2.1.2 CE 221 Results of Factor Analysis & Multiple Regression Analysis (DP1’s)

The factor analysis used Principal Component Analysis with Rotation and Varimax with Kaiser Normalization. The Rotation converged in 5 iterations, and the component value is rejected below 0.30. Kaiser-Meyer Measure of Sampling Adequacy is 0.936, Bartlett’s Test of sphericity has approx. Chi square of 13047.557. The result of factor analysis for CE 221 by using SPSS is presented in Figures 2 (a, b).

Figure 2a. Rotated Component Matrix - CE 221

![Figure 2a. Rotated Component Matrix - CE 221](image)

Figure 2b. Rotated Component Matrix - CE 221

![Figure 2b. Rotated Component Matrix - CE 221](image)

“Help improve listening skills” and “ability to concentrate” are the first two with the highest R. This shows that a big classroom with 118 students in lecturing mode is pretty good of a challenge to enhance learning without a microphone.
Figure 3 Total Variance Explained on Rotation sums of squared loadings - CE 221

Figure 3 shows the percent of variance of the three (3) components as explained.

Figure 4. Total Variance Explained - CE 221

Figure 4 shows the total variance of the three (3) components in which component 1 and 2 are closely related. By assessing the influences, it was found a distinct behavior in which cultural values matters most to students followed by the educational values. With a diverse community, so rich in cultural values, the challenges now posed to the researcher is how cultural aspects are addressed and preserved while the educational values are enhanced so as quality of learning is to achieve. The rest of the figures give visual representations of the behavior of the predictors.

Figure 5. Component Transformation Matrix - CE 221

Figure 6. Scree Plot on Factor Analysis - CE 221

Figure 6 shows the scree plot of the influential patterns in linearity in which two (2) components prevail, as illustrated by the Eigenvalue of each component number of predictors.

Figure 7. Component Plot on Factor Analysis

The 3D component plot in rotated space is shown in figure 7, where x represents component 1 - the cultural aspect, y depicts component 2 - the educational aspects, and z is component 3. The plot in of figure 8 shows that only a component, the cultural aspect, is strong. Figures 9 and 10 give a better insight in the problem under analysis.
Multi regression analysis was made to find out the relationship of the weighted means of each response with the rotated matrix of R values. The results are shown in figures 11 to 14.

Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of Responses</td>
<td>4.4648</td>
<td>2.0463</td>
<td>50</td>
</tr>
<tr>
<td>Influence Factor 1</td>
<td>6.007</td>
<td>1.5621</td>
<td>50</td>
</tr>
<tr>
<td>Influence Factor 2</td>
<td>5.854</td>
<td>1.4581</td>
<td>50</td>
</tr>
</tbody>
</table>

Figure 11. Regression Descriptive Statistics - CE 221

Correlations

- Pearson Correlation
  - Mean of Responses: 1.000
  - Influence Factor 1: -0.971
  - Influence Factor 2: 0.900
- Sig. (1-tailed)
  - Mean of Responses: .000
  - Influence Factor 1: .000
  - Influence Factor 2: .000
- N
  - Mean of Responses: 50
  - Influence Factor 1: 50
  - Influence Factor 2: 50

Figure 12. Regression Correlation - CE 221

Variables Entered/Removed

- Mode 1: Influence Factor 1, Influence Factor 2
- Method: Enter

a. All requested variables entered.
b. Dependent Variable: Mean of Responses

Figure 13. Retained Variable - CE 221

ANOVA

- Mode 1: Regression
  - Sum of Squares: 925
  - df: 2
  - Mean Square: 462
  - F: 19.280
  - p: .000

Figure 14. ANOVA - CE 221

Figures 13 and 14 show that the variable is a statistically significant unique contribution to the equation. This is very dependent on which variables are included, and how much overlap there is among the independent variables. The criterion is that if the Sig. value is less than .05, then the variable gives a significant unique contribution to the prediction of the dependent variable. Thus, if Sig. is greater than .05, then one can conclude the corresponding variable do not give a significant unique contribution and should be rejected. In this case, two components are retained and none is rejected.
2.1.3 CE 211-F Results of Factor Analysis & Multiple Regression Analysis (DP1’s)

