CHAPTER ONE

INTRODUCTION

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1-1 : Preface:-

A statistical research generally relies on the study of various phenomena during different periods of time and studies the relationships between them and benefit from the results of these studies in the development of appropriate recommendations and make good decisions. This research relies on the concept of random variables and probability distributions study supported one variable in terms of more than one independent variable (multiple regression) and preparation random variables to the appropriate probabilistic applications. The evolution of science statistics and the same multivariate analysis led to develop the concept of multiple regression to study a set of dependent variables with a set of independent variables This method is called canonical correlation analysis as it is applied to the study of the relationship between the two sets of variables (set explanatory variables and a set of variables to respond.) , But he less prevalent and limited use because of the difficulty of interpreting and arranging results **.**

1-2 :Research problem

To measure the strength of the correlation between a set of variables of response and explanatory variables is used to analyze the canonical correlation and to understand these relations in many areas of scientific and medical fields of psychology, such as (a set of standards of academic achievement and a set of measures of success) (a set of psychological traits and a set of physiological attributes

In such studies are thus find the correlation, and the best way to interpret that relationship is the canonical correlation analysis

1-3 : Research Importance

Represents the importance of research in that it is the few statistical research dealing explains the relationship between the behaviors of students. and theoretical research important in addressing one of the methods multivariate (canonical correlation analysis) to understand the relationship between the variables under study and the Basic research importance of the is to find out the relationship between the explanatory variables and the response The canonical variables generated by the linear structures Canonical correlation

1-4 : Research Objectives

1 – To know the relationship between the explanatory variables and (psychological acceptance of Lecturer (Instructor) from the point of view of the student (y1) degree student in the final exam (y2))

2 - to obtain the canonical correlation between the study variables

3 - find the correlation between the variables of the original study and the canonical variables

1-5 :Research data:

To apply the analysis of canonical correlation, which will be explained in this research the data was collected by questionnaire to all students the Third year Department of Statistics (57 student), Faculty of Science in Sudan University of Science and Technology.

1-6 :Research hypotheses

1- Canonical correlation analysis has good interpretation of the relationship between explanatory and responses variables (y1, y2).

2- There is no relationship between the explanatory variables (x1,x2,,x3,x4,x5,x6,x7,x8,x9,x10,x11) and response variables (y1,y2) under study.

1-7 : Research methodology:-

Descriptive method to describe research data and analytical method of canonical correlation analysis we will using the Statistical Package **(SPSS, STATA, EXCEL)**

1-8 : Research Structure:-

This research contains four chapters and is the first chapter includes a problem and the importance of goals and assumptions and data research and research methodology in addition to previous studies and researches Chapter II contains a theoretical framework for research and analysis includes the concept of canonical correlation definition Canonical correlation and canonical variables and statistical tests to test the Significantly canonical correlation It contains the third chapter on the practical side of the research, which was a description of the data and testing hypotheses of the study variables and find correlation to the canonical variables canonical The correlation between the original variables and canonical variables chapter IV contains the conclusions that have been reached and recommendations relating to suggested research

1-9 : previous studies:-

The following we review some of the previous studies in which the use of the canonical correlation analysis:-

1- **Schul, Patrick L., William M. Pride, and Taylor L. Little (1983), "The Impact of Channel Leadership Behavior on Intrachannel Conflict."** ***Journal of Marketing*** **47(3): 21–34.**

This article uses canonical correlation analysis, applied to determine the effects of leadership style upon perceptions of intrachannel conflict. By examining the strength and direction of the relationship between leadership style and overall intrachannel conflict, canonical correlation analysis provides the researcher with information to improve distribution channel transactions. Findings of this nature also provide managers of channel member organizations with a means of structuring their conduct with other channel members. Three leadership styles—participative, directive, and supportive—which have been theorized to exhibit an inverse relationship with two forms of ntrachannel conflict—administrative and product-service—are defined and measured. It is through this technique that researchers are able to explore the relationship between such multifaceted constructs as leadership and conflict. Data from a sample of 349 franchised real estate brokers were analyzed to test for an association between channel leadership (as the predictor, or independent variables) and intrachannel conflict (as the criterion, or dependent variables). The authors are able to confirm that there exists a strong relationship between the type of channel leadership and intrachannel conflict by examining the redundancy index (indicates the amount of variance explained in a canonical variate by the other canonical variate) and the correlation between the two variates. Through individual analysis, all three leadership styles are shown to reduce conflict..

2- **Luthans, Fred, Dianne H. B. Welsh, and Lewis A. Taylor III (1988), "A Descriptive Model of Managerial Effectiveness."** ***Group and Organization Studies*** **13(2): 148–62.**

By conducting a canonical correlation analysis, this study seeks to determine which specific managerial activities relate to organizational effectiveness. The authors identify nine managerial activities and eight items on organizational subunit effectiveness. The activities of 78 managers are observed and recorded in order to measure engagement in the identified behaviors. To eliminate same source bias that may be introduced if the managers rate subunit effectiveness, their subordinates (278 in all) rate subunit effectiveness. Whereas other studies examine the activities of successful managers (i.e., those on a fast promotion track), this study seeks to identify those behaviors that contribute to organizational effectiveness. The canonical correlation analysis between the frequency of the managerial activities and subordinate-reported subunit effectiveness is used in order to reveal the presence and strength of the relationship between the two sets of variables.

Results indicate a significant canonical variate (canonical correlation = .44); however, the strength of the relationship is not assessed (i.e., the redundancy index, which is a better measure of the ability of the predictor variables to explain variation in the criterion variables, is not reported). Interpretation of the results suggests a continuum of management orientation from quantity-oriented human resources to quality-oriented traditional. Quantity-oriented human resource managers are understood to focus on staffing and motivating or reinforcing activities and are perceived as having quantity performance in their units. These managers, however, have limited outside interaction, engagement in controlling and planning activities, or the perception of quality performance in their units.

3- Van Auken, Howard E., B. Michael Doran, and Kil-Jhin Yoon (1993), "A Financial Comparison between Korean and U.S. Firms: A Cross–Balance Sheet Canonical Correlation Analysis." *Journal of Small Business Management* 31(3): 73–83.

In this article, the authors seek to examine cross–balance sheet relationships and general financing strategies of small- to medium-sized Korean firms through the use of canonical correlation analysis. From a random sample of 45 Korean firms, financial position statements from 1988 were obtained for various asset, liability, and equity accounts. The relationships between the assets (cash, accounts receivable, inventories, and long-term assets) and

liabilities and equities (accounts payable, other current liabilities, long-term debt, and equity) were explored using canonical correlation analysis. The study's design allowed the authors to compare the results of previously published works on Mexican and U.S. small- and medium-sized firms. This and previous studies have demonstrated that the financial strategies of small firms are influenced by economic conditions and cultural elements. The results of the study
should aid in the decision making of small business owners who are developing financing strategies in similar economies.

The analysis resulted in all four canonical functions being significant. As a further assessment of the canonical functions, the authors calculate a redundancy index. The proportion of the asset variance accounted for by the liability variance is .60. The liability variance shared with the asset variance is .24. Because the canonical relationships were acceptable, the authors proceed to make the following interpretations about small- to medium-sized Korean firms: (1) they experience hedging, (2) they use collateral for loans, (3) their inventories are associated with accounts payable, and (4) they manage risk with the simultaneous use of lower leverage and greater liquidity balances. Compared to U.S. firms, Korean firms rely heavily on the use of current debt. The findings extend earlier studies, which suggest that the financial strategies of small firms in other countries are dependent on the marketing constraints of the country in which the firm operates.

4-Mahmood, Mo Adam, and Gary J. Mann (1993), "Measuring the Organizational Impact of Information Technology Investment: An Exploratory Study." ***Journal of Management Information Systems*** **10(1): 97–122.**

This article seeks to determine whether a relationship exists between information technology (IT) investment and the strategic and economic performance of the firm. From past research measuring the impact of IT on the organization, the authors determine which measures to include in the study. The predictor variables consist of five IT investment measures, and the criterion variables include six organizational strategic and economic performance measures. Canonical analysis is used for exploratory purposes with no specific hypotheses offered. The technique enables the researchers to determine the presence and magnitude of the association between multiple IT and organizational performance measures. From the results, the authors offer hypotheses and a model depicting the interrelationships between IT investment and performance.

The canonical correlation analysis is performed with a sample of 100 firms. The results indicate a significant relationship with 10.4 percent of the variation in the organizational performance measures explained by IT investment. Although only one of the five canonical functions is significant, the authors interpret the two functions that account for nearly 86 percent of the total explained variation (i.e., of the 10.4 percent). By examining the canonical loadings of the two functions, the authors are able to determine the relative importance of each variable. Altogether, the findings are interpreted as indicating that IT investment contributes to organizational performance when the firm invests in both equipment and employee IT training. These conclusions lead the authors to call for further research to test the interdependencies between IT investment and firm performance using different methods and samples.

5-R .A.Aljarah; M.A. Karim(2012); " Analyses of Canonical Correlation between statistical tools and artificial neural network" Journal Basra for Science 1(26): 12-27

The aim of this paper is to arrive the Canonical Correlation by using tow tools: statistical & artificial neural network and demonstrate of their sufficient with application on sample under discuss.

Was reached that he can rely on the method of artificial neural networks in finding variables canonical in simple cases and also having a significant correlation between the study variables and variables canonical and recommended a final study to the use of neural networks in finding variables canonical as an alternative method of statistical studies is complex and also draw attention to the study canonical link in the case of non-linear variables

6-A. Kanbar (2012) "Canonical Correlation Analysis for Understanding the Relationship between Root and Shoot Morphological Traits in Barley under Contrasting Moisture Stress Condition during Early Growth Stage"; Damascus University Journal of Agricultural Sciences 1(28):77-89

In this article for understanding the relationship between root system and shoot related traits is an important objective in crop breeding programs. Canonical correlation analysis has been adopted to study the strength of association between the root morphological traits and shoot morphological traits under low-moisture stress and well-watered conditions and to find the root morphological characters that have the largest influence on shoot-related traits in seedling stage. Most of the traits under study revealed a significant reduction under low-moisture stress condition except root length which showed a significant increasing under the same condition. Root length and root number were had the largest effect on shoot dry weight and plant height under low-moisture stress and well-watered condition. The results of cumulative redundancy showed that about 45% of the variability in the shoot-related characters is accounted for by the root morphological characters under control condition and this percentage reduced up to 41% under moisture stress.

CHABTER TWO

CANONICAL CORRELATION ANALYSIS

1-1: Introduction

1-2: Canonical correlations and canonical variates

1-3: Properties of canonical correlations

1-4: Tests of significance of canonical correlation

1-5: Interpretation

2-1: Introduction:-

Correlation analysis is concerned with the amount of (linear) relationship between two sets of variables. We often measure two types of variables on each research unit. (Rencher, 2002). The researcher may be interested in relationships between sets of multiple dependent and multiple independent variables. Canonical correlation analysis is the answer for this kind of research problem. It is a method that enables the assessment of the relationship between two sets of multiple variables. (Hall Publishing 2006).

For example, a set of aptitude variables and a set of achievement variables, a set of personality variables and a set of ability measures, a set of price indices and a set of production indices, a set of student behaviors and a set of teacher behaviors, a set of psychological attributes and a set of physiological attributes, a set of ecological variables and a set of environmental variables, a set of academic achievement variables and a set of measures of job success, a set of closed-book exam scores and a set of open-book exam scores, and a set of personality variables of freshmen students and the same variables on the same students as seniors.

