CORRELATIONAL ANALYSIS OF SENIOR HIGH SCHOOL PROFICIENCY LEVEL

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Abstract - Assessment is very important to determine the proficiency level of the students [23]. Using assessment like the periodical test as the basis of comparison is a lot helpful. Applying data mining in academic institution with the utilization of discovering information in the relevant data called the Educational Data Mining is useful[19]. This study applied educational data mining in examining the proficiency level of senior high school students with an aid of correlational analysis algorithm. In this paper, data was extracted from the database and use as data set. Result shows that students taking up Technical Vocational subject have a greater potential in achieving higher Mean Percentage Scores and mastered the competencies rather than those who are taking up the academic subjects. Findings shows that MPS of all subjects was attained and increased as expected. It was given emphasize as well that the number of examinees per exam has a lot of impact in the result of mean percentage score and standard deviation.

Keywords - KDD, Educational Data mining, correlational algorithm, comparison, proficiency level, MPS, standard deviation

INTRODUCTION

Department of Education (DepEd) is a governing institution that carried out basic education. In accordance to their dream of having a competitive Filipino citizen DepEd add another year in the curriculum of the basic education that aims to provide sufficient time for mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship [6].

In Senior High School, the way to measure the capacity, quality and adequacy and determining if the requirements was meet the subject is through formative and summative assessment which is constituted by diagnostic test, first quarter and second quarter as well as post test[15]. With this, the department can evaluate if the proficiency level of students are improving so they can compete in the real world and are prepared in the upcoming tertiary education or work. In education, the term proficiency is used in a different ways, normally in reference to (1) proficiency levels, scales, and minimum scores on periodical tests and other assessment form, (2) achievement of students whether they fail or passed as their proficiency levels determined by tests and assessments, and (3) students demonstrating or failing to demonstrate proficiency in relation to learning standards[8].

DepEd uncovered the decreasing achievement rates in the past years of elementary and high school around the Philippines[12]. Former DepEd Secretary Armin Luistro presented a graph that shows the downward trend in the achievement levels and survival rate of the students in elementary and secondary level their basis is the National Achievement Tests (NAT) in which the foundation is the institutional assessment like diagnostic test, periodical exams and posttest [12].

One question is revealed on this paper, with the problem facing in the achievements and proficiency rates of basic education, are Senior High School proficient in their level? Does MPS are achieved by teacher and increases it for every periodical exam? [12]

To be able to answer problems in the achievement and proficiency of the students as well as determining if the MPS has been met or increased, some data mining techniques will be used. Data mining refers to the analysis of observational data sets and knowledge discovery from data to search for the unknown relationships and to encapsulate the data in innovative ways that are both reasonable and beneficial to the data owner [17]. The process of mining knowledge to be used in this study is the Knowledge Discover in Database (KDD). An automated or convenient extraction of patterns representing knowledge implicitly stored large database or other massive information repositories [19].

And since the focus of this study is about educational institution, researcher utilized educational data mining (EDM), which is defined as the process designed for the analysis of data from the educational setting to better understand proficiency of students [20]. Very timely, it is because this study will help the institution to identify as to what kind of subjects students excel.

This paper will investigate the proficiency of the students in the selected Senior High School implementer through monitoring of their Mean Percentage Score (MPS). This paper will also compare prevailing proficiency level of students per subject area, and achievement exam such as Diagnostic and Post Test. This paper will also determine courses of the students excel, whether through Academic Subjects or the Tehnical Vocational (TechVoc) subject.

II. RELATED WORKS

Classroom assessment is a joint process that involves both teachers and learners. Teachers provide appropriate assessment when they aim to holistically measure learner's current and developing abilities in the process [5].

Department of Education uses item analysis that engages many statistical method to provide a useful information in improving the value and correctness of items to choose. Using this item analysis, scores of students will be determined if the questions made by the teachers is difficult and easy [16].

In relation to item analysis is the "Mean Percentage (MPS) score that indicates the ratio between the numbers of correctly answered items and the total number of test questions answered by the students" [10]. It specifies how well the students perform in the class especially in their exam. It indicates if the questions given by the teacher are hard or not.

Numerous studies show that the results of item analysis, with the scale of inter-correlations, as well as the factor analysis were consistent in the general provisions. As shown in the thinking styles that is related to academic achievement it has been proven that it has an association between thinking styles and grade point average. Results explained relative to the ideas and structure of the culture in the Philippines and school. That is also comparative to the developmental of theory of mental self-government [1].

As defined, correlation analysis is a method of statistical evaluation used to measure the strength of study with the relationship between two, numerically measured and continuous variables [22].

In relation to the study, there was a research paper about assessing the Mathematics activity and performance of Grade eight (8) students as the basis for Enhancing Instruction and aligning with K 12 curriculum. This sought to determine the performance and the difficulties of the Grade 8 students during the first conduct of the new K to 12 Mathematics. Findings showed in this study that students are in beginning and developing level for the three content areas [2]**.** In addition, least mastered contents of Mathematics Achievement Test specify that there is no alignment for instruction and objectives [2].

