should be considered when selecting maintenance and rehabilitation strategies. These factors are how worse the pavement condition, available budget, traffic volume, and cost of proposed treatment action. The basic strategies for maintenance and rehabilitation actions are shown in Table 1 [23].

Table 1: The basic strategies for maintenance and rehabilitation strategies

Maintenance and rehabilitation actions	***Action description***
Routine maintenance	Defined as a planned maintenance action that should be performed on a schedule to store the roads at a required level of service.
Preventive Maintenance	Defined as a type of maintenance action that is designed to correct deterioration before getting into a worse condition.
Deferred action	This action is applying when the pavement condition is getting into the point that routine and preventive maintenance are not feasible for applying and no need for major rehabilitation.
Rehabilitation action	This action is an extensive corrective action that can extend the road service life when the routine, preventive, and deferred actions are no longer cost-effective.
Reconstruction action	This action is undertaken when the road cannot carry the traffic loads safely, and the other maintenance actions are not feasible to perform.

It is important to take the proper decisions for maintaining pavements based on type and severity of distress. The most common distresses for asphalt pavements are rutting, roughness, raveling, cracking, bleeding, and weathering and their treatments are either routine maintenance, surface seal coats, milling, and inlays, thin overlay, thick overlay, mill, and overlay, or reconstruction [13]. Each treatment should be applied based on trigger rules which include surface type, pavement age, pavement condition, and traffic volume. These trigger values are determined by engineers who have experience with treatment options and pavement network. The trigger values approach determines the feasibility of applying maintenance activities for each pavement section in the network, and it can be visualized as a decision tree or matrix to be easier for use by engineers and decision-makers. Fig. 7 shows the decision trees that was developed by the Ministry of Transport in Ontario (MTO) to determine the proper treatment decision and at each branch in the tree, specific option should be identified [24]. Also, Champaign County in Illinois uses a matrix to determine the proper treatment based on PCI, structural capacity, traffic volume, and as shown in Fig. 8 [25].

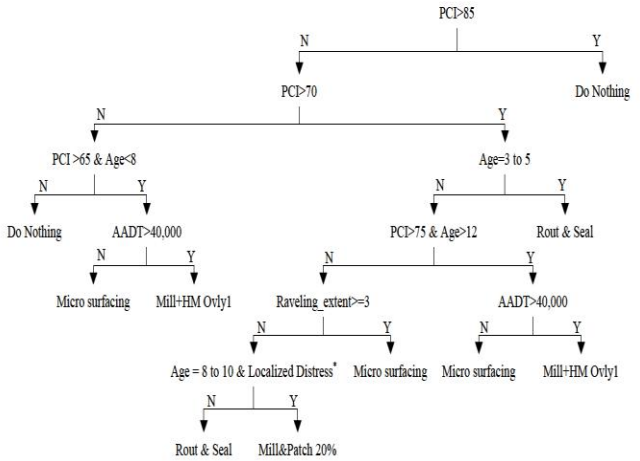

Fig.7: The MTO decision on the tree that used for determining the treatments

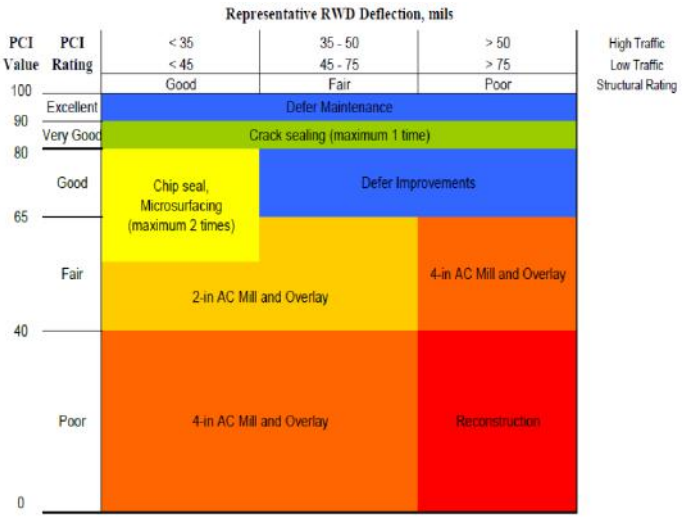

Fig. 8: Champaign County matrix for selecting treatments

The previous section discusses the feasible approach for the selection of proper treatment for pavements within the network. In general, the available funds for municipalities to repair their roads are not sufficient to fix all road segments in the network. Therefore, it is important to priorities the projects for consuming the available budget as wisely as possible. Ranking and benefit-cost analysis approaches have been widely utilized to priorities the maintenance and rehabilitation projects over the road network when there is insufficient budget.

A ranking approach is a simple approach to rank the projects based on agency criteria such as pavement condition and/or traffic level. In the ranking approach, the road sections are repaired based on the worst first strategy until consuming the available fund. The drawback of this approach is the cost-effective analysis is not considered which means the pavement network is not managed for long-term strategy.

A benefit-cost analysis approach is favored over a ranking approach as the cost-effectiveness is considered in terms of treatment types and impact of delaying or accelerating a treatment. The benefits in PMS are considered the additional performance provided after applying the treatment which is represented as a benefit area in Fig. 9. The benefit-cost ratio is calculated as a treatment benefit (area under performance curve after applying the treatment) divided by the treatment cost.

The road departments now have two options to priorities their projects either by using ranking or cost-effective analysis and that is based on the available fund.

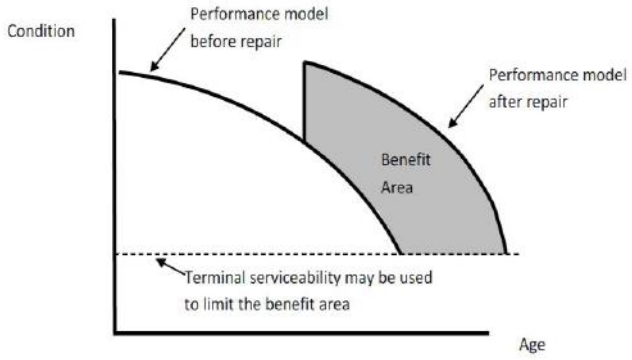

Fig. 9: Benefit calculation using the benefit performance curve [13]

IV. CONCLUSION

The paper reviewed the current practice of PMS and recommends the Al-Qassim municipality engineers to implement the PMS through collecting and store data, predicting future pavement performance, and applying effective treatments for the roadway network in the Al-Qassim region. Currently, the assessment of road conditions in most cities is not widely managed properly and the maintenance decisions are not made based on economic evaluation. Therefore, the PMS can play a significant role in the acquisition-related data, evaluation pavement condition, and allocating maintenance budget effectively. It has been proven that applying a PMS is better than working without any systemic approach for managing the roads network. The road agencies in Saudi Arabia should conduct a feasibility study for implementing a PMS for their roads. The potential costs for applying the PMS are the cost of collecting and storing data, acquisition of software and personal training, and cost of required maintenance and rehabilitation activities. The benefits of having a PMS can be included in two main outputs; maintaining the pavement condition of the road network at

a desirable level, and allocating the available maintenance budget on the network effectively.

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An Inquiry on the Self-Esteem and Self-Efficacy Level of Information Technology Students

Ruth G. Luciano, Cris Norman P. Olipas

College of Information and Communications Technology, Nueva Ecija University of Science and Technology, Philippines

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Abstract— *This study aimed to identify, analyze and determine the level of self-efficacy and self-esteem of B.S. Information Technology (BSIT) students of a higher learning institution in Nueva Ecija, Philippines. It was conducted during the 1st Semester of the academic year 2019-2020. This research utilized descriptive approach to describe the level of self-esteem and self-efficacy of the students and to draw valuable insights that may contribute to the improvement of the teaching and learning practices of the faculty members in the college. The researchers used random sampling to ensure that all year levels are well represented in the study. There were 285 students who voluntarily responded after the researchers explained to them the purpose of this study. Responses were tallied, summarized and interpreted. Results show that the level of self-esteem and self-efficacy of the students were moderate/medium (WM=2.03, WM=2.08). This indicates that depending on the given situation or context, students may increase or decrease the level of their self-esteem and self-efficacy. This study suggest that students may be exposed to more activities that may help them improve their self-esteem and self-efficacy to greatly contribute to their holistic development. Future studies may be conducted to a larger number of respondents and to understand the link between self-efficacy and self-esteem on their academic performance, drop-out rates, and retention rates.*

Keywords— ***Information Technology, Self-Efficacy, Self-Esteem***

I. INTRODUCTION

The mastery of information, ingrained knowledge and understanding, and expanded use of technological advancements are the goals of education in the twenty-first century (Stone, 2014). It encompasses the holistic development of the learner in order to be fully equipped for the world of work, to contribute to economic development, and to uplift the quality of life. Schools have the responsibility to contribute to the attainment of these goals. There has been a perception that schools should stress intellectual growth over other factors, but according to Kohn (2015), education's primary goal should be to produce competent, caring, loving, and likeable individuals. Apart from equipping the learners' cognitive aspect, affective domain must also be considered. Thus, looking at the self-esteem and self-efficacy of the learners help in understanding how to greatly help them.