The canonical correlation analysis addresses two primary objectives: (1) the identification of dimensions among the dependent and independent variables that (2) maximize the relationship between the dimensions (see Hair etc ,1998.)

.2-2: Canonical correlations and canonical variates:-

We assume that two sets of variables $y' = (y_2 \cdots \cdots y_p)$and $x' = (x_1 x_2 \cdots x_q)$ are measured on the same sampling unit. We denote the two sets of variables we consider a measure of overall correlation between y and x. Canonical correlation is an extension of multiple correlations, which is the correlation between one y and several x's. Canonical correlation analysis is often a useful complement to a multivariate regression analysis.

We first review multiple correlations. The sample covariance's and correlations among y, x1, x2. . . xq can be summarized in the matrices

$$\mathbf{S}=\begin{pmatrix} s_y^2 & s_{yx}' \\ s_{yx} & s_{xx} \end{pmatrix} \tag{2-1}$$

$$\mathbf{R}=\begin{pmatrix} 1 & r_{yx}' \\ r_{yx} & R_{xx} \end{pmatrix} \tag{2-2}$$

Where $S_{yx}' = (S_{y1} S_{y2} \dots \dots . . S_{yq})$ contains the sample covariances of y with $x_1 x_2 \dots \dots x_q$ and s_{xx} is the sample covariance matrix of the x's

$$S = \begin{pmatrix} S_{yy} & S_{y1} S_{y2} \dots \dots & S_{yq} \\ S_{1y} & S_{11} S_{12} \dots \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{yq} & S_{q1} S_{q2} \dots . & S_{qq} \end{pmatrix} \tag{2-3}$$

The partitioned matrix **R** is defined analogously; $r_{yx}' = (r_{y1} r_{y2} \dots . . r_{yp})$ contains the sample correlations of y with$x_1 x_2 \dots \dots x_q$, and R_{xx} is the sample correlation matrix of the x's

$$R = \begin{pmatrix} 1 & R_{y1} R_{y2} \dots \dots & R_{yq} \\ R_{1y} & R_{11} R_{12} \dots \dots & R_{1q} \\ \vdots & \vdots & \vdots \\ R_{yq} & R_{q1} S_{q2} \dots . & R_{qq} \end{pmatrix} \tag{2-4}$$

the squared multiple correlation between y and the x's can be computed from the partitioned covariance matrix (2-1) or correlation matrix (2-2) as follows:

$$R^2 = \frac{S'_{yx}S_{xx}^{-1}S_{yx}}{S_y^2} = r'_{yx}R_{XX}^{-1}r_{yx} \qquad (2\text{-}5)$$

In R^2, the q covariance's between y and the x's in S_{yx} or the q correlations between y and the x's in r_{yx} are channeled into a single measure of linear relationship between y and the x's. The multiple correlation R can be defined alternatively as the maximum correlation between y and a linear combination of the x's; that is, $R = \max \quad r_{by,b'x}$

We now return to the case of several y's and several x's. The covariance structure associated with two sub vectors **y** and **x** was first discussed in (see Rencher 2002, Section 3.8.) the overall sample covariance matrix for $(y_1 \dots \dots y_p, x_1 \dots \dots x_q)$ can be partitioned as

$$\mathbf{S}=\begin{pmatrix} S_{yy} & S_{yx} \\ S_{yx} & S_{xx} \end{pmatrix} \qquad (2\text{-}6)$$

where S_{yy} is the p × p sample covariance matrix of the y's, S_{yx} is the p × q matrix of sample covariance's between the y's and the x's, andS_{xx} is the q × q sample covariance matrix of the x's.

We discussed several measures of association between the y's and the x's in (see Rencher 2002, section 10.6). $R_M^2 = \frac{|\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\ S_{xy}|}{|\mathbf{S}_{yy}|}$, Which is analogous to $R^2 = \frac{S'_{yx}S_{xx}^{-1}S_{yx}}{S_y^2}$ in (2-!) R_M^2 can be rewritten as $R_M^2 = \left|\mathbf{S}_{yy}^{-1}\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\ S_{xy}\right|$ in Matrix Algebra R_M^2can be expressed as

$$R_M^2 = \left|\mathbf{S}_{yy}^{-1}\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\, S_{xy}\right| = \prod_{i=1}^{s} r_i^2 \qquad (2\text{-}6)$$

where s = min(p, q) and $r_1^2 r_2^2$,………r_s^2s are the Eigen values of $\mathbf{S}_{yy}^{-1}\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\, S_{xy}$ When written in this form, R_M^2 is seen to be a poor measure of association because $0 \le r_i^2 \le 1$ for all i , and the product will usually be too small to meaningfully reflect the amount of association . The Eigen values themselves, on the other hand, provide meaningful measures of association between the y's and the x's. The square roots of the Eigen values, $r_1 r_2 r_3 \ldots \ldots r_s$, are called **canonical correlations.**

The best overall measure of association is the largest squared canonical correlation (maximum Eigen value) r_1^2 of $\mathbf{S}_{yy}^{-1}\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\, S_{xy}$, but the other Eigen values (squared canonical correlations) of $\mathbf{S}_{yy}^{-1}\mathbf{S}_{yx}\mathbf{S}_{xx}^{-1}\, S_{xy}$provide measures of supplemental dimensions of (linear) relationship between **y** and **x**. As an alternative approach, it can be shown that r_1^2 is the maximum squared correlation between a linear combination of the y's, u =$\mathbf{a}'\mathbf{y}$, and a linear combination of the x's, v =;$\mathbf{b}'\mathbf{x}$ that is,

$$r_1 = \max_{a,b} r_{a'y,b'x} \qquad (2\text{-}7)$$

We denote the coefficient vectors that yield the maximum correlation as $a_1$andb_1.Thusr_1 (the positive square root ofr_1^2) is the correlation between $u_1 = a_1'y$ and $v_1 = b_1'x$. The coefficient vectors **a**1 and **b**1 can be found as eigenvectors [see (2-10) And (2-11)]. The linear functions u_1 and v_1 are called the **first canonical variates.**

There are additional canonical variates $u_i = a_i'y$ and $v_i = b_i'x$

$r_2 r_3 \ldots \ldots r_s$.

It was noted in (Rencher 2002, Section 2.11.5) that the (nonzero) Eigen values of **AB** are the same as those of **BA** as long as **AB** and **BA** are square but that the eigenvectors of **AB** and **BA** are not the same. If we let $\mathbf{A} =$

$\mathbf{S_{yy}^{-1}S_{yx}}\mathrm{x}$ and $\mathbf{B} = \mathbf{S_{xx}^{-1}S_{xy}}$, then $r_1^2 r_2^2, \ldots\ldots\ldots r_s^2$ can also be obtained from

$\mathbf{BA} = \mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}}$

as well as from $\mathbf{AB} = \mathbf{S_{yy}^{-1}S_{yx}S_{xx}^{-1}}\,\mathrm{S_{xy}}$. Thus the Eigen values can be obtained from either of the characteristic equations

$$|\mathbf{S_{yy}^{-1}S_{yx}S_{xx}^{-1}}\,\mathrm{S_{xy}} - \mathrm{r}^2\mathrm{I}| = 0 \qquad (2\text{-}8)$$

$$|\mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}} - \mathrm{r}^2\mathrm{I}| = 0 \qquad (2\text{-}9)$$

The coefficient vectors $\mathbf{a_i}$ and $\mathbf{b_i}$ in the canonical variates $\mathrm{u_i} = \mathrm{a_i'y}$ and $\mathrm{v_i} = \mathrm{b_i'x}$ are the Eigen vectors of these same two matrices:

$$(\mathbf{S_{yy}^{-1}S_{yx}S_{xx}^{-1}}\,\mathrm{S_{xy}} - \mathrm{r}^2\mathrm{I})\mathrm{a} = 0 \qquad (2\text{-}10)$$

$$(\mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}} - \mathrm{r}^2\mathrm{I})\mathrm{b} = 0 \qquad (2\text{-}11)$$

Thus the two matrices ($\mathbf{S_{yy}^{-1}S_{yx}S_{xx}^{-1}}\,\mathrm{S_{xy}}$ and $\mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}}$ have the same (nonzero) Eigen values, as indicated in (2-8) and (2-9), but different eigenvectors, as in (2-10) and (2-11). Since **y** is p × 1 and **x** is q × 1, the $\mathbf{a_i}$'s are p × 1 and the $\mathbf{b_i}$'s are q ×1. This can also be seen in the sizes of the matrices in (2-10) and (2-11); that is $\mathbf{S_{yy}^{-1}S_{yx}S_{xx}^{-1}}\,\mathrm{S_{xy}}$, is p × p and $\mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}}$ q × q. Since p is typically not equal to q, the matrix that is larger in size will be singular, and the smaller one will be nonsingular. We illustrate for p < q.

When p < q, the rank of $\mathbf{S_{xx}^{-1}S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}}$ is p, because $\mathbf{S_{xx}^{-1}}$ has rank q and $\mathbf{S_{xy}S_{yy}^{-1}}\,\mathrm{S_{yx}}$ has rank p. In this case p Eigen values are nonzero and the remaining q − p Eigen values are equal to zero. In general, there are s = min (p, q) values of the squared canonical correlation r_i^2 with s corresponding pairs of canonical variates

$u_i = a_i'y$ and $v_i = b_i'x$. For example, if p = 3 and q = 7, there will be three canonical correlations, $r_1 r_2$ and r_3

Thus we have s canonical correlations $r_1 r_2 \dots \dots r_s$ corresponding to the s pairs of canonical variates u_i and v_i :

$$\begin{array}{lll} r_1 & u_1 = a_1'y & v_1 = b_1'x \\ r_2 & u_2 = a_2'y & v_2 = b_2'x \\ \cdot & \cdot \quad \cdot \quad \cdot & \cdot \quad \cdot \quad \cdot \\ \cdot & \cdot \quad \cdot \quad \cdot & \cdot \quad \cdot \quad \cdot \\ \cdot & \cdot \quad \cdot \quad \cdot & \cdot \quad \cdot \quad \cdot \\ r_s & u_2 = a_2'y & v_2 = b_2'x \end{array} \tag{2-12}$$

For each i, r_i is the (sample) correlation between u_i and $v_i$that is, $r_i = r_{u_i, v_i}$. The pairs $(u_i\ v_i)$ i = 1, 2. . . s, provide the s dimensions of relationship. For simplicity, we would prefer only one dimension of relationship, but this occurs only when s = 1, that is, when p = 1 or q = 1.

The s dimensions of relationship$(u_i\ v_i)$, i = 1, 2. . . s, are non redundant. The information each pair provides is unavailable in the other pairs because $u_1 u_2 \dots \dots u_s$ are uncorrelated. They are not orthogonal because $a_1 a_2 \dots \dots a_s$ are eigenvectors of $S_{yy}^{-1} S_{yx} S_{xx}^{-1} S_{xy}$ which is non symmetric. Similarly, the vi's are uncorrelated, and each u_i is uncorrelated with allv_j, $j \neq i$, except, of course, v_i .