In addition, there are studies that was conducted in order to test the English Proficiency and Academic Performance of the Philippine Science High School Student. The primary aim of this research is to find the relationship between the English language proficiency and the performances of the Grade eight (8) students academically, it also tried to discover and analyze the English language ability as well as the academic ability in Science, Mathematics and English of Grade eight (8) students of Philippine Science High school. As a result of this study, it was revealed that majority of Grade 8 students belongs to the satisfactory rank. Also, most of the students who signifies a well academic performance in Science and Mathematics are students who also belong to the very good level in English. With it, results further exhibits that there is a meaningful relationship concerning the students' English language aptitude and their academic competence in each of the subject [11].

Correlation analysis was also used in the study using the Pearson Product Moment Correlation, this is used in order to establish if there are any relationships between two sets of scores. This study also used students-t-distribution to discover the significant difference in the performances of the student using .05 as the significant [21].

With the literature and study presented it shows that in the proficiency rate of the student have the greatest contributing factors. Not only that the blog of Tabora can also be helpful since this study will see and compare if the subjects enrolled by the students really affect their study for them to get a high level of proficiency.

Basically this study is closely related to Bernardo which determine the item analysis as part of the proficiency level of students that explained the concepts and practices of the Philippine schools and the developmental assumptions. With it, another study is also related with the researcher's study since the researcher will also use descriptive-correlational type of research design [2][11]. With the research conducted [18], which they use correlation and utilized descriptive and inferential data analysis that establishes the relationship between two sets of scores.

III. METHODOLOGY

Data Collection

Various data collection method was used to be able to gather data. To obtain the necessary data, an interview was conducted to the Master Teachers of every subject areas and the Curriculum Implementation Development (CID) Officer of the Senior High School since they are the person who are responsible in keeping the data of the Mean Percentage Score and Item analysis of Grade 11 teachers. The data was then tabulated and recorded if there are some changes in scores from First Periodical Test until Fourth Periodical test of the School Years 2016-2017 and partial Periodical Exam for 2017-2018.

To validate clearly if proficiency level of students are achieved, the pupils' raw scores are transformed into Mean Percentage Scores (MPS). This specify the ratio among the total correct answered items in a test and the overall number of items asks. MPS is always anchored with the Key Result Area (KRA) of the principal [4]. This means that a teacher should always get a 75% of MPS or higher in order to attain the objective. The MPS is the one of the basis of the

Department of Education in giving the performance based bonus to the teacher [4].

Table 1 presents the attribute and their description that exist in the data taken from the source database.

Attribute	Description	Possible Values
Subject Areas	Subjects taken by the students enrolled in Senior High School	Oral Comm, Pagbasa, 21st Century, MIL, Bus.Math., OM, EIM, SMAW, Horti
Types of Track	Refers to the course taken by the Senior High School student	Academic, Tech-Voc
MPS Result	It is the result of the test items from the given item analysis	Diagnostic, First Quarter, Second, Third and Fourth
Item Analysis	The number of students who got it correct from the test items	25, 35, 40, 11, 12, 23, 17…
Item Range	Refers to the range of item analysis	Absolutely No Mastery, Very Low, Low, Average, Moving Towards Mastery, Closely Approximately Mastery, Mastered.
Standard Deviation	Refers to the scores distribution get by the student	.05, 2.21, 5.25 …

Table 1. Periodical Exams Record on Different Attributes, its description and possible values.

The variables used in analyzing proficiency level of the students as shown in table 1 are the subject areas enrolled by the students, the type of their track enrolled, MPS result, and the result of the item analysis and the range of the item. The Senior High School is offering academic track which include the Accounting, Business and Management (ABM), General Academic Strand (GAS) and Humanities and Social Sciences (HUMSS), meanwhile for the Technical Vocational (TechVoc), the courses they are offering are Electrical Installation maintenance (EIM), Shielded Metal Arc Welding (SMAW), Automotive Servicing, Home Economics (HE) and Agricrops which is consists of 7 sections for Technical Vocational track and another 7 sections for the Academic Track.

Percent	Descriptive Equivalent
96 - 100	Mastered (M)
86 - 95	Closely Approximating Mastery (CAM)
66 - 85	Moving Towards Mastery (MTM)
35- 65	Average (AVR)
15- 34	Low (L)
5-14	Very Low (VL)
0-4	Absolutely No Mastery (ANM)

Table 2. Achievement Level Descriptive Equivalent

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To be able to determine the proficiency level of students per subjects, table 2 is used if the student has mastery in their respective subject matter. The marks contains the Percentage of Correct Replies (PCR) per learning competency by subject area. To be able to clarify the PCR, Achievement Level Descriptive Equivalent is used.

Data Processing

Using the process of knowledge data discovery diagram (Figure 1), data set were reduced and summarized as shown in the diagram (Figure 1).