Several educational studies have shown the relevance of self-esteem and self-efficacy in the school system, notably on student performance. Self-esteem is defined as a psychological trait that involves self-judgment based on one's ideals about humans (Alesi et al, 2012). It entails being conscious of one's value system as well as one's emotional assessment of one's self-worth. (Schunk, 1985). People who have a high degree of self-esteem have a high level of social adjustment (Martin et al, 2014). Students must have good self-esteem to strengthen social skills and ability to cultivate supportive and lasting relationship (Watson, 2020).

On the other hand, self-efficacy is a person's conviction in his or her ability to carry out the actions required to achieve certain performance goal (Bandura, 1977). It is the belief in one's ability to succeed. Relevant to a specific task or area of knowledge or performance, self-efficacy

shapes the behaviors and strategies that help pursue one's goal (Gunn, 2020).

Literature reviewed have shown the impact of self-esteem and self-efficacy to students. Wood (1987) conducted four studies to examine the relationship between self-efficacy and performance in college course. It was found out that self-efficacy is significantly related to academic performance and to self-set academic grade goals. Academic self-efficacy is an essential factor influencing academic performance among students (Hayaat et al, 2020). The higher the self-efficacy among the students, the better performance and results they can get compared to students with low self-efficacy (Ahmad & Safaria, 2013).

On the other hand, Arshad et al (2015) found that there was a significant relationship between self-esteem and academic performance among university students. Moreover, significant difference was found out between male and female students. Meanwhile, Zao et al (2021) asserts that self-esteem positively predicted academic engagement among students.

Based from reviewed literature, self-esteem and self-efficacy affects students in different forms, both positive and negative. This study contributes to the existing body of knowledge by providing insights about the level of self-esteem and self-efficacy among Information Technology students. Further, this study aims to answer the following:

1. What is the demographic profile of the BSIT students based on:
   1.1. age; and
   1.2. sex?
2. What is the level of the self-esteem of the BSIT students?
3. What is their level of self-efficacy?

II. METHODOLOGY

A research design is a blueprint or strategy that is produced particularly to respond to the research topic (Dulock, 1993). Descriptive research aims to "describe" the variables under investigation without identifying its connection to other variables. The main goal is to provide information about the relevant features or details of the variables under study.

This study was conducted in a higher learning institution in Nueva Ecija, Philippines. It involved 285 IT student-respondents based from the result of the random sampling conducted during the second semester of academic year 2019-2020.

Three-part survey instrument was used for this study. The first part covered the respondent's demographic profile such as age and sex. The second part was the self-esteem checklist adapted from Lawrence (2006). It consisted of 48-item inventory divided into 10 sections namely; (1) unrealistic perception about self, (2) weak foundation for positive self-esteem, (3) not confident for school works, (4) does not cope well with failure, (5) finds it hard to accept responsibility for own actions, (6) negative perceptions from others, (7) easily lead, (8) image is very important, (9) does not have positive friendship and (10) eating pattern disturbed. The third part of the instrument solicits the self-efficacy level of the respondents. It is composed of 12-item statements where majority of the items were taken from the study conducted by McKenzie (1999).

To ensure that the instrument was valid and reliable, reliability analysis was done. As shown in Table 1, results indicate that the instrument was acceptable based from the Cronbach's Alpha value of .917 for Self-Esteem instrument and .886 for Self-Efficacy instrument.

Table 1: Reliability Analysis

Items	Cronbach's Alpha	No. Of Item
Self-Esteem	.917	48
Self-Efficacy	.886	12

In interpreting the answers and the computed results, scoring guide and rating scale is necessary. Table 2 presents the scoring guide used for this study.

Table 2: Scoring Guide

Range	Verbal Description	Interpretation
2.21-3.00	High	Applies to some extent
1.71-2.20	Medium	Certainly applies
1.00-1.70	Low	Strongly applies

To gather the needed data, the researchers' hand-over survey questionnaire to the randomly selected respondents. The researchers explained the contents of the instrument to the respondents and ensured them that the gathered data will be treated for research purpose only with utmost anonymity and confidentiality. After the researchers answered the queries related to answering the instrument, the respondents took time to answer the survey questionnaire.

After the researchers handed over the instrument to 285 respondents, they started data encoding, data cleaning, data

organization, and data treatment. Data treatment and analysis was done using Statistical Package for Social Sciences (SPSS) version 20. Appropriate statistical tools and techniques were used to come up with relevant and reliable results.

III. RESULTS AND DISCUSSION

A. Demographic Profile of the Respondents

Figure 1 below presents the demographic profile of the respondents based on their age. Results revealed that among the 285 IT students, 13% were 15 to 17 years old, 64% were 18 to 20 years old, 19% were 21 to 23 years old,

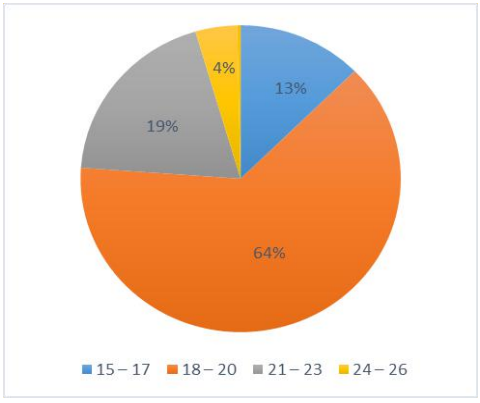

Fig. 1 – Demographic Profile based on Age

and 4% were 24 to 26 years old.

In figure 2, 66% of the respondents were male and 34% were female. Results revealed a 32% gap based on sex. In different computing programs, several studies revealed a significant gap between male and female (Chan et al, 2000; Luciano, et al., 2020; Olipas and Cochanco, 2021). In a study conducted by Olipas and Luciano (2020), more male enrolled in IT program compared to female students posing an opportunity for the college to devise programs and activities to narrow the gender gap among students in computing programs.

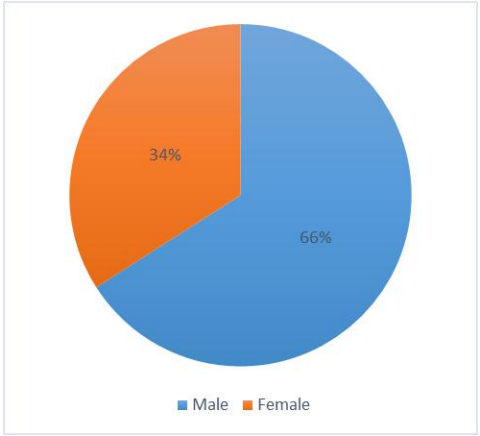

Fig. 2 – Demographic Profile based on Sex

B. Level of Self-Esteem of the BSIT Students

Table 3: Level of Self-Esteem of the BSIT Students

Item	WM	VI	Rank
Unrealistic Perception about self	2.02	Certainly Applies	5
Weak Foundation for Positive Self-Esteem	2.03	Certainly Applies	4
Not Confident for School Works	2.06	Certainly Applies	2
Does Not Cope well with failure	2.03	Certainly Applies	4
Finds it hard to accept responsibility for own actions	2.04	Certainly Applies	3
Negative Perceptions from others	2.03	Certainly Applies	4
Easily Lead	2.04	Certainly Applies	3
Image is very important	2.01	Certainly Applies	6
Does not have positive friendship	2.06	Certainly Applies	2
Eating Pattern Disturbed	2.07	Certainly Applies	1
Overall Grand Mean	**2.04**		
Self-Esteem Level	**Medium**		

Table 3 presents the result of the evaluation on the level of self-esteem among the BSIT students. Respondents have reported that self-esteem have greatly affected their eating patterns (WM=2.07), their positive friendship to others (WM=2.06), and not confident for school works (WM=2.06). Further, students find it hard to accept responsibility for own actions (WM=2.04), easily lead (WM=2.04), has negative perception from others (WM=2.03), do not cope well with failure (WM=2.03), and has weak foundation for positive self-esteem (WM=2.03). It may also certainly apply that for the student-respondents image is very important (WM=2.01), and their unrealistic perception about self (WM=2.02).