We examine the elements of the coefficient vectors a_i and $b_i$for the information they provide about the contribution of the y's and x's to r_i.

These coefficients can be standardized, as noted in the last paragraph in the present section and in (Section 2-5-1).

As noted, the matrix $S_{yy}^{-1}S_{yx}S_{xx}^{-1}\ S_{xy}$is not symmetric. Many algorithms for computation of Eigen values and eigenvectors accept only symmetric matrices. Since $S_{yy}^{-1}S_{yx}S_{xx}^{-1}\ S_{xy}$ is the product of the two symmetric matrices S_{yy}^{-1} and $S_{yx}S_{xx}^{-1}\ S_{xy}$, we can proceed as in (see Rencher 2002) and work with $((U'\,)^{-1}S_{yx}S_{xx}^{-1}\ S_{xy}(U)^{-1}$where$U'U = S_{yy}$ is the Cholesky factorization of S_{yy} (see Recher2002 Section 2.7). The symmetric matrix $((U'\,)^{-1}S_{yx}S_{xx}^{-1}\ S_{xy}(U)^{-1}$ has the same Eigen values as $S_{yy}^{-1}S_{yx}S_{xx}^{-1}\ S_{xy}$ but has Eigen vectors Ua_i where a_is given in (2.).

In effect, the pq covariance's between the y's and x's in S_{yx} have been replaced by s = min(p, q) canonical correlations. These succinctly summarize the relationships between y and x. In fact, in a typical study, we do not need all s canonical correlations. The smallest Eigen values can be disregarded to achieve even more simplification.

As in (see Rencher2002 chapter 8) for discriminate functions, we can judge the importance of each Eigen value by its relative size:

$$\frac{r_i^2}{\sum_{j=1}^{s} r_j^2} \qquad (2\text{-}13)$$

The canonical correlations can also be obtained from the partitioned correlation matrix of the y's and x's ,

$$\begin{pmatrix} R_{yy} & R_{yx} \\ R_{xy} & R_{xx} \end{pmatrix} \qquad (2\text{-}14)$$

where R_{yy} is the p × p sample correlation matrix of the y's, R_{yx} is the p × q matrix of sample correlations between the y's and the x's, and $R_{xx}$is the q ×

q sample correlation matrix of the x's. The matrix $R_{yy}^{-1}R_{yx}R_{xx}^{-1}R_{xy}$ is analogous to $r_{yx}'R_{xx}^{-1}\ r_{yx}$ in the univariate y case. The characteristic equations corresponding to (2-8) and (2-9)

$$|R_{yy}^{-1}R_{yx}R_{xx}^{-1}\ R_{xy} - r^2I| = 0 \qquad (2\text{-}15)$$

$$|R_{xx}^{-1}R_{xy}R_{yy}^{-1}\ R_{yx} - r^2I| = 0 \qquad (2\text{-}16)$$

Yield the same Eigen values $r_1^2, r_2^2 \dots \dots r_s^2s$ as (2.-10) and (2-11) (the canonical correlations are scale invariant; see property 1 in(section 2-3). If we use the partitioned correlation matrix in place of the covariance matrix in(2-10) and (2-11), we obtain the same Eigen values (squared canonical correlations) but different eigenvectors:

$$(R_{yy}^{-1}R_{yx}R_{xx}^{-1}\ R_{xy} - r^2I)c = 0 \qquad (2\text{-}17)$$

$$(R_{xx}^{-1}R_{xy}R_{yy}^{-1}\ R_{yx} - r^2I)d = 0 \qquad (2\text{-}18)$$

The relationship between the eigenvectors **c** and **d** in (2-17) and (2-18) and the Eigen vectors **a** and **b** in (2-10) and (2-11) is

$$c = D_y a, \text{and}\ \ d = D_x b \qquad (2\text{-}19)$$

Where $D_y = \mathrm{diag}(S_{y1}S_{y2} \cdots S_{yp})$ And $D_x = \mathrm{diag}(S_{x1}S_{x2} \cdots S_{xp})$

The eigenvectors **c** and **d** in (2-17), (2-18), and (2-19) are standardized coefficient vectors. they would be applied to standardized variables.

To show this, note that in terms of centered variables **y** − **y**, we have

$$u = a'(y-\bar{y}) = a'D_yD_y^{-1}(y-\bar{y})$$

$$= c'D_y^{-1}(y-\bar{y})$$

$$= c_1\frac{y_1-\overline{y_1}}{s_{y_1}} + c_2\frac{y_2-\overline{y_2}}{s_{y_2}} + \cdots + c_p\frac{y_p-\overline{y_p}}{s_{y_p}} \qquad (2\text{-}20)$$

Hence **c** and **d** are preferred to **a** and **b** for interpretation of the canonical variates $u_i$andv_i.

Canonical Correlation Analysis assumption:-

1-A strong conceptual foundation is needed to specify the sets of independent and dependent variable

2-Variables can be either metric or non metric

The acceptable sample size is at least 10 cases per measured variable, except for exploratory research

3-As with all other multivariate methods, the essential assumptions including linearity, normality, homoscedasticity, and multicollinearity should be met or remedied (see Pearson Prentice Hall Publishing).

2-3: Properties of canonical correlations:-

Two interesting properties of canonical correlations are the following [for other properties,[see Rencher (1998); Section 8.3]:

1. Canonical correlations are invariant to changes of scale on either the y's or the x's. For example, if the measurement scale is changed from inches to centimeters, the canonical correlations will not change (the corresponding eigenvectors will change). This property holds for simple and multiple correlations as well.

2. The first canonical correlation r1 is the maximum correlation between linear functions of **y** and **x**. Therefore, r1 exceeds (the absolute value of) the simple correlation between any y and any x or the multiple correlation between any y

.

2-4: Tests of significance of canonical correlation:-

In the following two sections we discuss basic tests of significance associated with canonical correlations. For other aspects of model validation for canonical correlations and variates, [see Rencher (2002,Section 11.4)].

2-4-1: Tests of No Relationship between the y's and the x's:-

In test of independence (Rencher2002, Section 7.4.1) we considered the hypothesis of independence, (H_0: $\sum_{yx} = 0$. If$\sum_{yx} = 0$), the covariance of every (y_i) with every (x_i) is zero, and all corresponding correlations are likewise zero. Hence, under H0, there is no (linear) relationship between the y's and the x's, and H0 is equivalent to the statement that all canonical correlations ($r_1 r_2 \cdots r_s$) are non significant. Furthermore, which also relates all the y's to all the x's. the significance of($r_1 r_2 \cdots r_s$) can be tested by

$$\Delta_1 = \frac{|S|}{|S_{yy}||S_{xx}|} = \frac{|R|}{|R_{yy}||R_{xx}|} \qquad (2\text{-}21)$$

which is distributed as $\Delta_{p,q,n-1-q}$We reject H_0 if $\Delta_1 \leq \Delta_{\propto}$Critical values $\Delta_{\propto}$are available in Table A.9 using $v_H = q$ and $v_E = n - 1 - q$. The statistic Δ_1 in(2-!) is also distributed as _$\Delta_{p,q,n-1-q}$. Δ_1 is expressible in terms ofthe squared canonical correlations:

$$\Delta_1 = \prod_{i=1}^{s}(1 - r_i^2) \qquad (2\text{-}22)$$

In this form, we can see that if one or more $r_i^2$is large, Δ_1 will be small. We have used the notation Δ_1 in (2-!) and (2-!) because in Section 2-3-2we will define $\Delta_2 \Delta_{31}$and so on to test the significance of r_2 and succeeding $r_i's$ after the first.

If the parameters exceed the range of critical values for Wilks' Δ in Table A.9(see), we can use the χ^2-approximation we get :-

$$\chi^2 = -\left[n - \frac{1}{2}(p + q + 3)\right] \ln \Delta_1 \qquad (2\text{-}23)$$

Which is approximately distributed as $\chi 2$ with pq degrees of freedom. We reject H0 if $\chi^2 \geq \chi^2_\propto$. Alternatively, we can use the F-approximation given in

$$F = \frac{1 - \Delta_1^{1/t} df_2}{\Delta_1^{1/t} df_1} \qquad (2\text{-}24)$$

which has an approximate F-distribution with df_1 and df_2 degrees of freedom, where

$$df_1 = pq$$

$$df_2 = wt - \frac{1}{2}pq + 1$$

$$w = n - \frac{1}{2}(p + q + 3)$$

$$t = \sqrt{\frac{p^2q^2 - 4}{p^2 + q^2 - 5}}$$

We reject H0 if F > Fα. When pq = 2, t is set equal to 1. If s = min(p, q) is equal to either 1 or 2, then the F-approximation in (2-24) has an exact F-distribution. For example, if one of the two sets consists of only two variables, an exact test is afforded by the F-approximation in (2-24). In contrast, the χ2-approximation in (2-23) does not reduce to an exact test for any parameter values.

Pillai's test statistic for the significance of canonical correlations is:-

$$V^{(s)} = \sum_{i=1}^{s} r_i^2 \qquad (2\text{-}25)$$

Upper percentage points of $V^{(s)}$ are found in Table A.11, indexed by

$$s = \min(p, q), \quad m = \frac{1}{2}(|q-p|-1)$$

$$, N = \frac{1}{2}(n-q-p-2)$$

For F-approximations for$V^{(s)}$,

The Lawley–Hotelling statistic for canonical correlations is

$$U^{(S)} = \sum_{I=2}^{S} \frac{r_i^2}{1-r_i^2} \qquad (2\text{-}26)$$

Upper percentage points for $v_E U^{(S)} | v_H$ are given in Table A.12 in,(Rencher) which is entered with p, $v_H = q$, and

$v_E = n - q - 1$For F-approximations

Roy's largest root statistic is given by

$$\theta = r_i^2 \qquad (2\text{-}26)$$

Upper percentage points are found in Table A.10, with s, m, and N defined as before for Pillai's test. An "upper bound" on F for Roy's test. Even though this upper bound is routinely calculated in many software packages, it is not a valid approximation.

2-4-2: Test of Significance of Succeeding Canonical Correlations after the First:-

If the test in (2-22) based on all s canonical correlations rejects H_0, we are not sure if the canonical correlations beyond the first are significant. To test the significance of $(r_2\ r_3 \ldots\ldots r_s)$, we delete r_i^2 from $\Delta_1 1$ in (2-!) to obtain

$$\Delta_2 = \prod_{i=2}^{s}(1 - r_i^2) \qquad (2\text{-}27)$$

If this test rejects the hypothesis, we conclude that at least r_2 is significantly different from zero. We can continue in this manner, testing each r_i in turn, until a test fails to reject the hypothesis. At the k'th step, the test statistic is

$$\Delta_k = \prod_{i=k}^{s}(1 - r_i^2) \qquad (2\text{-}28)$$

which is distributed as $\Delta_{p-k+1,q-k-1,n-k-q}$ and tests the significance of $(r_k, r_{k+1}, \ldots . r_s)$.Note that each parameter is reduced by k − 1 from the parameter Values p, q, and n − 1 − q for Δ_1 in (2-!) or (2-!). The usual χ2- and F-approximations can also be applied toΔ_k. The χ2- approximation analogous to (2-!) is given by:-

$$\chi^2 = -\left[n - \frac{1}{2}(p + q + 3)\right] \ln \Delta_1 \qquad (2\text{-}29)$$

which has (p −k +1)(q −k +1) degrees of freedom. The F-approximation for Δ_k is a simple modification of (2-24) and the accompanying parameter definitions. In place of p, q, and n, we use p − k + 1, q − k + 1, and n − k +1 to obtain:-

$$F = \frac{1-\Delta_1^{1/t} df_2}{\Delta_1^{1/t} df_1} \qquad (2\text{-}30)$$

Where

$$df_1 = (p - q + 1)(q - k + 1)$$

$$df_2 = wt - \frac{1}{2}[(p-k+1)(q-k+1)] + 1$$

$$w = n - \frac{1}{2}(p+q+3)$$

$$t = \sqrt{\frac{(p-k+1)^2(q-k+1)^2 - 4}{(p-k+1)^2 + (q-k+1)^2 - 2}}$$

2-5: Interpretation:-

We now turn to an assessment of the information contained in the canonical correlations and canonical variates. Distinction can be made between interpretation of the canonical variates and assessing the contribution of each variable. In the former, the signs of the coefficients are considered; in the latter, the signs are ignored and the coefficients are ranked in order of absolute value.