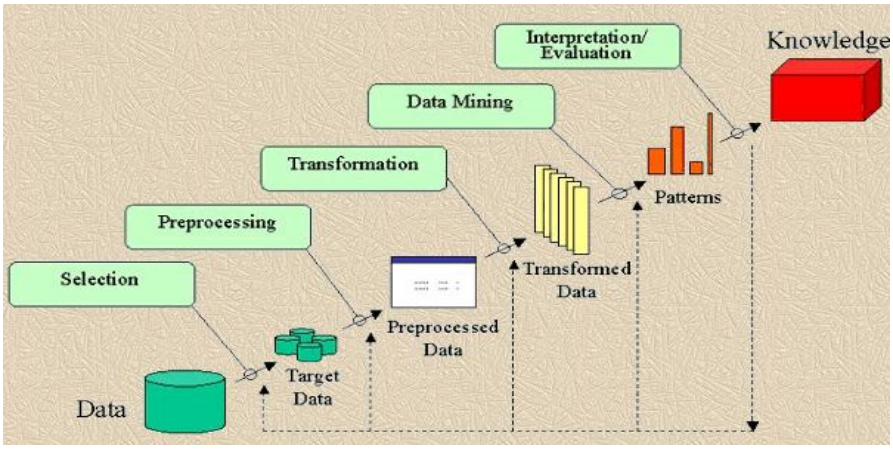

Figure 1. Process Diagram of Knowledge Data Discovery

The proponent used the five process of Knowledge Discover in Database. First step is the selection of data set. Next is the preprocessing, it is where data is preprocessed, followed by a transformation in which data is transformed to be used in mining activity and interpretation and evaluation, to be used in giving the results and evaluate it. Then the pattern can be evaluated to be able to presents the visual and knowledge representation [19].

With the help of knowledge data discovery, all data sets were condensed and summarized as shown in table 1. From the database, selection and preprocessing was performed in order to collect necessary attributes to be used in the study.

The selected data set was run down in SPSS v16.0. It is used by every business and educational institution in order for them to clearly understand their data and it is used for editing and analyzing all sorts of data and displays them in visual [23].

Mean Percentage Score is filtered and grouped into areas such as academic, general education and techvoc subjects. This can be visualized using the correlational by distance to determine the variance of each subjects. Table 3 illustrates the corresponding Mean Percentage score of each subject, from the quarterly exams for the school year 2016-2017 and 2017-2018. It indicates how the MPS of each subject is changing from one quarter exams to another.

	2016-2017				2017-2018	
Gen. Ed. Subjects	diagnostic	first quarter	2nd quarter	Post Test	diagnostic	first quarter
Oral Communication	35.58	73.25	77.80	79.87	45.76	48.65
Pagbasa at Pagsusuri ng Iba't Ibang Teksto Tungo sa Pananaliksik	40.18	73.45	74.79	77.43	30.68	48.65
21st Century Literature from the Philippine and the World	37.66	68.75	78.90	78.98	53.47	66.48
Media and Information Literacy	52.31	74.78	79.65	79.68	43.38	74.42
General Mathematics	42.46	70.72	73.75	75.70	11.10	67.89
Physical Science	35.11	71.70	77.23	78.80	31.47	63.57
Physical Education and Health (HOPE)	27.29	70.68	78.80	79.77	24.41	54.07
Personal Development	60.58	73.25	79.43	79.78	38.16	65.70

Table 3. Mean Percentage Score for General Education Subjects per major Exam.

In addition, academic subjects were analyzed as well. Table 4 shows the result of MPS, year it was taken and the corresponding subjects. Table 4, shows the academic subject performed in the School Year 2016 and 2017. It presents that there are three academic subjects offered by the institution and the quarterly exams taken by the students.

	2016-2017				2017-2018	
Academic Subjects	diagnostic	first quarter	2nd quarter	Post Test	diagnostic	first quarter
Business Math	40.35	75.07	76.32	77.21	45.52	75.07
Organization Management	28.05	70.67	77.25	78.31	39.05	58.41
Introduction to Philosophy of the Human Person	32.17	72.56	81.24	82.35	37.30	58.75

Table 4. Mean Percentage Score for Academic Subjects

Table 5 also shows the MPS of the TechVoc subjects. There are five TechVoc subjects offered by the institution, it also displays the corresponding quarterly exams and the school year it was taken. It exhibits the school year 2016-2017 up to school year 2017-2018.

	2016-2017				2017-2018	
TECHVOC SUBJECTS	diagnostic	first quarter	2nd quarter	Post Test	diagnostic	first quarter
Automotive Servicing	28.21	76.70	81.80	82.34	36.89	61.75
Bread and Pastry	41.70	72.88	79.88	79.94	36.82	66.50
Electrical Installation & Maintenance	25.74	71.70	82.71	83.21	37.18	62.22
Shielded Metal Arc Welding	32.22	75.00	82.25	82.75	44.56	72.95
Agriculture	33.86	73.81	79.83	79.88	0.00	0.00

Table 5. Mean Percentage Score for all Techvoc subjects in Technical Vocational Strand

Another way to analyze the student's proficiency level is the number of students who took the exam. It is because these data can affect the result of the MPS and item analysis which can be used to determine the proficiency level of senior high school students. It contains the subject offered, the quarterly exam and the year when the examination was taken.