Medium to Low Self-Esteem among students have significant impact to their academic performance, to their relationship to others, and their view of oneself. Results revealed that IT students have a medium level of self-

esteem as reflected in the overall grand mean of 2.04. This shows that in certain situations, their self-esteem may change due to their exposure to several factors other than those mentioned above.

C. Level of Self-Efficacy of the BSIT Students

Table 4: Level of Self-Efficacy of BSIT Students

Item	WM	VI
Self-Efficacy	2.08	Certainly Applies

As shown in Table 4, the self-efficacy of the BSIT students can also be considered medium as reflected in the mean score of 2.08. Self-efficacy significantly affects their academic performance in many ways; thus, it is necessary to help them improve their self-efficacy so they can also improve the other aspects of their being.

IV. CONCLUSION AND RECOMMENDATIONS

This study inquired about the level of self-esteem and self-efficacy of the BSIT students in a higher learning institution in Nueva Ecija, Philippines. It was participated by 285 randomly selected respondents. Based on the results, majority of the respondents, 64%, were between ages 18-20 years old. There was a 32% gap between male and female respondents. The results of the assessment on self-esteem revealed that BSIT students have medium level of self-esteem as reflected in the over-all mean rating of 2.04. Also, the level of self-efficacy fell on the medium level as shown in the over-all mean rating of 2.08.

Medium level of self-esteem and self-efficacy may affect the academic performance of the BSIT students. Thus, the following recommendations are presented.

1. The Gender and Development Unit of the College may utilize the data depicting gaps between Male and Female to come-up with activities or programs to contribute in narrowing gender gap in the computing program;
2. The CICT Guidance and Counselling Coordinators may consider the results in coming-up with activities that would help students improve the level of their self-esteem and self-efficacy; and
3. Future researches may be conducted to look at the factors affecting the level of self-esteem and self-efficacy among the BSIT students.

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Challenges and Adjustments in the Curriculum and Instruction of the K+12 Program: Basis for Strategic Plan

Dr. Gerald A. Quijano

Faculty Member, Nueva Ecija University of Science and Technology – Fort Magsaysay Campus, Palayan City, Nueva Ecija, Philippines

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Abstract— *The Philippines adapted the K+12 program to uplift its educational standards in order to become comparable to those of other countries. RA 10533 was enacted and mandated that all schools both public and private must comply with its provisions/guidelines to better equip its citizens with the necessary knowledge and skills to meet the higher educational demands of life and work of the 21st century. This study assessed the curriculum, instruction, challenges, adjustments, and compliance to the standard of the K+12 program implementation of teachers together with their principal/school heads in the Laboratory High School of Nueva Ecija University of Science and Technology, during the academic year 2019-2020. The study utilized the descriptive method in order to describe the current status of the K+12 curriculum implementation in the said school. A total of 69 respondents were selected through purposive sampling coming from the four campuses of NEUST namely Gabaldon Campus, San Isidro Campus, Fort Magsaysay campus and General Tinio Campus. Weighted means were used to analyze their assessment of the curriculum, instructional-related factors and the challenges and adjustments encountered. The findings showed that the curriculum content, objectives and instructional-related factors are in conformity with the standards, policies or guidelines set by RA 10533, or otherwise known as "Enhanced Basic Education Act of 2013", subject to some improvements due to the addition of elective subjects. Respondents consider their learners as the center of the educational process, use varied types of teaching strategies and techniques depending upon the learners need, and has individual, paired or group applications. Resource materials and facilities are available but they are not adequate, nonetheless, school environment is generally conducive to learning. No significant relationship exists on their assessments with respect to the challenges experienced and the adjustments made in the implementation of the K+12 curriculum.*

Keywords— ***K+12 Curriculum, curriculum implementation, 21st century learners, curriculum challenges, curriculum adjustments.***

I. INTRODUCTION

Education has always been considered a vital factor in achieving the general objectives of national development and progress (Combalicer, 2016). In order to achieve the objectives of education, an instrument that serves as a vehicle of operation is required, that instrument is the curriculum which can be defined as all the learning experiences and intended learning outcomes systematically planned and guided by the school through the reconstruction of knowledge of the cognitive, affective and psychomotor development of the learner (Aneke, Nnabuike, and Otegbulu, 2016).

In the light of the foregoing statements, it can be said that the curriculum is one of the foundational elements of effective schooling and teaching, hence, it is often the object of educational reforms.

Pursuant to such reforms, the Philippine government continuously explores innovative programs and measures to improve the country's educational system (Montebon, 2014). In its effort to effect quality education, it adapted the K+12 program which started in the year 2012-2013 and was made into law by virtue of RA 10533. It is now on its 5th year of full implementation.

The goal of the K+12 program is to create a functional basic education system that would produce productive and responsible citizens equipped with the essential competencies and skills for both life – long learning and employment. This program will enhance the basic education system to full functionality to fulfill basic learning needs of students (Sequete 2015).

To receive basic quality education is a fundamental right guaranteed by the Constitution (Article XIV, Section 1). The implementation of K+12 should be regarded as a serious issue as the curriculum itself. This is because no matter how lofty the curriculum is designed, if it is not effectively implemented, the objective of education cannot be achieved.

Curriculum implementation entails the interaction of the learner and the curriculum contents under the guidance of the teacher in order to acquire desired knowledge, attitudes, abilities and skills (Aneke et.al, 2016). The learner is therefore the central figure in the curriculum implementation process. Implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas and attitudes to enable him/her to function effectively and responsibly in a given society (Chaudhary, 2015).

At the basic education level, the Department of Education (DepEd) sets the overall educational standards and mandates standardized tests for the K+12 basic education system, although private schools are generally free to determine their own curriculum in accordance with existing laws and Department regulations.

The Nueva Ecija University of Science and Technology being a recognized tertiary institution in the region needs to abide by this mandate for it caters secondary high school students under its Laboratory High School. Said department is under the supervision of the College of Education. It was established to serve as a training ground for NEUST future educators, for their educational experimentation, educational research, and professional development.

The researcher being a regular faculty member of Nueva Ecija University of Science and Technology came up with the idea of assessing its K+12 curriculum implementation. To be able to find out whether or not, the same is in accordance or in conformity with the standards and objectives set by the K+12 program. Hence, the reason for this study.

II. METHODOLOGY

The study utilized the descriptive method in order to describe the current status of the K+12 curriculum implementation of the school, subject of this study. Accordingly, descriptive research describes a present certain condition (Creswell, 2014). Relatively, such method is deemed appropriate since the study involved survey and description of facts and conditions existing within the school system itself. A total of 69 respondents (teachers with their principal) were selected through purposive sampling coming from the four campuses of NEUST namely Gabaldon Campus, San Isidro Campus, Fort Magsaysay campus and General Tinio Campus. To facilitate data collection, the researcher made use of a scholarly-made questionnaire with closed-ended question so as to allow respondents to appropriately choose their response. Weighted means were used to analyze their assessment of the curriculum, instructional-related factors and the challenges and adjustments encountered. Personal interviews were also conducted to obtain first-hand information. Pearson product moment correlation was used to determine if there exist a significant relationship between their assessment on the challenges experienced and the adjustments made in the implementation of the K+12 curriculum.

III. RESULTS AND DISCUSSION

This section provides the presentation of data relevant to the study. Corresponding analysis and interpretation were discussed using the above statistical tools.

Table 1 provides for the mean scores and verbal interpretations of the items pertaining to curriculum content as assessed by the teachers and their principals. Based from their assessment, the first-five items which obtain the highest mean are: It follows the spiral progression approach to ensure continuity of learning; instructional materials selected are based on their suitability to attain the objectives of the lesson; geared towards developing the critical thinking skills of the students; designs activities that develop student creativity and flexibility; and contents are contextualized in the light of the present situation with a weighted mean of 3.95, 3.91, 3.91, 3.89 and 3.89 respectively.