In Sections 2-5-1, 2-5-2, 2-5-3 we discuss three common tools coefficients, (2) the correlation between each variable and the canonical variate, and (3) rotation of the canonical variate coefficients. The second of these is the most widely recommended, but we note in Section 2- 4-2 that it is the least useful. In fact, for reasons to be outlined, we recommend only the first, standardized coefficients.

2-5-1: Standardized Coefficients:-

The coefficients in the canonical variates ($u_i = a_i' y$) and ($v_i = b_i' x$) reflect differences in scaling of the variables as well as differences in contribution of the variables to canonical correlation. To remove the effect of scaling, (a_i) and (b_i) can be standardized by multiplying by the standard deviations of the corresponding variables

$$c_i = D_y a_i$$
$$d_i = D_x b_i$$
Where $D_y = \mathrm{diag}(S_{y1} S_{y2} \cdots S_{yp})$ And $D_x = \mathrm{diag}(S_{x1} S_{x2} \cdots S_{xp})$, alternatively, c_i and $d_i$can be obtained directly from (2-10) and (2-11) as eigenvectors of $(R_{yy}^{-1} R_{yx} R_{xx}^{-1} R_{xy})$ and $(R_{xx}^{-1} R_{xy} R_{yy}^{-1} R_{yx})$, respectively. It was noted at the end of (Section 2-2) that the coefficients in c_i are applied to standardized variables [see (2-13)]. Thus the effect of differences in size or scaling of the variables is removed, and the coefficients ($c_{i1} c_{i2} \cdots c_{ip}$) in ci reflect the relative contribution of each of ($y_1 y_2 \cdots y_p$) to u_i . A similar statement can be made aboutd_i.

The standardized coefficients show the contribution of the variables in the presence of each other. Thus if some of the variables are deleted and others added, the coefficients will change. This is precisely the behavior we desire from the coefficients in a multivariate setting.

2-5-2: Correlations between Variables and Canonical Variates:-

Many writers recommend the additional step of converting the standardized coefficients to correlations. Thus, for example, in $c_1^{'} = (c_{11} c_{12} \cdots c_{1p})$, instead of the second coefficient c_{11}we could examine r_{y2u1} , the correlation between $y_2$and the first canonical variate u_1. Such correlations are sometimes referred to as loadings or structure coefficients, and it is widely claimed that they provide a more valid interpretation of the canonical variates. has shown, however, that a weighted sum of the correlations betweeny_j and the canonical variates $u_1 u_2 \dots . u_s$ is equal to $R^2_{yj|X}$, the squared multiple correlation between y_j and the x's. There is no information about how the y contributes jointly to canonical correlation with the x's. Therefore, the correlations are useless in gauging the importance of a given variable in the context of the others. The researcher who uses these correlations for interpretation is unknowingly reducing the multivariate setting to a univariate one. Rencher (2002, Section 11.5.2)

2-5-3: Rotation:-

In an attempt to improve interpretability, the canonical variate coefficients can be rotated see (Rencher (2002 Section 13.5) to increase the number of high and low coefficients and reduce the number of intermediate ones. We do not recommend rotation of the canonical variate coefficients for two reasons:-

1. Rotation destroys the optimality of the canonical correlations. For example, the first canonical correlation is reduced and is no longer equal to $max_{a,b}\, r_{a'yb'x}$ as in (2-!).

2. Rotation introduces correlations among succeeding canonical variates. Thus, for example, $u_1$and u_2 are correlated after rotation. Hence even though the resulting coefficients may offer a subjectively more interpretable pattern, this gain is offset by the increased complexity due to interrelationships among the canonical variates. For example, u_2 and v_2 no longer offer a new dimension of relationship uncorrelated with u_1 and $\mathrm{v}_1$the dimensions now overlap, and some of the information in u_2 and $\mathrm{v}_2$is already available in u_1 andv_1. Rencher (2002, Section 11.5.3)

* Canonical correlation analysis is a useful and powerful technique for exploring the relationships among multiple dependent and independent variables. The technique is primarily descriptive, although it may be used for predictive purposes. Results obtained from a canonical analysis should suggest answers to questions concerning the number of ways in which the two sets of multiple variables are related, the strengths of the relationships, and the nature of the relationships defined. Canonical analysis enables the researcher to combine into a composite measure what otherwise might be

an large number of bivariate correlations between sets of variables. It is useful for identifying overall relationships between multiple independent and dependent variables, particularly when the data researcher has little a priori knowledge about relationships among the sets of variables. Essentially, the researcher can apply canonical correlation analysis to a set of variables, select those variables (both independent and dependent) that appear to be significantly related, and run subsequent canonical correlations with the more significant variables remaining, or perform individual regressions with these variables.

CHAPTER THREE

APPLICATION

3-1: Preface

3-2: Data research

3-3: Descriptive analysis of the variables of the study

3-4: Correlation matrix

3-5: Raw coefficients canonical variates

3-6: canonical correlation

3-7: Tests of significance of all canonical correlations

3-8: Test of Significance of Succeeding Canonical Correlations after the First

3-9: Linear combinations for canonical correlations

3-10: Standardized coefficients canonical variates

3-11: Correlation between variable and canonical variates

3-1: Preface:-

This chapter includes the application to what has been explained in the theoretical framework of the research, And to find canonical correlations that show the relationship between two sets of the variables in this research, and build structures linear two of the sets of the variables individually. And to find coefficients of variables that maximizes those canonical correlations.

3-2: Data research:-

Research was collated questionnaire (Appendix 1) on the third year students who were substance differential equations (57 students). The answered to the questions of the questionnaire and which questions that represent the search variables that revolve around the level of students in the subject of differential equations and the reasons for the level. And was a divided research variable into two groups:-

First Section: set explanatory variables

In this group: -

1 – Gender(x1).

2 - Student Housing(x2)

3 - Do you set aside times for study material before setting a data exam(x3)

4 - If you set aside time to study and select the number of hours of study devoted to the study material (daily average)(x4)

5 - Full –time student for the academic duties (x5)

6 - The book provides a systematic or any other source assistant to article(x6)

7 - Student's ability to use modern methods of teaching(x7)

8 - The level of family income (x8)

9 – teacher ability in control of class (x9)

10 - portability teacher upon receipt of material clearly and smooth (x10)

11 - to accept the student material and convinced of their importance in the present time or future (11)

Section second: set of response variables

In this group: -

1 - psychological acceptance of Lecturer (Instructor) from the point of view of the student (y1)

2- degree student in the final exam (y2)

3-3: Descriptive analysis of the variables of the study:-

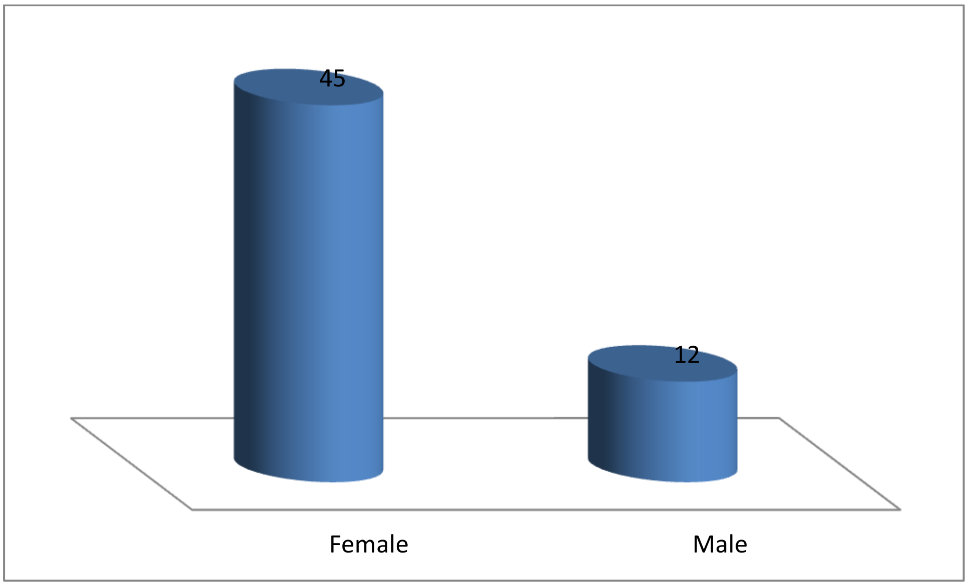
1- Gander(x1) : -

Table (3-1):- frequency distribution of gander(X1)

Gander	**Frequency**	**Percent**
Male	12	21.1%
Female	45	78.9%
Total	57	100%

Source: prepared by the researcher by **SPSS** program

Figure (3-1):- frequency distribution of gander(X1`)



Source: prepared by the researcher by **.Excel** program

Seen from the table (3-1) and figure (3-1) above that there is 45 males and by 78.9%, while there are 12 female and by 21.1% Of respondents**.**

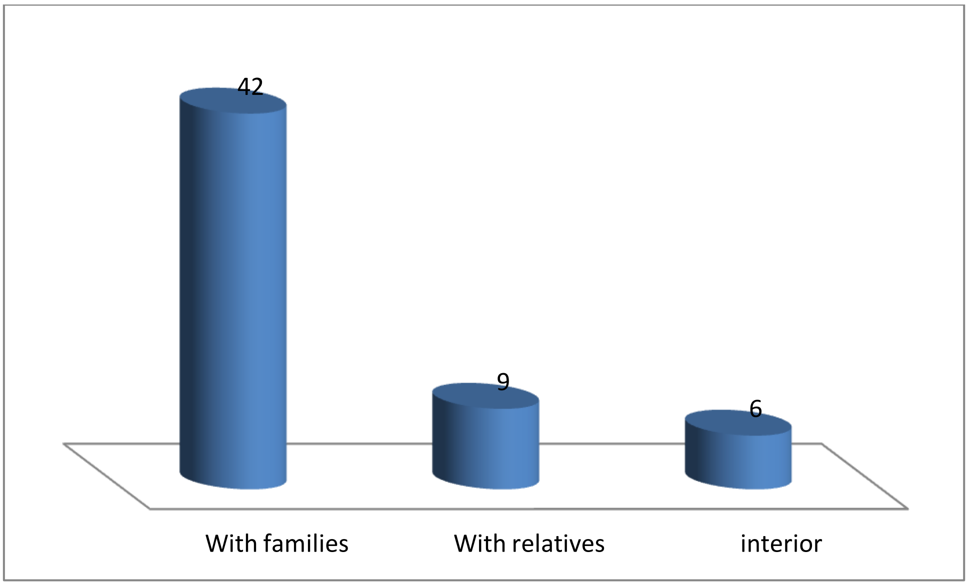
2-Student housing (x2):-

Table (3-2):- Frequency distribution of Student housing (x2**)**

Student housing	**Frequency**	**Percent**
interior	6	10.5%
With relatives	9	15.8%
With families	42	73.7%
Total	57	100%

Source: prepared by the researcher by. **SPSS** program

Figure (3-2):- Frequency distribution of Student housing(X2)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-2) and figure (2-3) above that 42 of the students live with their families, and by 73.7%, while 9 of the students live with relatives, and 15.8% and 6 students live in the interior and by 10.5% Of respondents.