	2016-2017				2017-2018	
Subjects	diagnostic	first quarter	2nd quarter	Post Test	diagnostic	first quarter
Oral Communication	208	393	393	390	100	169
Pagbasa at Pagsusuri ng Iba't Ibang Teksto Tungo sa Pananaliksik	300	393	392	392	256	296
21st Century Literature from the Philippine and the World	107	177	175	174	32	33
Media and Information Literacy	300	393	392	392	273	303
General Mathematics	300	393	392	392	304	304
Physical Science	300	393	392	392	229	264
HOPE	392	405	405	405	142	303
Introduction to Philosophy of the Human Person	45	60	60	59	257	302
Business Math	70	77	77	76	21	30
Automotive Servicing	23	30	30	30	54	64
TechVoc(Bread and Pastry)	53	61	61	60	68	72
Tech Voc(Electrical Installation & Maintenance)	20	25	24	24	34	36
Tech Voc(Shielded Metal Arc Welding)	13	18	18	18	18	21
Personal Development	300	393	392	393	262	296
Organization Management	107	177	177	177	23	29
TECH VOC (Agriculture)	20	30	29	29	0	0

Table 6. Summary of students who took the quarterly exam for the year 2016-2017 and 2017-2018.

RESULTS AND DISCUSSION

The result shows that many students took the exam for some Academic Subjects such as Oral Communication, Pagbasa, Media, Math, Physical Science and Personal Development. While in some subjects there are few students who took the quarterly exam. The TechVoc subject which is the Shielded Metal Arc Welding and the Agriculture subject has the lower examinees which are 111 students. The most subject which was exam is the Media and Information Literacy with a total of 2146 students.

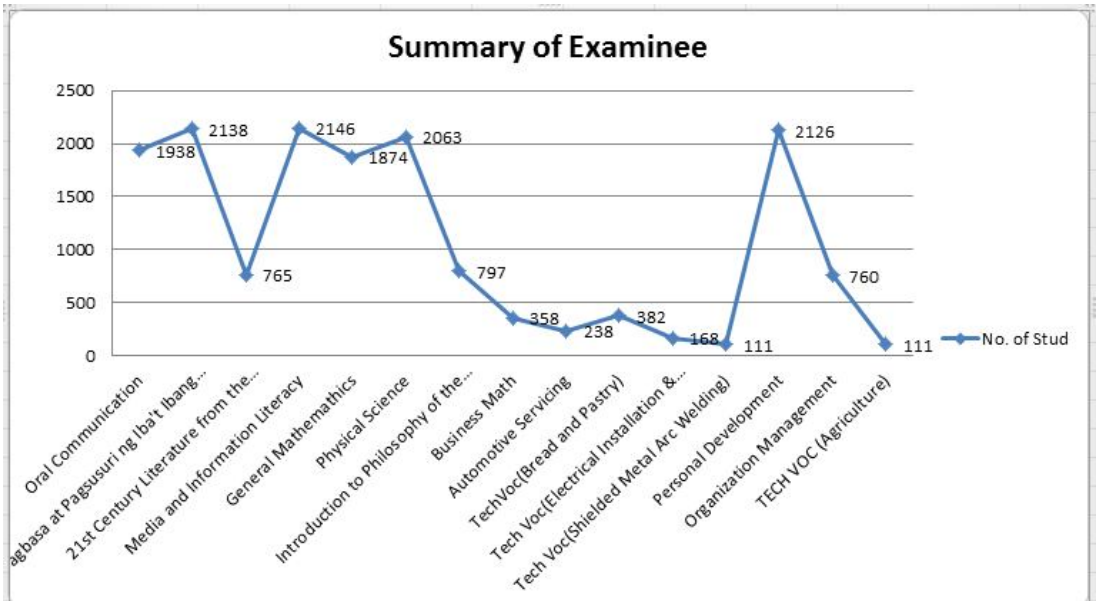

Figure 1. Number of students took the exam per subject

When it comes to the achievement of the MPS result, it indicates from Figure 2 that first quarter which is 72.52% and second quarter which evaluated as 77.99% has the most number of achieved MPS, while diagnostic test indicates the lower value and result it only got 37.22%. Figure 2 shows that there are an increase and changes in the MPS from diagnostic exam up to posttest. It only shows that an MPS has been achieved and indicated changes from diagnostic up to the second quarter exam.

With the result in variance, the result in P-value is more than .05 which is 1.11 this means that the result of significant differences is at a good point. The result means that the quarter exam result is better than the previous exams.

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIAGNOSTIC	18	37.22	2.067778	1.70523
FIRST QUARTER	18	72.52711	4.029284	3.222541
SECOND	18	77.99	4.332778	10.90474
POST	18	51.8	2.877778	3.873877
DIAGNOSTIC	18	60.56	3.364444	5.465967
FIRST	18	114.5271	6.362617	2.958942

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	196.8309	5	39.36617	8.396238	1.11E-06	2.303493
Within Groups	478.232	102	4.688549			

Figure 2. The MPS result per subject per periodical exam.