The factor analysis uses Principal Component Analysis as extraction method, while rotation method uses Varimax with Kaiser normalization. The rotation converged after 5 iterations. Kaiser-Meyer measure rotation above 0.30, the rest are rejected. The result of factor analysis for CE 211-F is presented below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Total</th>
<th>% of Variance</th>
<th>Cumulative %</th>
<th>Total</th>
<th>% of Variance</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44.037</td>
<td>89.074</td>
<td>89.074</td>
<td>44.037</td>
<td>89.074</td>
<td>89.074</td>
</tr>
<tr>
<td>2</td>
<td>1.157</td>
<td>2.314</td>
<td>22.318</td>
<td>1.157</td>
<td>2.314</td>
<td>22.318</td>
</tr>
<tr>
<td>3</td>
<td>0.813</td>
<td>1.626</td>
<td>44.940</td>
<td>0.813</td>
<td>1.626</td>
<td>44.940</td>
</tr>
<tr>
<td>4</td>
<td>0.587</td>
<td>1.174</td>
<td>56.114</td>
<td>0.587</td>
<td>1.174</td>
<td>56.114</td>
</tr>
<tr>
<td>5</td>
<td>0.525</td>
<td>1.050</td>
<td>66.666</td>
<td>0.525</td>
<td>1.050</td>
<td>66.666</td>
</tr>
</tbody>
</table>

Figures 15, 16 and 17 shows the total variance of the two components in which components 1 and 2 are closely related. By assessing the influences, it was found a distinct behavior where cultural values matters the most to students, followed by the educational values. Similar results were found for CE 221.

With a diverse community, in which the country is so rich in cultural values, the challenges now posed are how cultural aspects are addressed and preserved while educational values are enhanced so as quality of learning is to achieve. The rest of the figures give visual representations of the behavior of the predictors.

What was so intriguing in the data of the correlation matrix before they were rotated was the rejection of a predictor that requires the application of outlying principles and concepts in Engineering Fluid Mechanics. The strongest components show that the relevance of cultural aspects is greater than that of the educational aspects. However, when rotation is applied, the said predictor is included but with a reduced value for R. It is thus imperative that teaching Engineering Mechanics & Engineering Materials to a diverse group in which no one comes from Lae City, where the University is located, requires a strategy that best suit their particular preferences to motivate participation. Interestingly, it was found that the respondents do not like to be instructed by the lecturer because only 2.38 percent responded. Many of them said they wanted to prepare for their career as Civil Engineers, but they wanted to do it their own way, according to their own cultural beliefs. Indeed, teaching these groups of students is so challenging.

Figure 18 shows the scree plot of the influential patterns where two (2) components prevail, as illustrated by the Eigenvalue of each component number of predictors.
Multi regression analysis was performed to find out the relationship of the weighted means of each response with the rotated component matrix R values. The results are shown in figures 21 to 29.

Looking at figures 21 to 23, one can see that the variables included in the model contributed to the prediction of the dependent variable. We find this information in the output box labeled Coefficients, in the column labeled Beta under Standardized Coefficients. The standardized coefficients are used to compare the different variables, not the unstandardized ones. ‘Standardized’ means that these values for the different variables have been converted to the same scale so that one can compare them. If there is a need for constructing a regression equation, unstandardized coefficient values, which are labeled as B, should be used. In this case, the researcher is interested in comparing the contribution of each independent variable; therefore, we will use the beta values, in which the Beta column has the largest beta values (ignoring any negative signs). The largest beta coefficient is -.547, which is related to Component 1. This means that this variable makes the strongest unique contribution to explain the dependent variable when the variance explained by all other variables in the model is controlled.

Figure 24 shows the collinearity of the coefficients of the predictors for CE 211-F, along with factor component 1, while figure 25 relates to the excluded variable.

Figure 26 shows the collinearity diagnostics for CE 211-F for the regression.

Figure 27 shows a statistically non-significant unique contribution to the equation. The criterion is if the Sig. value is less than .05 (.01, .001, etc.), then the variable is a significant unique contribution for the prediction of the dependent variable. The criterion is if Sig. is greater than .05 (in this case Sig is 0.139), then one can conclude that that variable is not making any significant unique contribution and is rejected. In this case, one component is retained and one is rejected.
To check whether an unexpected case has any undue influence on the results for our model as a whole, we can check the value of the Cook's Distance, which can be found close to the bottom of the Residuals Statistics table of figure 27. According to Tabachnick & Fidell (2001), cases with values larger than 1 are a potentially problematic. In our case, the maximum value for the Cook's Distance is 0.114, which suggests no major problems.

![Residual Statistics - CE 211-F](image)

**Figure 27. Residual Statistics - CE 211-F**

Figures 28 and 29 give a better insight to the problem under analysis.

![Normal P-P Plot of Regression Standardized Residual - CE 211-F](image)

**Figure 28. Normal P-P Plot of Regression Standardized Residual - CE 211-F**

![Regression Scatter - CE 211-F](image)

**Figure 29. Regression Scatter - CE 211-F**

### 2.14 DP3 - Student Support Tools

From the results of factor analysis, two striking relationships of the students' influences were found for both courses: 1) **cultural aspects** (self-concept and self-efficacy belief) and 2) **educational aspects** (academic behavior and attitude). A support mechanism is needed to address these issues, taking into account that PNG students usually favor the cultural aspects rather than educational values.