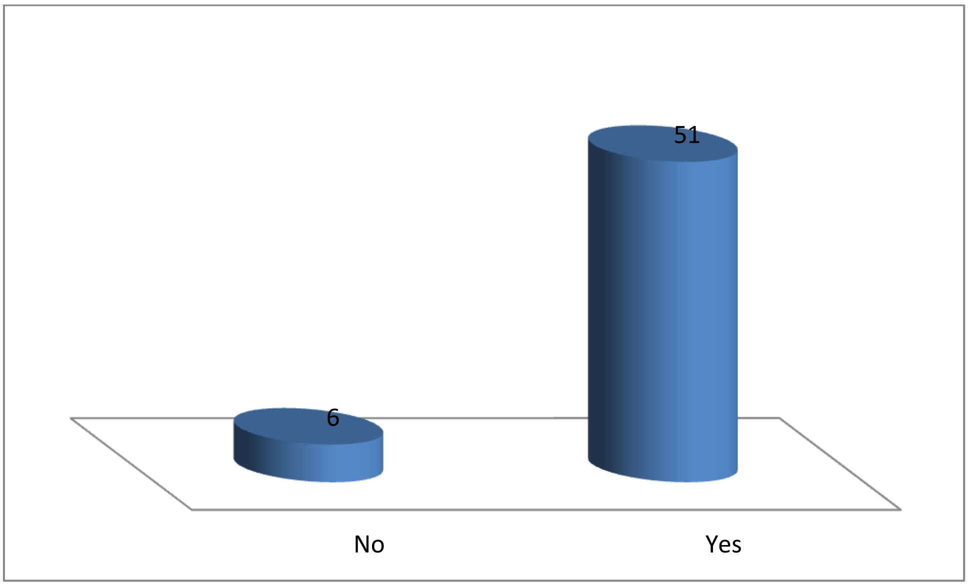
3- Do you set aside times for study material before setting a data exam(x3) :-

Table (3-3):- Frequency distribution of (x3)

phrase	Frequency	Percent
Yes	51	89.5%
No	6	10.5%
Total	57	100%

Source: prepared by the researcher by **SPSS**. program

Figure (3-3):- Frequency of distribution of (x3)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-3) and figure (3-3) above that 51 of the students determines time to study the subject before setting a date exam And the proportion 89.5% And that only 6 of the students does not specify a time for the study of subject And the proportion 10.5% Of respondents.

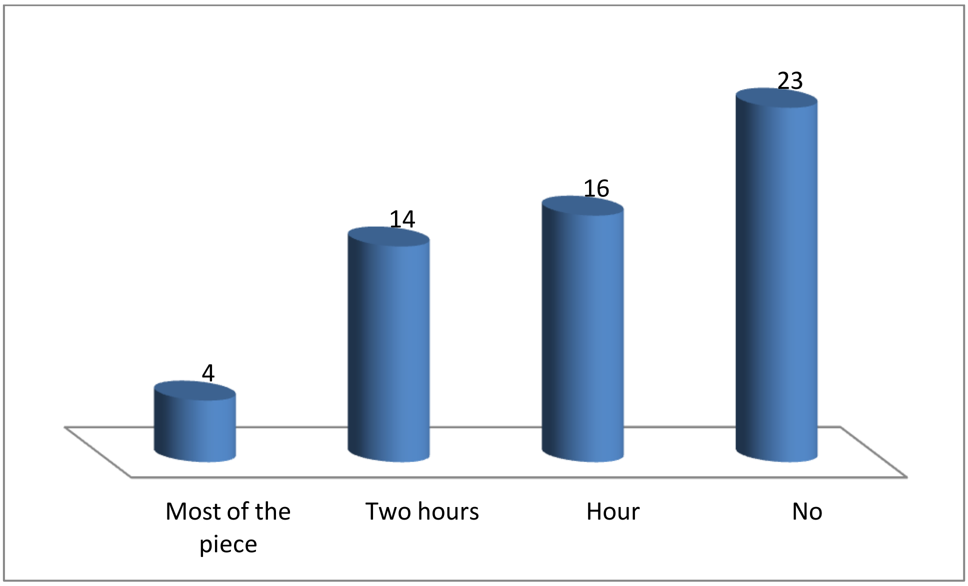
4- If you set aside time to study and select the number of hours of study devoted to the study material (daily average)(x4):

Table (3-4):- Frequency of distribution of (x4)

phrase	**Frequency**	**Percent**
No	23	40.4%
Hour	16	28.1%
Two hours	14	24.6%
Most of the piece	4	7.0%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-4):- Frequency of distribution of (x4):-



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-4) and figure (3-4) above that 23 students do not read material on a daily basis and by 40.4% and 16 student determines hour days to read the material by 28.1% and 14 student determines two hours to read the material and by 24.6% and 4 of the students read more than two hours, and by 7% Of respondents.

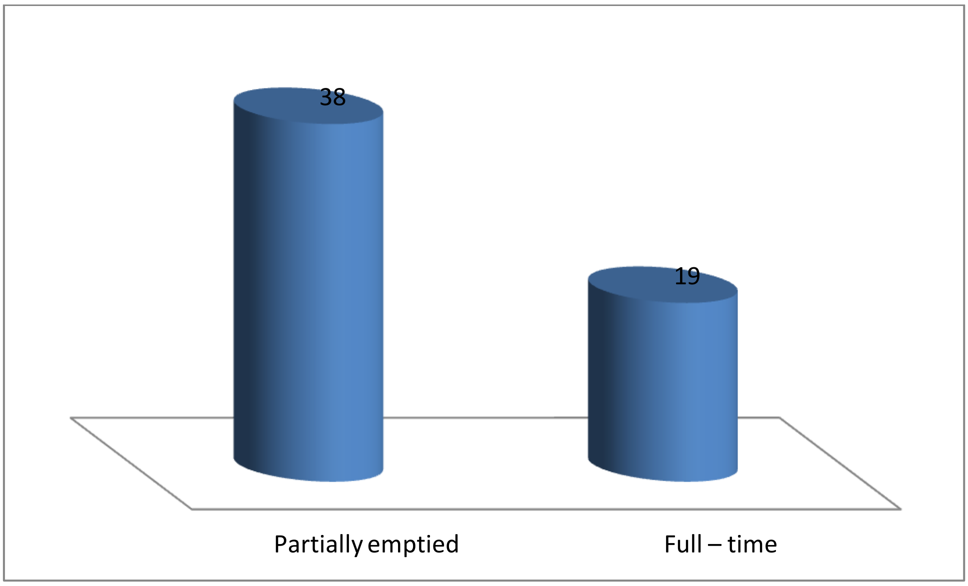
5- Full –time student for the academic duties(x5) :-

Table (3-5):- Frequency of distribution of (x5):-

phrase	Frequency	Percent
Full – time	19	33.3%
Partially emptied	38	66.7%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-5):- Frequency of distribution of (x5)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-5) and figure (3-5) above that only 19 full-time students complete tasks for the study and 33.3% of students and 38 dedicated emptied partially of the study, and by 66.7% Of respondents.

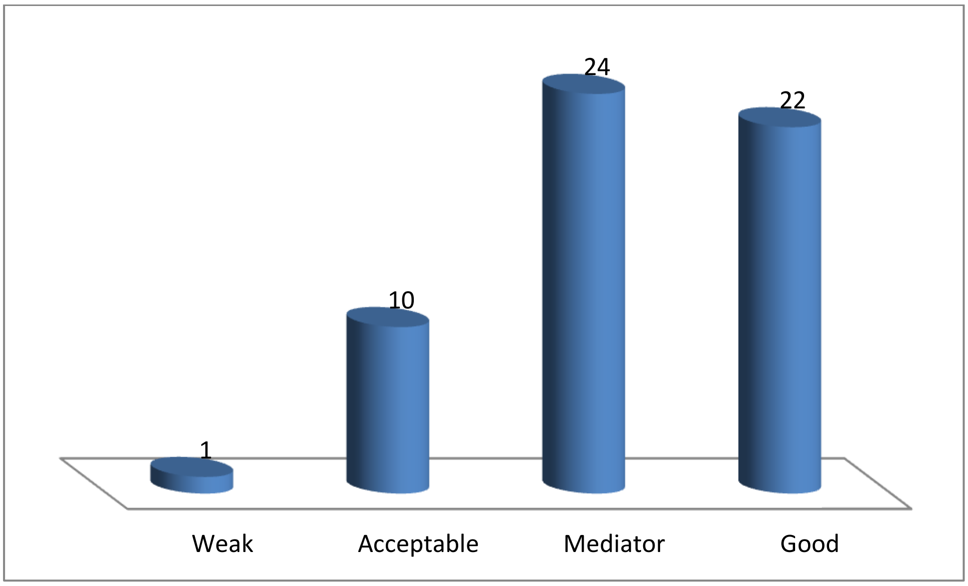
6- The book provides a systematic or any other source assistant to article(x6) :-

Table (3-6): Frequency of distribution of (x6):-

phrase	**Frequency**	**Percent**
Good	22	38.6
Mediator	24	42.1
Acceptable	10	17.5
Weak	1	1.8
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-6):- Frequency of distribution of (x6)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-6) and figure (3-6) above that Answered 22 students (good) by 38.6% and 24 students (average) by 42.1% and 10 students (acceptable) by 17.5% and one student (weak) 1.5% ,and that to the extent the availability of a book or other source material for assistant.