This means the teachers “strongly agree”, that the curriculum of NEUST laboratory high school adheres to the provisions of RA 10533 particular under section 5 of the same act. A careful scrutiny of the topics presented in the syllabus of instruction used by the teachers revealed that it jives with those topics listed under the DepEd’s curriculum guide, thus, it follows the spiral progression approach of learning content. The various syllabus used per subject provides the students with different types of

student activities and is dependent upon the lesson to be presented. These includes role playing, brainstorming, peer tutoring, simulation, debate, film viewing, concept mapping, problem solving and many others intended for the development of student creativity and flexibility as well as the enhancement of their critical thinking skills.

Table 1. Assessment of the Respondents on Curriculum Content

Contents	TWM	VI	PWM	VI
1) The contents of the curriculum are presented in chronological order.	3.83	SA	3.50	SA
2) It follows the spiral progression approach to ensure continuity of learning.	3.95	SA	3.75	SA
3) Specific values for a particular subject are integrated in each topic.	3.80	SA	3.00	A
4) Contents are contextualized in the light of the present situation.	3.89	SA	3.50	SA
5) Abreast with the new trends and issues both for local and international.	3.81	SA	3.00	A
6) Instructional materials selected are based on their suitability to attain the objectives of the lesson	3.91	SA	3.50	SA
7) Geared towards developing the critical thinking skills of the students.	3.91	SA	3.75	SA
8) Contents are evaluated and revised annually.	3.72	SA	3.50	SA
9) Designs project-based learning situations for active students participation	3.82	SA	3.00	A
10) Integrates the culture, customs and traditions of the community	3.86	SA	3.25	A
11) Creates situations that enable the students to develop communication skills.	3.83	SA	3.50	SA
12) Designs activities that develop student creativity and flexibility.	3.89	SA	3.25	A
13) Shows no dichotomy between knowledge and skills.	3.72	SA	3.00	A
14) Integrates relevant scholarly works and ideas as needed	3.77	SA	2.75	A
15) Resources available in the immediate school environment and community are used to facilitate learning, hence, "localized".	3.86	SA	3.00	SA
Overall Weighted Mean (OWM)	**3.84**	**SA**	**3.28**	**SA**

Legend: WMT – Teacher's weighted mean; WMP – Principal's weighted mean 1.00-1.75 Strongly Disagree (SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

Taylor (2004) as cited by Ballesteros (2015) defined contextualization as the development of new skills, knowledge, abilities and attitudes in students when they are presented with new subject matter in a meaningful and relevant context. According to Ballesteros (2015), this was further elaborated by Febby (2011) who defined it as a concept of learning that helps teachers link between the materials taught with real-world situations of students and encourage them to make the connection between the knowledge possessed by its application in their lives as family members and in the community.

The curriculum implementation of the NEUST laboratory high school as observed at the school level encourages students to become active and proactive members of the community through their acquired learning experience in and out of the classroom as evidenced by the various activities used by the teachers. This allows students to get in touch with the real-life issues and to be exposed with real life situations and problems.

To illustrate, students are allowed to perform different extracurricular activities like sports, quiz bee and research competitions in order to boost their morale at the same time allowing them to become more competitive. They are also encouraged to join different student group or organizations like the "HSTAG" which stands for "High School Theatre Arts Group, GSP/BSP scouts, Campus journalism with the "THE CORE" as their campus official newspaper as well as LSC or the Local Student Council for each campus. These organizations allow the students not only to hone their leadership skills and talents, but also training them on how to become assertive and responsible individuals of the community. Thus, there is no question that the concept of contextualization is being practiced. In addition, this also proves that the curriculum of the laboratory high school adheres to standards and principles enunciated by RA 10533.

It is also worthy to note, that when the teachers are asked with regard to the conduct or celebration of their yearly scheduled activities, they answered that ***"****it was pursuant to the DepEd Order No. 007, s.2019", though some of those activities were done on a different date."* This is to show that the LHS do not deviate from the DepEd's mandate by virtue of such order. In addition, LHS also follows the prescribed lists of subjects intended for educating the junior and senior high school, subject to few exceptions like the addition of elective subjects. When the teachers are asked as to what are those elective subjects taken by the students in addition to their regular subjects, they replied, ***"****they have their computer subject in grade 7, business mathematics in grade 8, statistics in grade 9 and research in grade 10".*

This proves that the students at an early age are given the chance to experience the basics of life necessities such as computer literacy, knowledge of business and financial transactions as well as investigative works. In effect, this would enable students to acquire learned strategies that would help them to thrive in their future.

Meanwhile, the assessment of the principal on curriculum content did not reveal much of a deviation from the assessment of the teachers as evidenced from the computed overall weighted mean of 3.28 which is verbally interpreted as "strongly agree".

This means that their responses are consistent with those of the teachers in terms of their assessment on curriculum content that it was aligned with the DepEd's curriculum guide and was made in accordance with the provisions of RA 10533. The difference in their choices among the items listed can be attributed from the difference of their

functions performed in school. Teachers are more on instruction, research and extension while their principal is focused more on supervisory functions.

Table 2. Respondents' Assessment on Curriculum Objectives

Objectives	TWM	VI	PWM	VI
1) The objectives are clear and concise.	3.98	SA	3.50	SA
2) They are measurable, attainable and time bound.	3.89	SA	3.50	SA
3) They are basically designed to respond to the current needs of our country.	3.83	SA	3.00	SA
4) The objectives are student oriented.	3.94	SA	3.75	SA
5) The Objectives are geared towards the realization of national goals and aspirations.	3.82	SA	3.25	SA
6) They are realistic and attained with contemporary needs of the country.	3.71	SA	3.00	SA
7) Opinion of the students, parents and other stakeholders are solicited in the formulation of the objectives.	3.69	SA	3.50	SA
8) The objectives are assessed and modified once a year.	3.74	SA	3.75	SA
9) They are designed to realize the optimum development of the child.	3.82	SA	3.75	SA
10) The objectives is in accordance with the curriculum guide of the K-12 program.	3.94	SA	3.75	SA
Overall Weighted Mean (OWM)	**3.84**	**SA**	**3.48**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

Table 2 shows the mean scores and verbal interpretations of the items relating to curriculum objectives as assessed by the respondents. Based from the assessment of teachers, the first-five items which obtain the highest weighted mean are: The objectives are clear and concise; the objectives are in accordance with the curriculum guide of the K-12 program; They are measurable, attainable and time bound; The objectives are student oriented; and they are basically designed to respond to the current needs of our country where all are interpreted as "strongly agree".

A careful analysis of the objectives used by the respondents on each lesson as reflected on their syllabus of instruction reveals that it is well-defined and unambiguous. It is directed for the attainment of one key outcome. It is learner-centered, realistic and achievable. It is performed within a certain time-frame and suitably resourced which means that resources include access to individuals with relevant skills and knowledge, as well as the necessary tools needed for knowledge and skill enhancement.

Next from the listed items are the following assessments based on the weighted mean value: The objectives are assessed and modified once a year; They are designed to realize the optimum development of the child; The Objectives are geared towards the realization of national goals and aspirations; they are realistic and attained with contemporary needs of the country; they are designed to realize the optimum development of the child and Opinion of the students, parents and other stakeholders are solicited in the formulation of the objectives.

The overall weighted mean of 3.84 on the part of the teachers which was strongly confirmed by the computed overall weighted mean of 3.48 with that of their principal suggests that, the respondents "strongly agree" that all these characteristics are deemed incorporated within the NEUST's educational goals, given the fact that it is already a well-established and known tertiary institution in the region, with good reputation in producing good quality graduates.

The objectives of the Laboratory High School Department are hereby stated, to wit: Provide high quality standard of teaching with emphasis to Science, Math, and English; Provide opportunities for the acquisition of knowledge and skills which help develop the student total personality and equip them to their part as active members of the community; Train the student to work independently and to think critically, thus, applying the principle of self-activity; Equip students with advanced general knowledge that will enable them to cope with the college task; Develop and inculcate within the student positive human values and productivity skills necessary to nation building; Provide competent students who will contribute towards the transformation of society into a more just and humane society; Provide training and assistance to student teachers' during their in-campus observation, participation and practice teaching activities; and Encourage and maintain relevant research and barangay-based extension service programs involving faculty and students.

As reflected under Table 3, the following assessments have been observed: Considers the learner as the center of educational process, recognize his/her student learning styles and needs of each individual learner are prioritized in the selection of subject matter, all obtained the highest weighted mean of 3.95, followed by, uses student-based knowledge on subject matter as spring board for discussion with a weighted mean of 3.94, Recognize each learner as unique individuals, Recognize the learner's physical, mental, and emotional development both with weighted mean of 3.92. All are interpreted as "strongly agree".