On the result of MPS grouped per subject correlated with the students track, it only shows that there is a significant change in MPS from diagnostic test up to post test. There is a significant difference on the first quarter of the year 2016 to this year 2017. Meanwhile, the graph shows that the result of diagnostic exam in the year 2016 is lower than the result of the periodical exams.

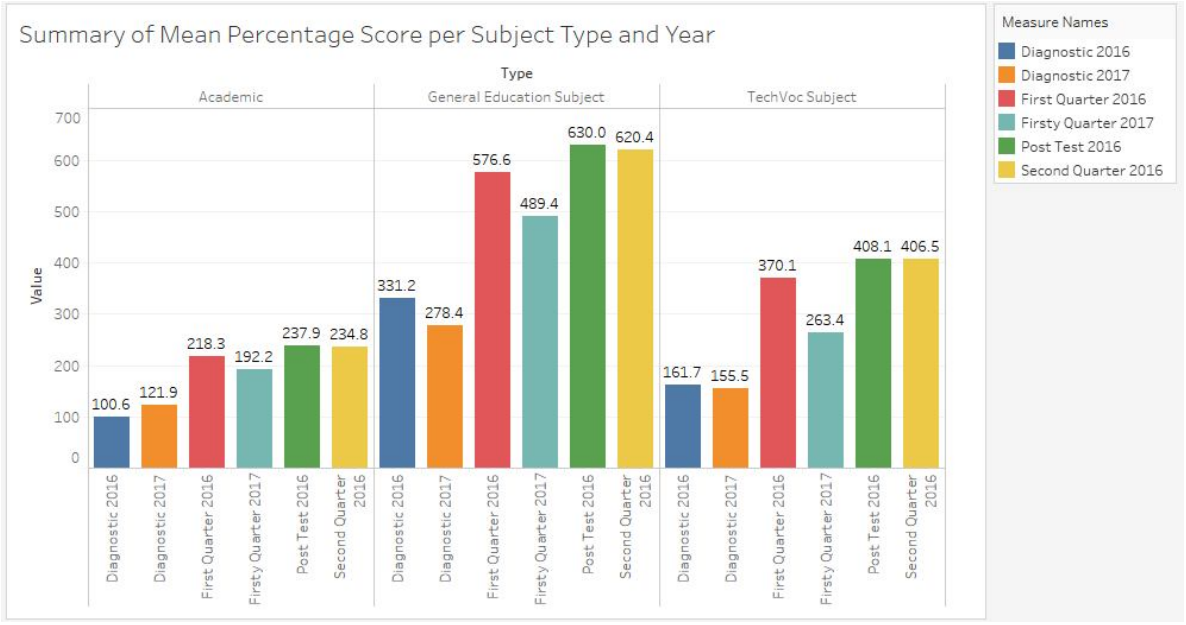

Figure 3. Summary of MPS Result per subject area

On the standard deviation result, there are distributed frequencies of questionnaires. It shows that there is no significant relationship between the periodical exams for the standard deviation. The computed P-Value of 1.11 indicates a negligible positive correlation and since the computed p-value of 1.11 is greater than .05 alpha levels, thus it can be infer that result of standard deviation is accepted. This also implies that the exam type has no direct effect in the increase/decrease of standard deviation. Which mean that numbers of items correct are properly distributed from one item number to another.