As a background to understand the preferred support tools, a review on the Papua New Guinea people's daily lives is useful and can be found at Culture of Papua New Guinea (2014).

Briefly, PNG people lives vary enormously because their great majority of the population lives in diverse rural landscapes in villages or hamlets. Rituals to ensure success and prosperity accompany many of their activities. The clan forms the major unit of social organization. Most Melanesian societies are patrilineal, and even matrilineal societies remain patriarchal, i.e., male-dominated. In some areas, lineage and land rights can be claimed through either parent, so people can belong to both their parents' clans. Large tribes are not unusual, but when they exist, they have a certain degree of political unity and they can be viewed as federations of clans. They may share origin myths, and in such cases clans can be seen as being like "brothers," sons of a founding father. These social structures form the lines of conflicts expressed in the inter-clan warfare that persists in the Highland provinces, and in those areas they often form the lines of political competition in contemporary elections.

When people migrate from rural villages to urban areas or to rural resettlement areas, they carry their languages and traditions with them and re-create their original social structures. Social bonds and obligations form the so-called **wantok** system, which can provide support for struggling in their new locations and create heavy demands to the more wealthy people who feel obliged to support their kin. The demands of **wantok** are often considered as root cause of corruption. Intergenerational tensions reflect the stresses of rapid social change in rural and urban contexts. In both villages and cities, music and dance celebrations often mark important life-cycle events such as birth, death, initiation, menarche, economic transactions (even the opening of a roadway), peacemaking, and religious observances. It is in this context that mapping the PV's from the DP's is essential as it addresses relevant facts that support the students' effective pedagogic learning. How the PV's are applied will be shown in the following discussion.

### 2.2 APPLICATION OF PV's

The intervention applied during the study time is the merit system or extra marks scheme to support the students' needs of escalating self-efficacy. The results are shown in figure 30 and were used as means to increase the percentage of passing without the content wise of the coursework. Thus, applications of the best strategy or solution to the challenges revealed by this study inspired on the Axiomatic Design approach.
The figure shows the students’ difficulty in understanding the course is relevant. To raise the students’ performance, an intervention was incorporated in the assessment process, as shown in figure 31.

Section 2.2.1 below shows the result of the intervention.

2.2.1 The students' performance

2.2.1.1 CE 211-F - Engineering Materials

The results of student performance in the Engineering Materials class are presented in figure 32.

The graph of figure 33 shows the achievements (A’s, B’s, C’s, D’s, E’s and F’s grades). The result is pretty good, but the researcher finds that it is not content rich, thus another intervention should be sought.
The cultural value of the figure is over the course content and above the educational values. This illustration describes the findings of the study. Students want an experience where their self-concept and self-efficacy is maintained, and where behaviors are supported by cultural values, and the academic behavior and attitude is embodied in the educational values. The researcher will call this phenomenon as culture educational paradigm shift since it best describes the figure.

Two very distinct and opposing instructional approaches are the inductive and the deductive ones (Inductive and Deductive Instruction, 2014). Both approaches can offer certain advantages, but the biggest difference is the role of the teacher. In a deductive classroom, the teacher conducts the lessons by introducing and explaining concepts to the students (this is the instructional method used by the researcher, of which most of the students responses are opposing), and then expecting students to complete tasks to practice the concepts; this approach is very teacher-centered. Conversely, inductive instruction is a much more student-centered approach and makes use of a strategy known as ‘noticing’. Instead of explaining a given concept and following this explanation with examples, the teacher presents students with many examples showing how the concept is used. The intent is that the students “notice”, by way of examples, how the concept works.

3 CONCLUSION

The conclusion is that the pedagogical framework should include four groups: Recognition of Difference and Social support were rated ‘very important’ influencing factors to students both in CE 221 and CE 211-F. In addition, Connectedness and Intellectual quality were rated ‘very important’ and ‘essential’ for CE 221 and CE 211-F respectively. Because of the diversity of the population, the students who are enrolled in the above mentioned courses perform differently. However, when a multivariate analysis was applied, the pedagogical framework earlier posited was changed to address the challenge of the culture rich and educational poor values. In addressing these challenges, a new concept is realized and come up with a 'Culture Education Paradigm Shift Framework' by adopting the Inductive Instructional Methodology.

It is hereby recommended that the next delivery of the courses should be conducted in a Culture Education Paradigm Shift framework to address the challenges that were found by using the Axiomatic Design Model in the assessment of the pedagogic-learning results of Engineering Materials (CE 221) and Engineering Fluid Mechanics I (CE 211-F).

4 ACKNOWLEDGEMENT

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5 REFERENCES