It can be observed based from the responses that the teachers are very aware with regard to the concept that the learner is the center of educational process and is the primary factor to be considered in the implementation of the curriculum (Chaudhary 2015). In addition, recognition of the learners learning style suggests that different learners learn differently, therefore it is necessary that they must be exposed with varied classroom activities depending on their needs. Equally important is the

incorporation of the learner's ideas and suggestions during classroom discussions in order to encourage classroom participation.

Table 3. Assessment of the Items in Relation to the Learner as one of Instructional-related Factors

The Learner	TWM	VI	PWM	VI
1) Considers the learner as the center of educational process.	3.95	SA	3.75	SA
2) Employs student groupings in accomplishing projects.	3.89	SA	3.25	SA
3) Recognize each learner as unique individuals.	3.92	SA	3.75	SA
4) Exposes students to the resources of community.	3.71	SA	3.00	SA
5) Needs of each individual learner are prioritized in the selection of subject matter.	3.95	SA	3.50	SA
6) The universal and individual characteristics of learners are considered.	3.82	SA	3.50	SA
7) Uses student-based knowledge on subject matter as spring board for discussion.	3.94	SA	3.00	SA
8) Recognize the learner's physical, mental, and emotional development.	3.92	SA	3.50	SA
9) Establish good relationships to his/her students.	3.72	SA	3.25	SA
10) Recognize his/her student learning styles.	3.95	SA	3.50	SA
Overall Weighted Mean (OWM)	**3.88**	**SA**	**3.40**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean 1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

The views of the teachers with respect to the learners do not contradict with the views of the principal as evident from the obtained overall weighted mean of 3.40 which is interpreted as "strongly agree". This was in accordance with the view of Muring (2014) on the significant role played by the principal as the key leader of our educational system. As the key leader they must be deeply concerned with the success of each student and to ensure that quality basic education is being provided by the school. In other words, the principal is very much aware that they need to collaborate with their teachers and to work with them as a team so that the needs of their individual learner are addressed.

Table 4 presents the weighted means and verbal interpretations of the items relating to the teaching strategies/techniques used, as one of the identified instruction-related factors. The following assessments were obtained: Use varied types of teaching strategies designed to suit the needs of the new curriculum; Give clear and specific directions and emphasize the values to be internalized during learning activities; Employ more innovative techniques such as portfolio to make learning more output –based; Present lessons logically and sequentially and supports them with concrete examples; and Employ effective motivational techniques to sustain pupils' interest in the lessons, with their corresponding weighted means of 3.93, 3.87, 3.83, 3.80, and 3.67 all interpreted as "strongly agree".

Table 4. Assessment of the Items in Relation to the Teaching Strategies/Techniques Used

Teaching Strategies/Techniques	TWM	VI	PWM	VI
1) Does team teaching to bring about effective teaching.	3.47	SA	3.75	SA
2) Invites resource speakers to share expertise in the subject matter.	3.21	A	3.00	A
3) Use varied types of teaching strategies designed to suit the needs of the new curriculum.	3.93	SA	3.75	SA
4) Employ more innovative techniques such as portfolio to make learning more output –based.	3.83	SA	3.75	SA
5) Make use of every possible resource to improve them professionally, most particularly in terms of instruction.	3.50	SA	3.25	A
6) Enhance teaching through the use of research-informed strategies.	3.49	SA	3.75	SA
7) Incorporates student practical experiences with the lessons.	3.67	SA	3.50	SA
8) Taps community as a learning laboratory.	3.66	SA	3.50	SA
9) Consults with experts on the proper implementation of K+12.	3.20	A	3.00	A
10) Employs student groupings in accomplishing projects.	3.52	SA	3.50	SA
11) Employ effective motivational techniques to sustain pupils' interest in the lessons.	3.67	SA	3.75	SA
12) Present lessons logically and sequentially and supports them with concrete examples.	3.80	SA	3.50	SA
13) Phrase simple questions that encourage pupil's participation.	3.54	SA	3.50	SA
14) Give detailed and redundant explanations for difficult points.	3.61	SA	3.00	A
15) Direct discussion effectively and allow pupils to participate in the discussion.	3.63	SA	3.75	SA
16) Give clear and specific directions and emphasize the values to be internalized during learning activities.	3.87	SA	3.75	SA
Overall Weighted Mean (OWM)	**3.60**	**SA**	**3.50**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean 1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25; Agree(A);3.26-4.00 Strongly Agree(SA)

Finding application on the view of Armstrong (2013) pertaining to the importance of teaching strategies, and the idea of Alsubiae (2016) relating to the role of teachers as the most important person in the curriculum implementation process, there is no question that in the field of teaching profession, teaching strategies and techniques are factors which serves as the means through which the desired objectives of the curriculum is attained, and the effectiveness of such means depends upon the ability of the teachers who employs it in the real classroom situation. Thus, the ability of the teachers to use effective strategies brings successful learning outcomes.

Further examination on the different syllabus of instruction used in the different subjects reveals that teachers of LHS employs different types of strategies or techniques with individual, paired or group applications. Aside from the previously mentioned, the following are also included: practice/board work, pair activity, recall, problem solving, cooperative learning, exposition, drill exercises, question and answer, discovery learning, peer tutoring, field studies,

jigsaw, buzz session, symposium, simulation, dialogue, group/individual reporting, interview, socialized recitation, round table conference, mnemonics strategy and still many others.

From the perspective of curriculum implementation, the use of various types of strategies merely indicates the flexibility of the curriculum in dealing with different types of learning situations in order to upgrade their students' abilities and the capacities to learn. The giving of clear and specific directions towards the attainment of the goals for a particular learning task lies upon the teacher who served as the facilitator. Equally important are the internalization of values associated for each learning task so that students will appreciate the lessons and its applications in the real world to where he lives. The use of innovative strategies such as portfolios is also used. Most teachers require their students to submit their respective portfolios at the end of each grading period as evidence of their skills and abilities thereby enhancing their creativity. On the same note the use of concrete examples during classroom discussions allows the students to reflect upon themselves the lessons learned and relate it to the actual world. Finally, motivational techniques are basic concepts in the teaching and learning process. The teacher can use either intrinsic or extrinsic motivation to increase student's interest.

The overall all weighted mean of 3.60 which is interpreted as "strongly agree" would mean that the respondents are in favor of the different mentioned strategies. As the need arises, each or a combination of those strategies can be used by them in order to effectively deliver curricular instruction.

Again, the assessment of the principal with regard to the teaching strategies validates the assessment of the teachers based from the computed overall weighted mean of 3.50 interpreted as "strongly agree". The view of Fink and Resnick (2001) as cited by Bodnarchuk (2016) finds application in this particular case since it deals about the principal's responsibilities in supporting quality instruction. This is attained by ensuring that the curriculum is properly implemented and that the delivery of quality instruction must be maintained. By immersing themselves in all aspects of the school system, principals need to monitor daily activities, as well as emerging issues arising from student-teacher conflicts. In the real classroom setup, this can be achieved by the conduct of classroom observation to ensure that the teachers are in the right direction of implementing the curriculum.

Table 5 presents the weighted mean and verbal interpretations of the items relating to the resource materials and facilities available, which are identified as another instruction-related factor.

Based from the results of their assessments, the first-five items with the highest weighted mean are: Use instructional materials to motivate and sustain the varied interests of the pupils; Select instructional materials that are consistent with pupils' capabilities and learning styles; Provision of computer rooms with internet facility; Provides 1:1 ratio of textbooks in every subject; and Uses projector and ICT-related materials in teaching with their weighted means of 3.98, 3.98, 3.87, 3.87 and 3.83, respectively, and interpreted as "strongly agree".