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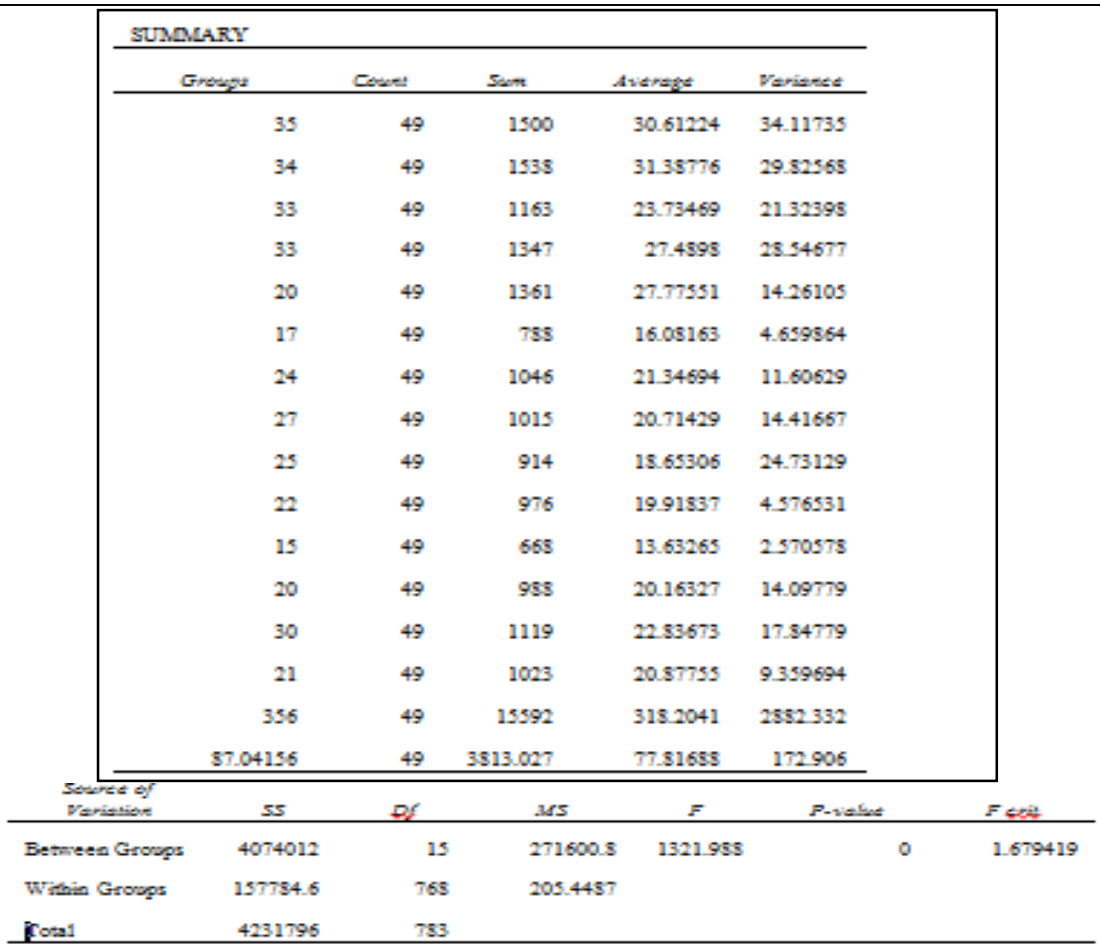
Within Groups	478.232	102	4.688549			
Total	675.0629	107				

Figure 4. Results of grouped Standard deviation correlated with exam

To be able to determine the number of correct items from the test question, item analysis for academic subject is also tested. It was grouped and counted. Figure 5 shows item analysis for general education subject. It depicts that the variance is do not have a remarkable difference. It is closely related with one another.



SUMMARY

Groups	Count	Sum	Average	Variance
35	49	1500	30.61224	34.11735
34	49	1538	31.38776	29.82568
33	49	1163	23.73469	21.32398
33	49	1347	27.4898	28.54677
20	49	1361	27.77551	14.26105
17	49	788	16.08163	4.659864
24	49	1046	21.34694	11.60629
27	49	1015	20.71429	14.41667
25	49	914	18.65306	24.73129
22	49	976	19.91837	4.576531
15	49	668	13.63265	2.570578
20	49	988	20.16327	14.09779
30	49	1119	22.83673	17.84779
21	49	1023	20.87755	9.359694
356	49	15592	318.2041	2882.332
87.04156	49	3813.027	77.81688	172.906

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	4074012	15	271600.8	1321.988	0	1.679419
Within Groups	157784.6	768	205.4487			
Total	4231796	783				

Figure 5. Item Analysis for General Education Subject

In addition, TechVoc subjects is also analyzed. From Figure 6, it displays that the variance of TechVoc subject is also closely related with each other. It also indicates that there is a significant changes in scores. The result of significant difference in between groups is considered as acceptable since it got higher value as expected.