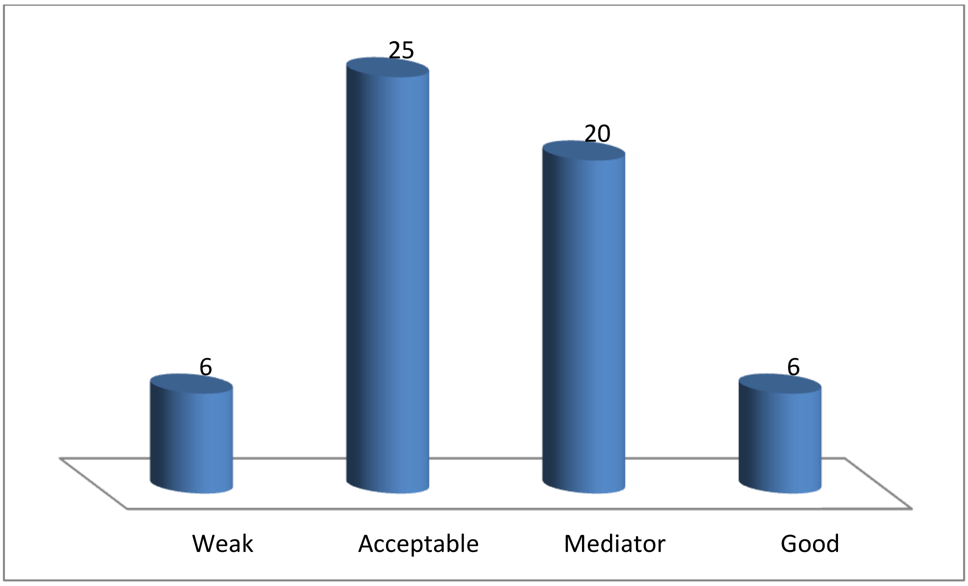
7- Student's ability to use modern methods of teaching(x7) :-

Table (3-7):- Frequency of distribution of (x7)

phrase	**Frequency**	**Percent**
Good	6	10.5%
Mediator	20	35.1%
Acceptable	25	43.9%
Weak	6	10.5%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-7):- Frequency of distribution of (x6):-



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-7) and figure (3-7) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , The extent to which the student on the use of modern methods of teaching

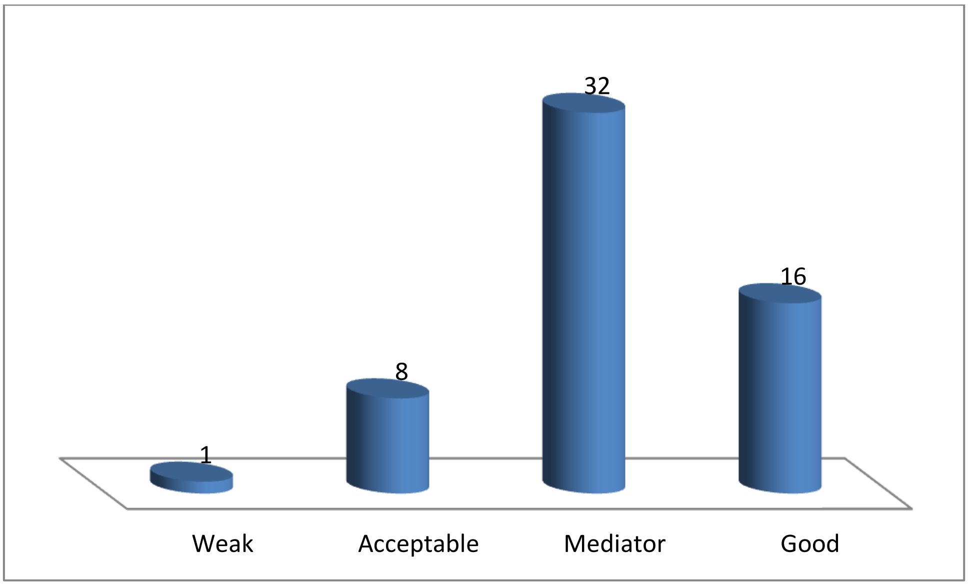
8- The level of family income(x8) :-

Table (3-8):- Frequency distribution of(x8)

phrase	Frequency	Percent
Good	16	28.1%
Mediator	32	56.1%
Acceptable	8	14.0%
Weak	1	1.8%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-8):- Frequency of distribution of (x8)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-8) and figure (3-8) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , To determine the level of family income.

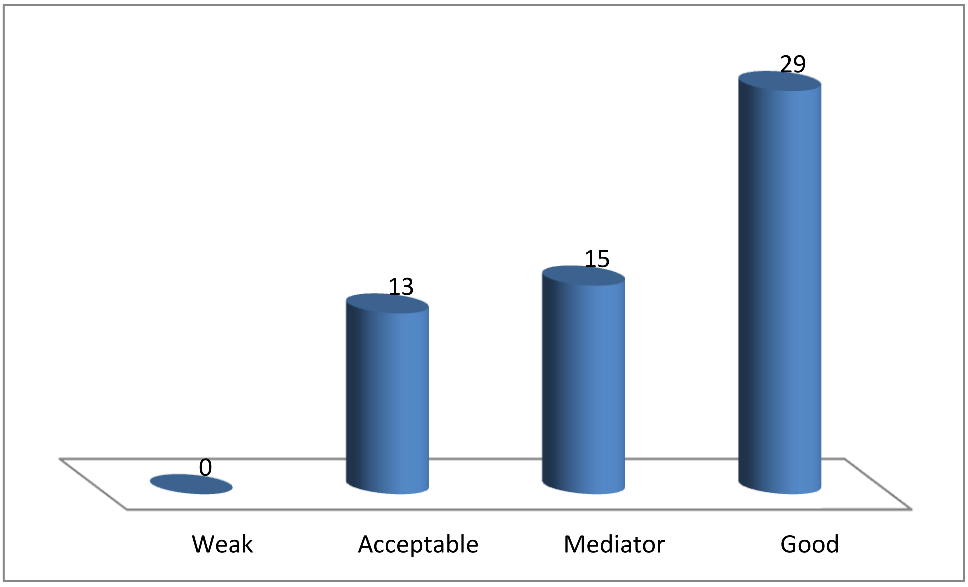
9- teacher ability in control of class (x9):-

Table (3-9):- Frequency distribution of (x9)

phrase	Frequency	Percent
Good	29	50.9
Mediator	15	26.3
Acceptable	13	22.8
Weak	0	0
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-9):- Frequency distribution of (x9)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-9) and figure (3-9) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , The extent to which the teacher in control of the air and the academic calm and order

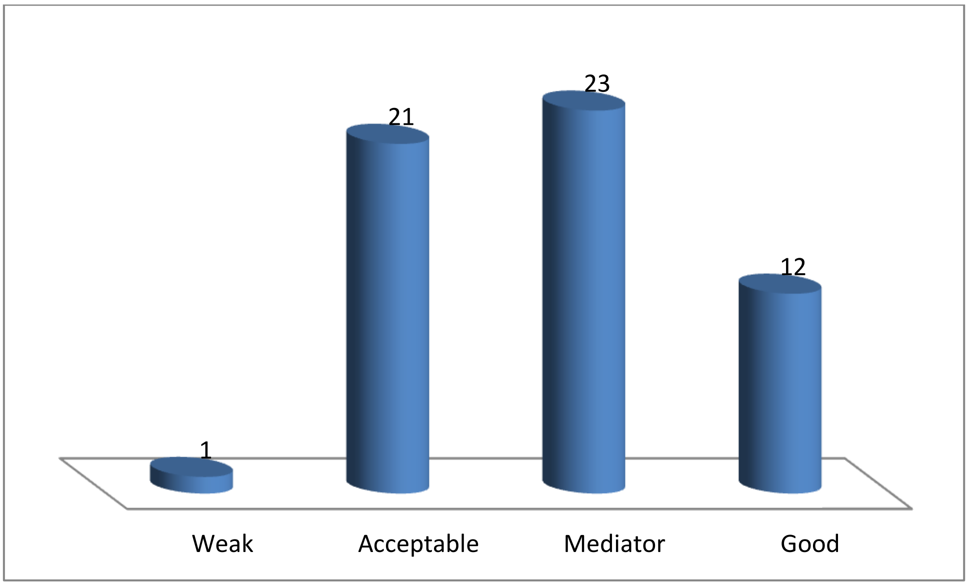
10 – Susceptibility teacher upon receipt of material in clear and smoothly (10):-

Table (3-10):- Frequency distribution of (x10)

phrase	Frequency	Percent
Good	12	21.1%
Mediator	23	40.4%
Acceptable	21	36.8%
Weak	1	1.8%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-10):- Frequency of distribution of (x10)



Source: prepared by the researcher by program .**Excel**

Seen from the table (3-10) and figure (3-10) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , The extent to which the teacher upon receipt of material clearly and smooth

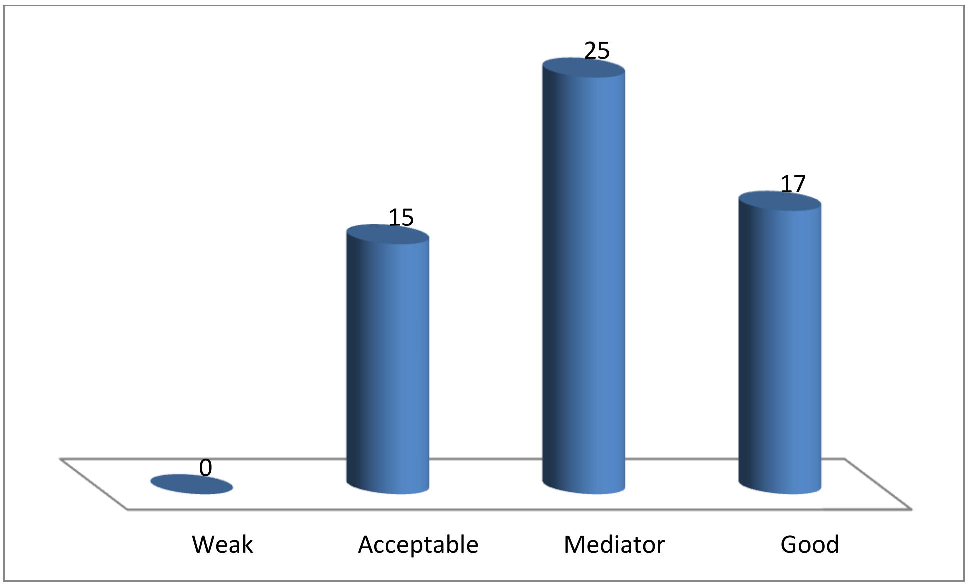
11- to accept the student material and convinced of their importance in the present time or future (11):-

Table (3-11):- Frequency of distribution of (x11)

phrase	Frequency	Percent
Good	17	29.8%
Mediator	25	43.9%
Acceptable	15	26.3%
Weak	0	0%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-11):- Frequency of distribution of (x11)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-11) and figure (3-11) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , On the acceptance of the student's material and convinced of their importance at the moment Or future

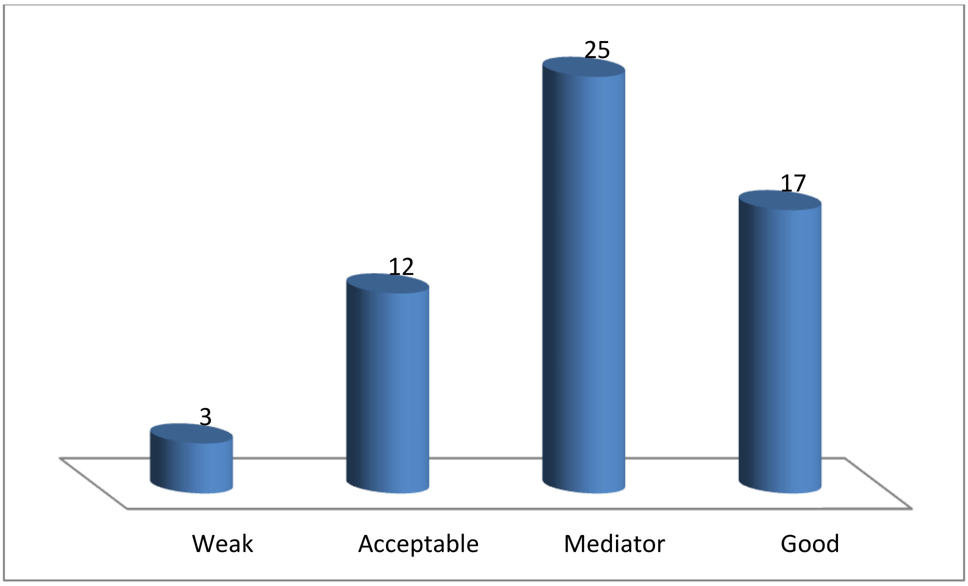
12- **psychological acceptance of Lecturer (Instructor) from the point of view of the student (y1) :-**

Table (3-12):- Frequency of distribution of (y1)

phrase	Frequency	Percent
Good	17	29.8
Mediator	25	43.9
Acceptable	12	21.1
Weak	3	5.3
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-12):- Frequency of distribution of (y1)



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-12) and figure (3-12) above that Answered 6 students (good) by 10.5% and 20 students (average) by 35.1% and 25 students (acceptable) by 43.9% and 6 student (weak) 10.5% , On the extent of the psychological acceptance of the minutes(Instructor) from the point of view student.