Table 5. Assessment of the Items on Resource Materials and Facilities

Resource Materials and Facilities	TWM	VI	PWM	VI
1) Reads varied references and materials on K+12.	3.63	SA	3.00	A
2) Collects a variety of learning materials for use in instruction.	3.66	SA	3.75	SA
3) Use instructional materials to motivate and sustain the varied interests of the pupils.	3.98	SA	3.50	SA
4) Select instructional materials that are consistent with pupils' capabilities and learning styles.	3.98	SA	3.75	SA
5)Use mock-ups, realia, models, dioramas and exhibits to expedite the teaching-learning process.	3.80	SA	3.50	SA
6) Employs technology-assisted instruction where appropriate.	3.52	SA	3.75	SA
7) Uses Desktop/laptop computers in teaching.	3.63	SA	3.50	SA
8) Uses projector and ICT-related materials in teaching.	3.83	SA	3.75	SA
9) Provides 1:1 ratio of textbooks in every subject.	3.87	SD	3.50	A
10) Provides enough supplies of modules to be used in all subjects.	3.58	SA	3.25	A
11) Provides sufficient reference materials in the library.	3.52	SA	3.00	A
12) Uses Laboratory rooms/equipment to engage students to long retention of learning.	3.67	SA	3.75	SA
13) Uses books and other references in the community library.	3.53	SA	3.00	A
14) Provides numerous project materials and books.	3.21	A	3.50	SA
15) Enough number of classrooms.	3.47	SA	3.50	SA
16) Provision of pamphlets, magazines, newspapers and other periodicals in the library.	3.24	A	3.50	SA
17) Provision of computer rooms with internet facility.	3.87	SA	3.75	SA
Overall Weighted Mean (OWM)	**3.65**	**SA**	**3.48**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

The results of the teacher's assessments merely shows that instructional materials or educational resources is deemed important in order to improve students' knowledge, abilities, and skills, to monitor their assimilation of information, and to contribute to their overall development and upbringing. The initial implementation of the K-12 curriculum did not bring much effect to the NEUST laboratory high school in terms of resource materials and facilities since the same are available in each of its nearby colleges and other departments. The College of Arts and Sciences as well as the College of Education can provide for the laboratory rooms, chemicals and equipment when needed. The College of Industrial Technology with the

laboratory rooms and materials needed to upgrade their tech-voc skills.

To illustrate, certain science teachers of Gabaldon Campus were asked if they are allowed to use the laboratory rooms of their nearby departments, they replied, *"Yes, we are allowed, but we must first seek the permission from the Dean of the college and the laboratory custodian to avoid overlapping of class schedules."*

In other words, all these facilities and materials are available in the University and can be used by the students as long as they are permitted upon requests. However, the availability of resource materials cannot be equated to adequacy. The availability of resource materials and facilities from one campus or from one college or department does not necessarily mean that they are also available in another campus, college or department of NEUST. This is made evident based from the previous answers of the respondents *that they only "seek permission or requests" to be able to utilize the facilities of other departments when the need arises.* In other words, in order to effectively implement the new curriculum, the issue on the "adequacy" of these resource materials and facilities must be resolved. Printed materials such as charts, journals, laboratory guides, modules, textbook and references, and workbooks as well as non-print materials such as computer-assisted instruction, instruction on audio format, instructions on video format, models, documentary films/movies/animations, laboratory equipment and power point presentations must be adequate in the laboratory high school as this is part of enriching or enhancing the curriculum in order to provide the students with meaningful learning experiences.

The use of print and non-print instructional materials and facilities is very important for many reasons. First, people tend not to remember what they are told if they don't have a visual to remember it by (especially if it's information they aren't highly motivated to remember). Second, students who are not academically inclined automatically tune out when a teacher is standing in the front and droning on and on about a topic. When there's something for them to watch, they end up paying attention and becoming engaged (in most cases). Third, students who are not native speakers may have a very difficult time understanding difficult or unfamiliar words, but if they have something visual to see, they can understand the concept and understand the new vocabulary faster.

The use of demos and models allows students to see a variety of equipment being used - some of which they may not have a chance to use themselves. Moreover, incorporation of computers into a specific course can and does add an important level of enhancement. Although not as conclusive as one might hope, studies do indicate that computer use can improve learning and positively influence students' attitudes and self-esteem.

As viewed from the table, the assessment of the principal does not run counter from the assessment of the teachers based from the result of the computed value of the overall weighted mean which is 3.48 that has an interpretation of "strongly agree".

This only suggests that they are fully aware of the importance of these instructional materials and facilities so that the objectives of the new curriculum would be met. In addition, as instructional leaders who has the primary responsibility of ensuring that the new curriculum is properly implemented, it is part of their duty not only to assess the teaching methods employed by the teachers inside the class but also to monitor the teacher's utilization of both their own and the school's resource materials and facilities. In this manner, time and effort is saved on the part of the teachers while their students continuously learn. Thus, by virtue of the appropriate materials used in every class session, the curriculum implementation process becomes suited to the ability and disposition of every child so as to maximize their full potential as learners (Muring 2014).

Table 6. Assessment of the Items on School Environment

School Environment	TWM	VI	PWM	VI
1) Maintenance of classroom cleanliness and orderliness.	3.90	SA	3.50	SA
2) Makes the school environment-friendly.	3.94	SA	3.50	SA
3) School has established learning centers.	3.83	SA	3.25	A
4) Strict observance of classroom discipline.	3.93	SA	3.50	SA
5) Avoidance of any obstruction that will impede learning.	3.89	SA	3.25	A
Overall Weighted Mean (OWM)	**3.90**	**SA**	**3.40**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean 1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA

Table 6 presents the mean scores and verbal interpretations of the items relating to the school environment, another instructional-related factor.

Based from the results of their assessments, the five items with the highest weighted mean are: Makes the school environment-friendly; Strict observance of classroom discipline; Maintenance of classroom cleanliness and orderliness; Avoidance of any obstruction that will impede learning and School has established learning centers which has an overall weighted mean of 3.90 and interpreted as "Strongly Agree".

This only means that a positive school atmosphere encourages student attendance motivates them and allowing them to become more engaged a factor that helps

cure many of the school woes. It also helps reduce stress for both teachers and students at the same time boosts a more positive mindset for everyone involved. Some studies even suggest that school climate is a key factor in student achievement and teacher retention. When the teachers are asked as to how important the school environment is in facilitating the learning process, they replied, *"it is their second home, and we treat them as our own children. As much as possible, we have to maintain the school's friendly atmosphere so they will feel more secured, loved and focused. In this manner they will become more motivated and become participative."*

Here, the idea of Wegner, et.al (2013) is applicable. If the teacher considers the learner's motivation and emotions as central condition for successful learning, it can promote active participation and a feeling of social integration.

It can be gleaned also from the table that the assessment of the principal does not negate with the assessment of the teachers as evidenced from the computed overall weighted mean of 3.40, which means that they "strongly agree" with their teacher's views that the school environment must be conducive to the child's learning development or progress. The results can also be attributed to the fact that, teachers and principals need to collaborate with each other in order to bring out the best quality service to their learners.

It is also worthy to note that from the principal's perspectives, the items listed under Table 6 are premised on an ideal learning environment through which the principal must be deeply concerned in order to carry out the school's educational goals, by instilling student conduct and discipline strategies that results in a positive environment conducive to student learning.

As reflected from the table, the average weighted mean obtained was 3.92 which are interpreted as "Strongly Agree". All the following items are applications of the provisions of RA 10533 under section 5, par.(c) which mandates that the curriculum must be "culture-sensitive". The laboratory high school conforms to this required standard. The teachers are not allowed to foster any form of discrimination against any students, or parents by reason of his/her race, color, religion, sex, national origin, age, ancestry, marital status, or him being handicapped. The school is open for all students subject to school policies on student admission.

Table 7. Assessment of the Items on Culture and Ideology

Culture and Ideology	TWM	VI	PWM	VI
1) Integrates the culture, customs and traditions of the community.	3.88	SA	3.50	SA
2) Avoidance of any form of cultural discrimination.	3.92	SA	3.25	A
3) Student's ideas and opinions are respected/recognized.	3.91	SA	3.25	A
4) Fosters cultural sensitivity during class interaction.	3.98	SA	3.50	SA
5) Shows respect to his/her student's religious belief systems.	3.89	SA	3.25	A
Overall Weighted Mean (OWM)	**3.77**	**SA**	**3.35**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean 1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

The teacher's assessment is validated by the assessment of their principal based from the computed overall weighted mean of 3.35 which is interpreted as "strongly agree".

The study of Squires (2015) is applicable in this particular case where she highlighted the role of principal as instructional leaders in facilitating curriculum change through which a positive school culture and the reflective practices of school leaders becomes a factor in influencing its implementation. Since the culture and ideology of the principal adheres to those of their teachers, it creates a positive school environment in the LHS where students can see and feel as they enter the school building. When there is no showing of unfair treatment or any form of discrimination, there is an assurance that the students are in good hands and they can fully develop themselves into successful individuals with the aid of their teachers.