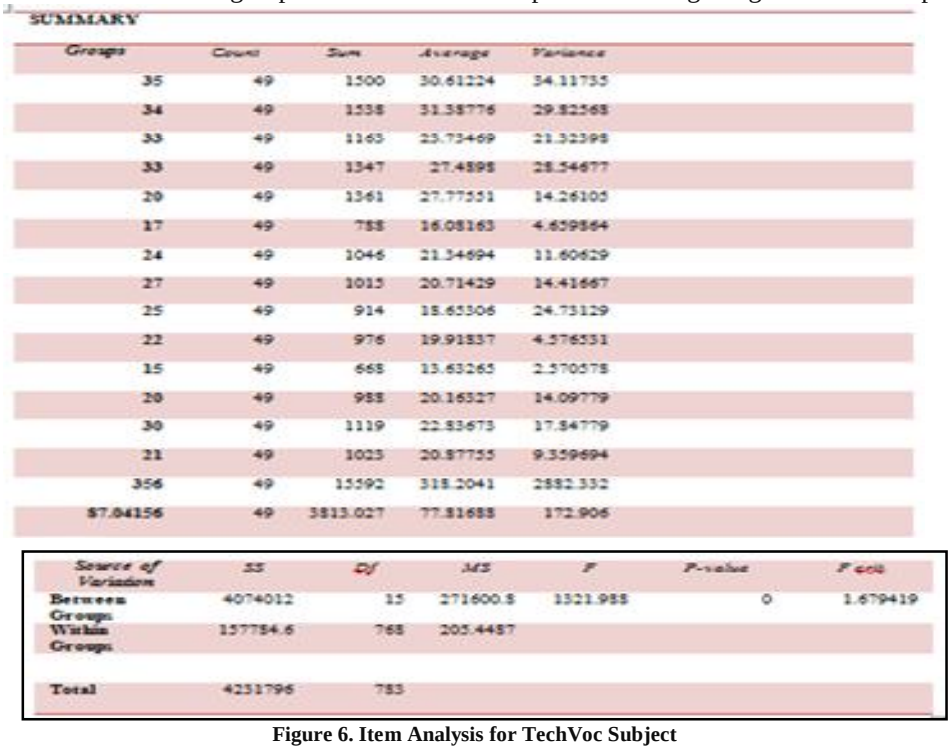


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Figure 6. Item Analysis for TechVoc Subject

Academic Subject is also tested, Figure 7 shows that there is no significant relationship between the TechVoc subjects and General Academic Subject. The computed P-Value of 1.11 indicates a negligible positive correlation and since the computed p-value of 3.3 is greater than .05 alpha levels, scores are properly distributed. This also implies that the Academic Subject has no direct effect in the increase/decrease of Item analysis for TechVoc and General Education subject.

SUMMARY

Groups	Count	Sum	Average	Variance
30	53	1343	25.33962	36.26705
33	53	1522	28.71698	24.39913
20	53	1525	28.77358	18.25544
17	53	929	17.5283	20.60015
15	53	917	17.30189	73.48403
115	53	6236	117.6604	353.8055
78.23129	53	4243.701	80.06982	164.6428

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	474151	6	79025.16	800.0186	3.3[illegible]206	2.123503
Within Groups	35955.61	364	98.77916			
Total	510106.6	370				

Figure 7. Item Analysis for Academic Subject grouped per subject

To be able to compare and show the result of the TechVoc, Academic and General Education subjects, each subjects that corresponds to them has been grouped and tested. Result shows in Figure 8 that TechVoc subjects has a bigger chance to get higher MPS. It was followed by academic subject and the General education subject.

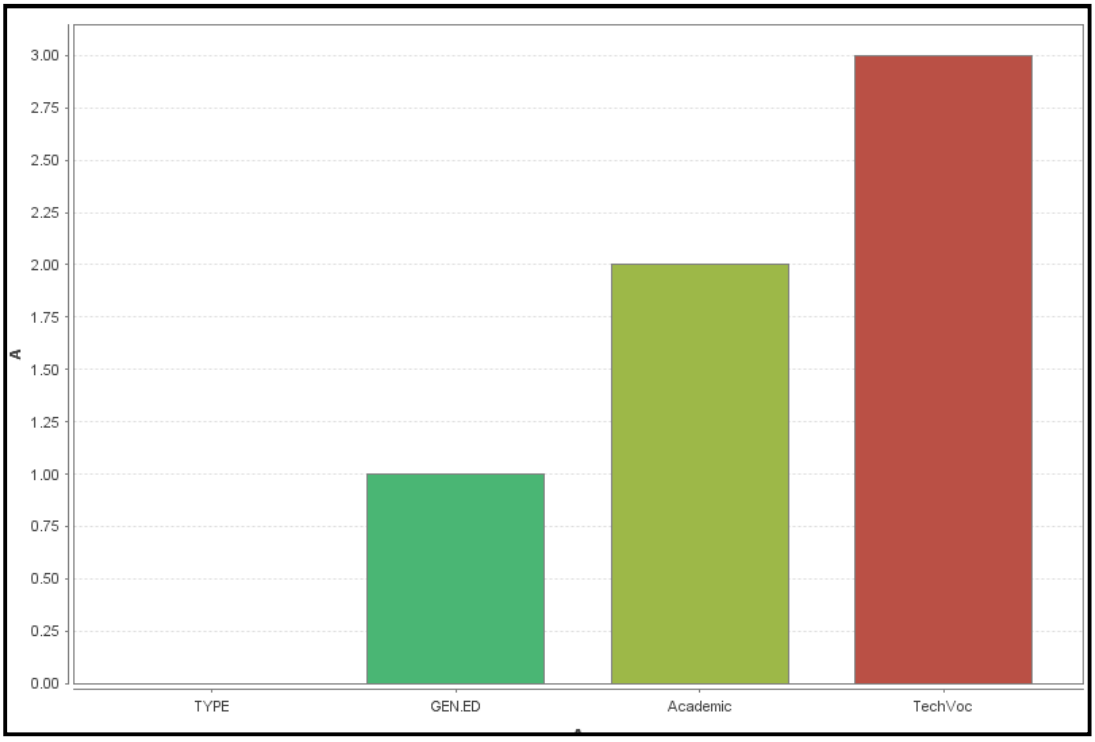

Figure 8. Group subject per category

In the result, all of the subjects has met the competencies. Figure 9 demonstrates the proficiency level of the subject area and their mastery level. From the result, subject from the Technical Vocational (TechVoc) had portrays higher mastery level. Meanwhile, subjects from the General Education indicate closely approximating mastery (CAM), as well as the subjects from the Academic Subjects shows Moving Towards Mastery (MTM). Generally, the result of the exam per subject has good proficiency level of the Senior High School students.