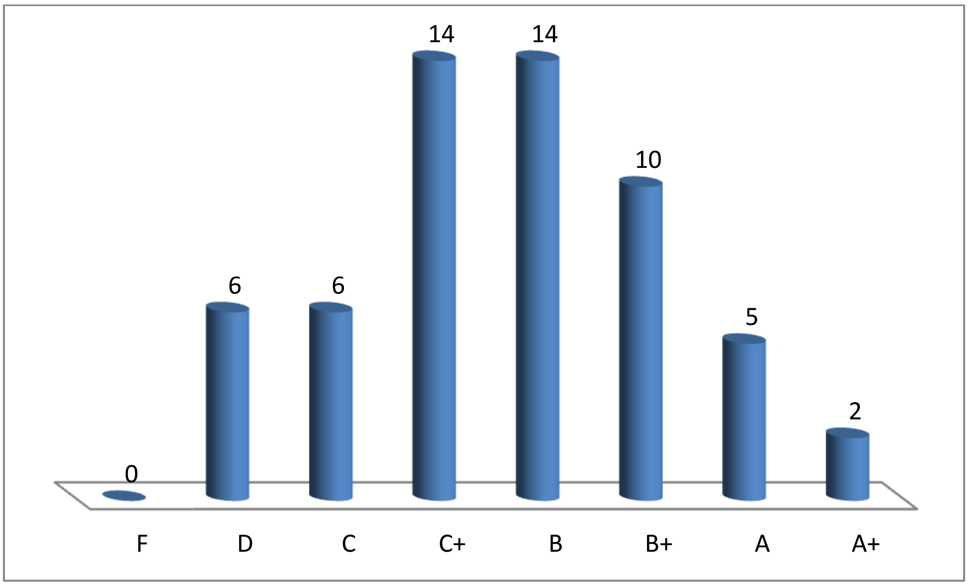
12-The final estimate of the student in the subject (y2):-

Table (3-13):- Frequency of distribution of(y2)

phrase	**Frequency**	**Percent**
A+	2	3.5%
A	5	8.8%
B+	10	17.5%
B	14	24.6%
C+	14	24.6%
C	6	10.5%
D	6	10.5%
F	0	0%
Total	57	100%

Source: prepared by the researcher by program **SPSS**

Figure (3-13):- Frequency of distribution of (y2):-



Source: prepared by the researcher by program **.Excel**

Seen from the table (3-13) and figure (3-13) above that 2 students only have obtained the assessment A + 3.5% and 5 students have obtained the assessment A and 8.8% and 10 students obtained the assessment B + 17.5% 14 students obtained the assessment B 24.6% 14 students obtained the assessment C + 24.6% 6 students obtained the assessment C by 10.5% 6 students obtained the D assessment of 10.5%, there is no student get an estimate F Of respondents.

14- Statistical scales:-

Table (3-14):- show Statistical scales

variable	n	mean	Std. Deviation	min	max	median	under - quartile	Upper - quartile
X1	57	1.79	.411	1	2	2	2	2
X2	57	2.63	.672	1	3	2	3	3
X3	57	1.105	.309	1	2	1	1	1
X4	57	1.98	.972	1	4	1	2	3
X5	57	1.66	.476	1	2	1	2	2
X6	57	1.825	.782	1	4	1	2	2
X7	57	2.54	.825	1	4	2	3	3
X8	57	1.89	.699	1	4	1	2	2
X9	57	1.71	.818	1	3	1	1	2
X10	57	2.19	.789	1	4	2	2	3
X11	57	1.93	.755	1	3	1	2	3
Y1	57	2.02	.855	1	4	1	2	3
Y2	57	4.315	1.549	1	7	3	4	5

Source: prepared by the researcher by program **SPSS**

Table(3-14) above shows the mean and standard deviation of the research variables and also The maximum value and the minimum value of these variables and also median and upper quartile and under quartile for these variables

3-4: Correlation matrix:-

Table (3-15):- Correlation matrix:-

var		x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	y1	y2
x1	r	1	-.09	.17	-.14	.09	.05	.18	-.20	-.18	-.20	**.39**	**-.29**	-.26
	sig	.	.49	.18	.28	.49	.71	.16	.13	.18	.13	.00	.02	.05
x2	r	-.09	1	.19	.18	**-.28**	.04	-.08	-.16	.19	.17	.04	.16	.14
	sig	.49	.	.15	.17	.03	.74	.53	.23	.13	.20	.74	.21	.27
x3	r	.17	.19	1	-.23	-.12	**.37**	.19	.13	.12	.06	.24	.19	.11
	sig	.19	.15	.	.08	.37	.00	.15	.32	.38	.65	.07	.15	.39
x4	r	-.14	.181	-.231	1	-.206	-.075	-.233	**-.32**	.15	.07	**-.29**	.02	.00
	sig	.29	.177	.084	.	.124	.582	.082	.016	.263	.583	.03	.87	.98
x5	r	.09	**-.28**	-.12	-.21	1	-.02	.06	.11	.03	-.06	.06	-.21	.12
	sig	.49	.04	.35	.12	.	.91	.65	.43	.82	.64	.62	.13	.37
x6	r	.05	.04	**.37**	-.07	-.02	1	**.34**	-.03	.17	.26	.08	.09	**.27**
	sig	.71	.71	.00	.52	.91	.	.00	.80	.19	.05	.55	.53	.04
x7	r	.18	-.08	.191	-.23	.06	**.34**	1	-.11	.15	.19	**.32**	-.04	-.05
	sig	.17	.54	.15	.08	.65	.01	.	.39	.26	.15	.01	.773	.69
x8	r	-.20	-.16	.14	**-.32**	.12	-.03	-.12	1	.01	-.09	-.01	-.06	.08
	sig	.13	.23	.32	.02	.43	.80	.39	.	.94	.49	.96	.68	.55
X9	ق	-.18	.20	.12	.15	.03	.17	.15	.01	1	**.47**	.09	**.31**	.04
x10	sig	.18	.14	.38	.26	.82	.2	.26	.94	.	.00	.46	.02	.71
	r	-.20	.17	.06	.07	-.06	.25	.19	-.09	**.47**	1	.07	**.57**	.19
	sig	.13	.21	.65	.58	.64	.05	.15	.49	.00	.	.59	.00	.14
x11	r	**.39**	.04	.25	**-.29**	.07	.08	**.32**	-.01	.09	.07	1	.03	-.11
	sig	.00	.74	.07	.03	.63	.56	.02	.96	.46	.6	.	.83	.41
y1	r	**-.29**	.16	.19	.02	-.21	.08	-.04	-.06	**.31**	**.57**	.03	1	**.36**
	sig	.03	.22	.15	.87	.13	.53	.77	.67	.02	.00	.83	.	.01
y2	r	-.26	.15	.12	.01	.12	**.27**	-.05	.08	.04	.19	-.11	**.36**	1
	sig	.05	.27	.39	.98	.36	.04	.7	.55	.75	.14	.41	.01	.

Source: prepared by the researcher by program **SPSS**

Table (3-15) above represents a matrix of correlations between variables of the study we note the existence of correlation significantly despite the weakness of the relationship between these variables but differ significantly from zero.

We note that the highest correlation between (x10, y1) is (0.57), the second correlation between the (x9, x10) is (0.47), and the third significant correlation between (x1, x11) a (0.39) and the fourth significant correlation between (x3, x6) a (0.37) and the fifth significant correlation between (y1.y2) a (0.36) and the sixth significant correlation between (x6, x7) a (0.34) and the seventh significant correlation between (x4., x8), a (0.32), and like him significant correlation between (x7, x11) a (0.32)
, Followed by the significant correlation between (x9, y1), a (0.31), followed by significant correlation between (x1, y1), a (-0.29) represented the link between the (x4, x11) a (-0.29) and after significant correlation between (x2, x3) a (-0.28) and another significant correlation (x6, y2) a (0.27), all of these correlation differ significantly from zero, Thus, for the rest of the variables, but not significant.

3-5: Raw coefficients canonical variates:-

Table (3-16):-

Raw coefficients canonical variates for the first variable set		
Variable	**first**	**Second**
X1	-0.7518	-1.0311
X2	-0.1857	0.5826
X3	1.1294	0.2703
X4	-0.1518	0.0835
X5	-0.5409	1.2250
X6	-0.2660	0.8408
X7	-0.2912	-0.1744
X8	-0.3083	0.2230
X9	0.1456	-0.4599

X10	0.9888	0.0986
X11	0.1347	-0.1785

Source: prepared by the researcher by program **.stata**

Table (3-17):-

Raw coefficients canonical variates for the second variable set		
Variable	**first**	**Second**
y1	1.2195	-0.2867
y2	-0.0945	0.6855

Source: prepared by the researcher by program **.stata**

Tables (3-16), (3-17) above shows coefficients for each of the variables canonical for explanatory variables and the response in Stages The first and second**.**

When compensation values views study in coefficients above we get a pair of values number (57) represents canonical variables first and the second canonical variables for the explanatory variables and the variables response(see Appendix3)**.**

We note that the variable (x3) is the most contribution (1.129) in the first canonical variable, followed by variable (x10) the contribution by (0.988), followed by the variable (x1) by (-0.751), but in the opposite direction, followed by variable (x5) by (-0.541) and also in the opposite direction, and so on up to the rest of the variables
While variable (x5) is the most variable contribution(1.22) in the second canonical followed by variable (x1) by (-1.031), but in the opposite direction, followed by variable (x6) by (0.841), followed by the variable (x2) by (0.5826), and so on up to the rest of the variables
And also note that the variable (y1) is the most variable contribution

(1.2195)to the canon first the variable (y2) is the most variable contribution(0.6855) in the second canonical.