Table 8. Assessment of the Items on Instructional Supervision and Assessment

Instructional Supervision and Assessment	TWM	VI	PWM	VI
1) Reinforce and enhance teaching practices to improve student learning.	3.92	SA	3.25	A
2) Provide meaningful feedback and direction to students	3.94	SA	3.25	A
3) Guides/facilitates students for every learning task.	3.98	SA	3.25	A
4) Uses varied assessment tools to rate student's performance.	3.89	SA	3.75	SA
5) Employ formative and summative assessment measures.	3.87	SA	3.50	SA
Overall Weighted Mean (OWM)	**3.92**	**SA**	**3.40**	**SA**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean .00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

Table 8 presents the assessment of the teachers and their principal in relation to instructional supervision and assessment as one of the identified instructional-related factors.

Based from the results of the teacher's assessments, the five items which obtained the highest mean were: Guides/facilitates students for every learning task; Provide

meaningful feedback and direction to students; Reinforce and enhance teaching practices to improve student learning; Uses varied assessment tools to rate student's performance and employ formative and summative assessment measures. The overall weighted mean of 3.92 tells us that the teachers "strongly agree" with the above listed items. The first three pertains to the teacher as the facilitator of learning.

The words of Maria Wilson-Portuondo find application on this particular aspect. According to her, *"A caring adult can make a big difference in the educational outcome of any child that is at risk of experiencing educational failure."*

As facilitator of learning, teacher should stop or must not act or operate under the traditional concept of teaching, but rather is meant to guide and assist students in learning in addition to the love and care that they foster to them. Again, this is not a problem for the laboratory high school teachers since most of them were already married and in their middle adulthood stage, and thus, can properly nurture and act as their second parents.

With regard to their assessment of student performance, the teachers stated that "*they are aware of DepEd order no.8, s. 2015."* which provides for policy guidelines on classroom assessment for the K-12 program. When the teachers are asked if the laboratory high school is also subject to the summative assessment given by DepEd, they replied, *"Yes, the students take up their NCAE which stands for National Career Assessment Examination. We also submit to the Department of Education our school profile, and various school forms such as forms 1,2,5,9 and 10."* This only proves that aside from being monitored by DepEd, the laboratory high school can also keep track of its student's overall performance through these types of examinations. Speaking of overall performance, it was not stated by the respondents that the laboratory high school students have been consistently performing well in their summative examinations.

The principal's assessment do not run counter from their counterpart teachers based from the computed overall weighted mean of 3.35, which is interpreted as "strongly agree". Chin Chen (2018) provides us the view of instructional supervision based from the principal's perspective. According to him, principals do not only play administrative roles but they also need to instruct teachers. In particular, principals should inspire teachers to overcome challenges and changes in education. Principals who are school leaders should consider the influence of teachers' instructional behaviors while emphasizing their own roles in instructional supervision.

This means that in order to positively affect teachers' instructional quality, principals must engage teachers in various activities that would improve their instructional practice and strategies as well as to empower them to become creative and innovative. This can be done by engaging teachers in instructional dialogue and reflective performance to ensure that they are thoroughly equipped to improved student performance. Establishing good communication and relationship with them is another way of gaining their trust and confidence. The same concept is also applicable on student assessment in relation to student achievement.

Table 9. Respondents' Assessment of the Items on the Challenges Experienced

Challenges	TWM	VI	PWM	VI
1) Lack of proper initiatives to generate school funds/income.	1.22	SD	2.00	D
2) Failure of the parents and other stakeholders in the community to give voluntary contributions.	1.34	SD	2.00	D
3) Failure to initiate proper solicitations from selected persons/individuals such as politicians, or other organizations such as NGO's, local and abroad.	1.52	SD	1.75	SD
4) Mismatched of teacher qualifications.	1.02	SD	1.25	SD
5) Lack of mastery on the subject being taught.	1.06	SD	1.25	SD
6) Insufficient number of seminars and workshops attended related to K-12.	1.68	SD	1.50	SD
7) Lack of proper training and skills.	1.60	SD	1.25	SD
8) Unbalanced student to teacher ratio.	1.68	SD	1.50	SD
9) Lack of knowledge, skills, proper attitudes and values pertinent to K+12.	1.05	SD	1.75	SD
10) Poor awareness on the goals, purposes, and objectives of K+12.	1.14	SD	1.50	SD
11) Failure to engage in research and extension activities.	1.54	SD	2.00	D
12) Inappropriate attitude and lack of work ethics fostered by colleagues.	1.48	SD	2.00	D
13) Inadequate knowledge on varied teaching strategies and techniques.	1.08	SD	1.25	SD
14) Insufficient knowledge on educational technology.	1.51	SD	1.50	SD
15) Inadequate knowhow on the use of varied assessment tools.	1.57	SD	1.75	SD
Overall Weighted Mean (OWM)	**1.36**	**SD**	**1.62**	**SD**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean; 1.00-1.75 Strongly Disagree (SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

Based from the results of their assessments, the first-five items which obtained the highest weighted mean were: Mismatched of teacher qualifications; Lack of knowledge, skills, proper attitudes and values pertinent to K+12; Lack of mastery on the subject being taught; Inadequate knowledge on varied teaching strategies and techniques and Poor awareness on the goals, purposes, and objectives of K+12, with their weighted means of 1.02, 1.05, 1.06, 1.08, and 1.14, all interpreted as "strongly disagree".

Here, the teachers believe that the subjects being taught by them are those that are within their field of specialization. They also disaffirm the notion that they lack proper attitudes, knowledge, skills and teaching strategies given the fact that most of these teachers are already "seasoned

teachers". Their strong disagreement on poor awareness on the goals, purposes and objectives of K+12 also holds true given the fact that they attended numerous seminars and conferences pertaining to it. Their response to the different items on challenges experienced gained an overall weighted mean of 1.36, which means that the teachers "strongly disagree" on the idea that the implementation of K-12 curriculum has become a serious issue or big problem within their department.

This was confirmed by their principal since their assessment do not contradict with the assessment of the teachers as evidenced from the computed overall weighted mean of 1.62, which is interpreted as "strongly disagree".

Table 10. Respondents' Assessment of the Items on the Adjustments Made in the Course of the K+12 Implementation

Adjustments	TWM	VI	PWM	VI
1) Have the initiative to asks local politicians for financial support.	3.23	A	2.75	A
2) Must have the initiative to ask solicitations from PTA, Alumni or other organizations such as NGO's, local and abroad.	3.33	SA	2.75	A
3) Proper initiative in designing off and in-campus activities intended for fund-raising like the conduct of "color run", auction sale of used goods for a cause.	3.57	SA	3.00	A
4) Teacher must assert to teach subjects within his/her field of specialization.	3.90	SA	3.50	SA
5) Teachers impart knowledge confidently and effectively, with the inclusion of important updates for each topic.	3.87	SA	2.75	A
6) Must have the drive to attend seminars and workshops related to K-12.	3.83	SA	3.25	A
7) Attend relevant K-12 trainings to keep abreast of the modern techniques of teaching and skill acquisition.	3.95	SA	3.50	SA
8) Proper scheduling and maximization of room utilization.	3.33	SA	3.25	A
9) Must have the initiative to seek administrative financial support to attend K-12 trainings.	3.23	A	3.00	A
10) Varied references and materials on K+12 are made accessible.	3.50	SA	3.00	A
11) Must undertake enough research-based trainings and workshops and be able to produced quality outputs.	3.87	SA	3.25	A
12) Plans and suggest measures to strengthen organizational relationships.	3.67	SA	3.25	A
13) They must undergo seminars and workshops on innovative techniques such as portfolio to make learning more output-based.	3.33	SA	3.75	SA
14) Must have knowledge and skills on the use of multimedia technology in the delivery of instruction.	3.92	SA	3.75	SA
15) Trainings on reliable assessment tools and techniques to evaluate student's performance.	3.87	SA	3.50	SA
Overall Weighted Mean (OWM)	**3.63**	**SA**	**3.22**	**A**

Legend: TWM – Teacher's weighted mean; PWM – Principal's weighted mean; 1.00-1.75 Strongly Disagree(SD);1.76-2.50 Disagree(D);2.51-3.25 Agree(A);3.26-4.00 Strongly Agree(SA)

This is true since as previously mentioned, the resource materials and facilities as well as the necessary equipment are available to the high school students and are within reach inside the university system. Being available, the quality of education being offered is still maintained. This supports the view of Chaudhary (2015) who pointed out that no meaningful teaching and learning can take place within the school environment without the necessary resource materials and facilities available to the students. Any school system must meet these requirements in order for the curriculum implementation process to be effective.