SUBJECT	RESULT	MASTERY LEVEL
Oral Communication in Context	89	CAM
Pagbasa at Pagsusuri ng Iba't Ibang Teksto Tungo sa Pananaliksik	90	CAM
21st Century Literature from the Philippines and the World	75	MTM
Media and Information Literacy	96	Iastered
General Mathematics	65	AVR
Earth and Life Science	70	MTM
Introduction to Philosophy of the Human Person	80	MTM
Physical Education and Health	88	CAM
Business Math	75	MTM
Philippine Politics and Governance	78	MTM
Automotive	93	CAM
Bread and Pastry	98	Iastered
Electrical Installation and Maintenance	96	Iastered
Horticulture	85	MTM
Shielded Metal Arc Welding	94	CAM
Personal Development	83	MTM
Organization and Management	75	MTM

Figure 9. Correlation of item analysis with the Subject

To evaluate the summary of item analysis, Figure 10 displays the cumulative item analysis. It depicts that the item analysis whether it is a general subject, TechVoc subject or Academic subject displays that it is increasing and changing. Figure 10, can be concluded that the Mean Percentage Score based on the Item Analysis is being met and changing. Frequency displays that most likely MPS is within 65% to 89.75% as a result of frequency. It is a good point because competencies can be concluded that it is met.

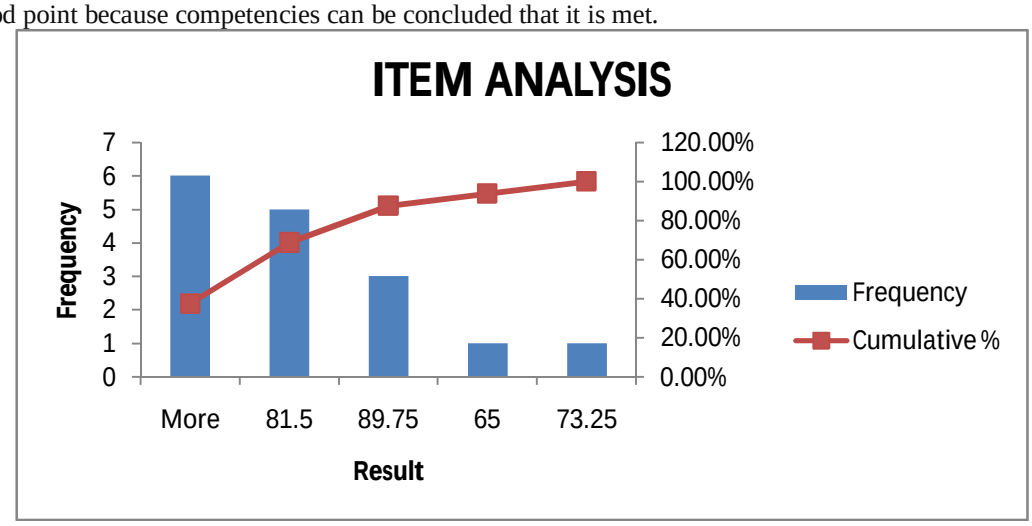

Figure 10. Item Analysis summary result

CONCLUSION

The proficiency level of the senior high school students as shown in the result indicated that there is a substantial relationship in the number of students who get the exam the more the students who took the exam, the bigger the chances MPS results is lower. On the other hand, if the students who took the exam is lesser the higher the chances to increase the MPS. Academic, TechVoc and General Education Subject is also tested separately and grouped. With it, it shows that there is no significant relationship between the TechVoc subjects and General to Academic Subject. This also implies that the Academic Subject has no direct effect in the increase/decrease of Item analysis for TechVoc and General Education subject or vice versa.

This study confirms the very potential of using the data mining models in the representation of knowledge-based specially in the academic institution.

The proficiency level of senior high school students based on the results described that the bigger number of students who took the exam has a larger effect in the result of Mean Percentage Score.

With regards to the standard deviation, it indicates a negligible positive correlation and since the computed P value of 1.11 is greater than .05 alpha levels, scores are well accepted. This also implies that the exam type has no direct effect in the increase/decrease of standard deviation. Which mean that numbers of items correct are properly distributed from one item number to another. In terms of comparing which subject has an impact to the scores of the students, from the item analysis result it exhibit that skills subject are more mastered than academic or general education subject. The result also presented that almost all Technical Vocational subject has a bigger chance to increase than those of general education subjects and academic subject. It only shows that students taking up Technical Vocational subject excel than those taking up academic subject. It can also be infer that MPS of all the subjects taken is increasing in compare to the previous quarterly exam.

As a whole there are mastery levels in almost all subjects as shown in the item analysis result. Then again there must be an appropriate action in the not so managed distributed of scores in the standard deviation. Proper test questions should be used in order to have a greater increase in MPS and the objective set will be met.

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