Table 10 presents the respondents' assessment of the items relating to the adjustments made by the respondents in the implementation of K-12 curriculum.

Based from the results of the computed weighted means, these are: Attend relevant K-12 trainings to keep abreast of the modern techniques of teaching and skill acquisition; Teacher must assert to teach subjects within his/her field of specialization; Must have knowledge and skills on the use of multimedia technology in the delivery of instruction; Teachers impart knowledge confidently and effectively, with the inclusion of important updates for each topic; Trainings on reliable assessment tools and techniques to evaluate student's performance; Must undertake enough research-based trainings and workshops and be able to produced quality outputs; with their weighted means of 3.95, 3.92, 3.90, 3.87, 3.87, and 3.87 all being interpreted as "strongly agree".

The result implies that the laboratory high school teacher's despite in their long years of teaching experience still have that urge and eagerness to learn. This supports the statement that learning is a continuous process. For teachers to deliver quality instruction, they must constantly update and upgrade themselves all for the benefit of their students. The overall weighted mean of 3.67 means that the teachers "strongly agree" to the listed suggested items to be adapted as part of the adjustments for a sound and effective implementation of the K-12 curriculum.

This was evidently confirmed by their principals since their assessment does not deviate with those of the teachers as evidenced from the computed overall weighted mean of 3.22, which is interpreted as "Agree".

The strong adherence of the teachers on the items under Table 10 which was validated by their principal is a clear manifestation that the latter plays a proactive role in supporting their teachers' adaptive efforts in implementing the new curriculum. This was confirmed by the teachers when they stated that their principal frequently interacts with them in a positive manner and on a daily basis dealing with instructional matters. According to them, their principal does not only discuss academic issues, but also, they guided, encouraged, reinforced and promote their instructional efforts. The teachers also made some utterances that their principal sees to it that teaching assignments were matched based on their expertise to ensure that student's needs are met. Moreover, according to the teachers, their principal provides them their instructional needs by allocating them resources and

materials for the purpose of implementing the new curriculum effectively. The view of Squires (2015) is applicable in the instant scenario as it highlights the cultivation of a strong sustained school culture toward the continuance of school improvement and student achievement while maintaining harmonious principal-teacher relationships within the school system.

Table 11. Correlation between their Assessment on the Challenges Experienced and Adjustments Made in the K+12 Curriculum Implementation

		Challenges	Adjustments
Challenges	Pearson Correlation	1	0.325
	Sig. (2-tailed)		0.237
	N	15	15

Table 11 provides for the correlation between the assessment of the respondents on the challenges experienced and the adjustments made in the course of the K+12 curriculum implementation.

Here, it was revealed that there was no significant relationship existing on their assessments as regards to the challenges experienced and the adjustments made where r = .325 at (p>.05). This can be attributed from the fact that the overall weighted mean of 1.36 for challenges experienced "strongly disagrees" with the overall weighted mean of adjustments made which is equal to 3.63, interpreted as "strongly agree". In other words, the respondents in the laboratory high school department did not experience much of the adverse effects brought about by the curriculum change.

To illustrate, the respondents were asked about what are their experiences during the initial implementation of the program, they answered, *"There are no bad experiences or challenges whatsoever, we have not run out of equipment and facilities that we use during our laboratories, nor we have been displaced to other schools during the transition period*." They added that, *"We are familiar with the K+12 subjects, since these are the same subjects that we took during our undergraduate and graduate studies. We are only tasked to teach those subjects in line of our field, they claimed."*

However, their assessment on adjustments merely implies that the respondents "strongly agree" that the suggested items must be constantly practiced and performed by them so as to effectively implement the new curriculum.

Proposed Strategic Plan for the Effective K-12 Curriculum Implementation

Objective: This proposed strategic action plan aims not only for the improvement but also for the promotion of the K+12 curriculum implementation, particularly in the laboratory high school department of NEUST.

A. Curriculum Enhancement and Enrichment

Encourage NEUST administrators to:

1. Develop strategic programs which will establish a sense of urgency among stake- holders in support of curriculum enhancement and use accountability mechanisms to track teachers' performance in delivering an effective and sustainable curriculum.
2. Provide instructional technology hardware for use in curricular integration, record keeping and stakeholder communications
3. Design and implement activities and programs with the intention to lead teachers in Curriculum implementation and to guide them in the preparation of an enriched K+12 curriculum.
4. Identify and adopt current benchmark curriculum models that use pedagogical approaches in line with the K+12 program.

B. Student Development, Engagement and Achievement

1. Upgrade existing infrastructure and resources to support all working and learning environments, as well as the learning needs of students.
2. Assess the current levels of student performance in Science, Mathematics and English subjects to determine their mastery, understanding, and progress in these subjects.
3. Engage and empower students to become more active participants in the learning experiences that are relevant to their lives and the global marketplace.
4. Design and adopt a continuous cycle of programs and activities that encourages student involvement and development.
5. Develop and implement use of a variety of alternate assessment practices that mirror differentiated instructional practices.

C. Instruction

1. Enhance or improve instructional materials, learning and teaching aids, learning resources and instructional tools to become more innovative

thereby increasing student motivation and interests.

2. Intensive use of technology-based instruction to improve teaching quality and effectiveness.
3. Provision of financial support and encouragement for teachers in the pursuance of their post-graduate degrees.

D. Strengthening Research Culture

1. Enhance a positive research culture by subjecting faculty members into various Research Capability training programs.
2. Further enhancement of necessary research skills in proposal writing, data-handling, statistical treatment through mentoring and coaching activities by seasoned researchers of the University.
3. Encourage and support the faculty members in the conduct of research presentation and publication in different fora.
4. Promote equal partnerships with other faculty members through research collaboration.
5. Encourage and incentivize Student's Involvement in research works.
6. Investing of research statistical softwares.

IV. CONCLUSIONS AND RECOMMENDATIONS

In the light of the above-cited findings, it can be inferred that the curriculum in general follows the K-12 curriculum guidelines established by the Department of Education in terms of content. It follows the standards and principles established by the provisions of RA 10533 otherwise known as the "Enhanced Basic Education Act of 2013".

The objectives set by the laboratory high school department are in accordance with its institutional goals and in line with the K-12 program. At the level of instruction, the objectives are specific, measurable, achievable, realistic and time-bound. The effect of curriculum change did not bring much negative impact in the NEUST laboratory high school as claimed by the respondents since the materials, facilities and equipment as well as human resources are available within the university system. The respondents were mindful that the items on adjustments must be faithfully observed and duly implemented in order to satisfy the objectives of the new curriculum. No significant relationship exists on their assessments with respect to the challenges experienced and the adjustments made in the implementation of the K+12 curriculum.

The purpose of RA 10533 will not be met if the national government lacks the genuine support in its implementation. It behooves upon it the provision of sufficient funding intended for all public educational institutions. In the same manner, teachers as the implementer and manager of the curriculum must be competent, creative and innovative in enhancing and enriching the curriculum. It is only then that the delivery of the content of the curriculum is made effective and in addition, the objectives of the law are realized.

In line of the challenges of the new curriculum, teachers must undergo intensive trainings on research and publication. Trainings must be conducted focusing on the use of statistical tools and its applications. The university also must invest on these statistical tools and the faculty researchers must be provided with such. Trainings pertaining to online publication must also be provided.

Teachers must master the competencies and skills in enhancing the curriculum to fit the nature, needs and interests of the learners. It is incumbent upon them to have the expertise to indigenize and localize the curriculum in order to maximize the use of community resources for student projects and research work as well as to make the curriculum appropriate in addressing community needs and the needs of the industry, thus making the curriculum relevant and responsive.

Adjustments in the implementation of the new curriculum is likewise made if the administrators and principals are giving proper incentives to teachers as a form of motivation who write instructional materials in their respective fields of specialization in order to serve as supplemental materials in their teaching tasks. In addition, provisions for upgraded facilities and technology-related equipment must be given preferential attention by school administrators in other campuses of NEUST to promote effective instruction in their respective localities. Moreover, a clear provision on the giving of incentives to teachers and students who are involved in research works must be prioritized to motivate them well to do such scholarly works.

Explore and establish permanent linkages with different stakeholders in the community as well as other educational institutions, business establishments and agencies to act as partners in the effective implementation of the K+12 curriculum. In addition, student orientation campaign regarding the K+12 curriculum may likewise be conducted for them to fully understand its rationale, objectives and importance. These adjustments are necessary for the K+12's effective implementation.

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