3- **6: canonical correlation**

Table (3-18):-

canonical correlation		
correlation	First	Second
R	0.78852	0.5712
R^2	0.623	0.326

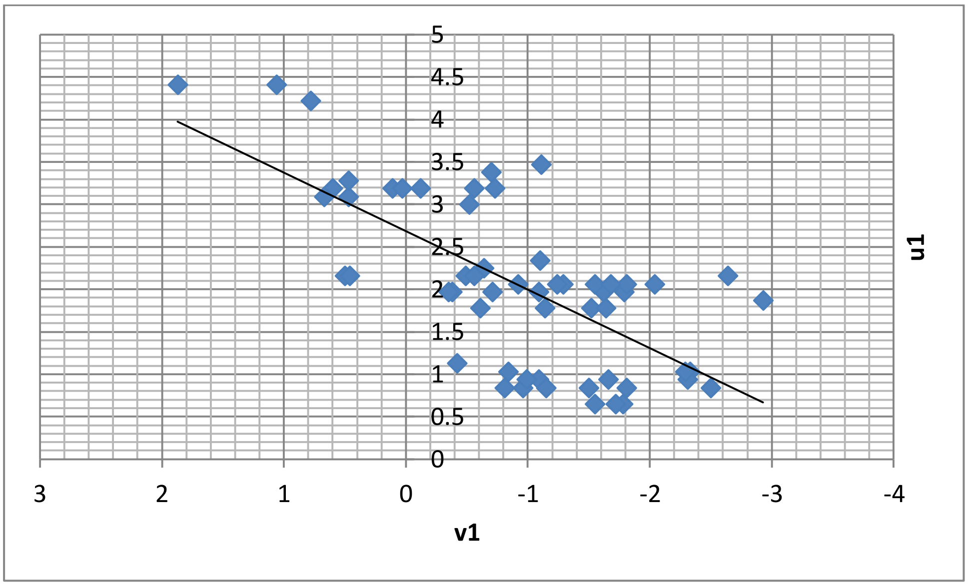
Source: prepared by the researcher by program **.stata**

Table (3-18) above it is clear that the value of the canonical correlation first amounted (.78852) the value of the second the canonical correlation Amounted to (.5712). It is noted here for the correlation the second value is less than the value of the first correlation, which in turn represent the highest linear correlation between the two sets of explanatory variables and the response.

Showed the value of square coefficient of determination (62.3%) of the variation in the explanatory variables may be expressed by the linear first composition (the first canonical variables) of the response variables, and that the contribution of these components of linear in the canonical variables was (32.6%).

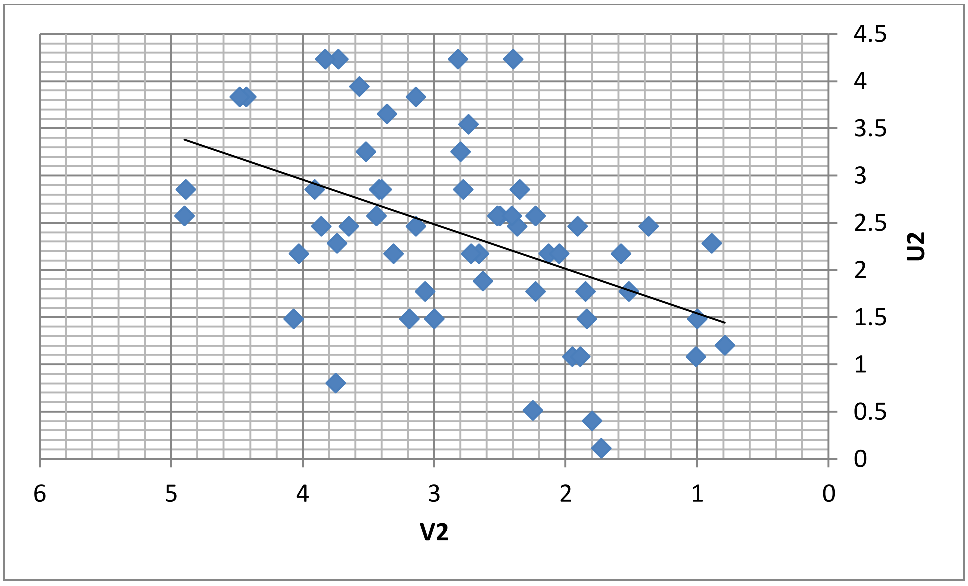
shown in lower of the figure (3-14) that the values of the variables canon first close more than shown by figure (3-15) the values of variables canon second This corresponds with the results of Canonical correlation analysis first and second.

Figure (3-14):- Show correlation between first canonical variate



source: prepared by the researcher by program **.Excel**

Figure (3-15):- Show correlation between second canonical variate



Source: prepared by the researcher by program **.Excel**

3-7: Tests of significance of all canonical correlations:-

Table (3-19):-

Tests of significance of all canonical correlations					
Tests	**Statistic**	**df1**	**df2**	**F-Approximate**	**P-value>F**
Wilks' lambda	.409221	22	88	2.2529	0.0041
Pillai's trace	.696017	22	90	2.1836	0.0054
Lawley-Hotelling's trace	1.1865	22	86	2.3191	0.0031
Roy's largest root	.90112	11	45	3.6864	0.0009

Source: prepared by the researcher by **.stata** program

Table(3-19) above test Results significantly (all p-value <0.05)the canonical correlation the first and second and the probabilistic values for each test and We note upon significantly the canonical correlation the first and second , In other words, the canonical correlation the first and second differ significantly from zero.

3-8: Test of Significance of Succeeding Canonical Correlations after the First:-

Table (3-20):-

Test of significance of canonical correlations 1-2					
Tests	**Statistic**	**df1**	**df2**	**F-Approximate**	**P-value>F**
Wilks' lambda	.409	22	88	2.2529	.00041

Source: prepared by the researcher by **.stata** program

Table (3-21):-

Test of significance of canonical correlation 2 :-					
Tests	**Statistic**	**df1**	**df2**	**F-Approximate**	**P-value>F**
Wilks' lambda	.777978	10	45	1.2842	0.2680

Source: prepared by the researcher by **.stata** program

Table (3-20) above We note significantly (p-value =0.00041<0.05) the canonical correlation the first and second combined.

The second the canonical link alone non significant (p-value =0.2680>0.05) as in the table (3-21) according to the test (Wilks' lambda). So for, the first canonical correlation is only most significant of the second canonical correlation

3-9: Linear combinations for canonical correlations:-

Coefficients of variables that measure the contribution of the variables in the canonical correlation (Ignore the signal), To interpret the linear combinations of the canonical correlation you must know the significance of variables under study, component of those linear combinations of the canonical variables using test (t).

Table (3-22):- Linear combinations canonical correlation for:-

Canonical variable	Variable	coefficients	Std Error	t- statistic	P>|t]
u1	X1	-0.7518	0.456	-1.65	0.005
	X2	-0.1857	0.262	-0.71	0.012
	X3	1.1294	0.608	1.86	0.039
	X4	-0.1518	0.195	-0.52	0.043
	X5	-0.5409	0.357	1.11 -	0.014
	X6	-0.2660	0.234	-1.14	0.261
	X7	-0.2912	0.223	-1.30	0.019
	X8	-0.3083	0.259	-1.19	0.239
	X9	0.1456	0.231	0.63	0.531
	X10	0.9888	0.239	4.14	0.000
	X11	0.1347	0.24	0.54	0.588
v1	Y1	1.2195	0.1795	6.79	0.000
	Y2	-0.0945	0.099	-0.95	0.034
u2	X1	-1.0311	.811	-1.27	0.021
	X2	0.5826	.466	1.25	0.022
	X3	0.2703	1.081	0.25	0.803
	X4	0.0835	.346	0.24	0.810
	X5	1.2250	.634	1.93	0.042
	X6	0.8408	.415	2.02	0.048
	X7	-0.1744	.398	-1.30	0.622
	X8	0.2230	.460	-1.19	0.024
	X9	-0.4599	.410	-1.12	0.267
	X10	0.0986	.425	0.23	0.817
	X11	-0.1785	.439	-0.41	0.686
v2	Y1	-0.2867	.319	-0.90	0.373
	Y2	0.6855	.179	3.89	0.00

Source: prepared by the researcher by program **.stata**

From table (3-23) above note Contributes to the first variable by 0.75 in the first canonical variable and contributes to the second variable by 0.18 second canonical variable, and so for the rest of the variables.

And notes in the first canonical variables that all the variables in the study, except for (x3,x8,x9,x11) statistically significant along with the canonical link first, and also in the second canonical variables all variables except (x1,x2,x5,x6,x8,y2) is statistically significant with the second canonical correlation

3-10: Standardized coefficients canonical variates:-

Table (3-23):-

Standardized coefficients canonical variates for the first variable set		
Variable	**first**	**Second**
X1	-0.3092	-0.4241
X2	-0.1247	0.3913
X3	0.3497	0.0837
X4	-0.1477	0.0813
X5	-0.2573	0.5826
X6	-0.2080	0.6575
X7	-0.2403	-0.1439
X8	-0.2155	0.1559
X9	0.1191	-0.3764
X10	0.7803	0.0778
X11	0.1017	-0.1348

Source: prepared by the researcher by program **.stata**

Table (3-24):-

Standardized coefficients canonical variates for the second variable set		
Variable	**First**	**Second**
y1	1.0433	0. 2453-
y2	-0.1463	1.0617

Source: prepared by the researcher by program **.stata**

Coefficients in the table (3-16),(3-17) Coefficients are real variables that explain the variables under study to the canonical variables

The Coefficients in the tables (3-24) (3-25) Coefficients measure the standard variables which also measure the contribution of the variables under study in the canonical variables

For example, contributes to the standard variable corresponding to the first variable (x1) by (0.3904) in the variable legal canon (u1)

3-11: Correlation between variable and canonical variates:-

Table (3-25):-

Correlation between variable list 1 and canonical variates from list 2:-		
Variable	**v1**	**v2**
x1	-0.2687	-0.2021
x 2	0.1524	0.1164
x3	0.1867	0.0749
x4	0.3222	-0.0014
x5	-0.2314	0.1789

x6	0.4492	0.2635
x7	-0.0330	-0.0466
x8	-0.4708	0.0996
x9	0.3205	-0.0312
x10	0.5728	0.068
x11	0.0463	-0.1265

Source: prepared by the researcher by program **.stata**

Table (3-26):-

Correlation between variable list 2 and canonical variates from list 1		
Variable	**u1**	**u2**
y1	0.6820	0.0643
y2	0.1576	0.5587

Source: prepared by the researcher by program **.stata**

In the Tables (3-26) ,(3-27) above we note the correlation between the variables under study and the canonical variables

That the greatest correlation between (y1) and (u1) and equals (0.682), followed by between (x10) and (v1) and equals (0.573), followed by between (y2) and (u2) and equals (0.559), and so for the rest of the correlation.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4-1**:** Preface

4-2: Conclusions

4-3: Recommendations

4-1: Preface:

This chapter contains the results that have been reached through the practical side of the research.

In addition to the proposed recommendations relating to using canonical correlation analysis

4-2: Conclusions:-

1- Through the analysis of the results of the canonical correlation for the first stage and the second and configuration of linear explanatory variables and the response. We find that value of the first canonical correlation (0.7898) and the value of the second canonical correlation (0.571). And the drawing showed the values of the canonical variables for the first stage in the convergence points more than the values shown by drawing the canonical variables for the second phase these findings are consistent methodology analysis of the canonical correlation

2- Show through tests of statistical correlation for the canonical significantly of those correlations the canonical Stages

The first and second , also to know which of two correlation is more importance , also find first canonical correlation is better than the second canonical correlation

3- The results of the correlation between the original variables and the canonical variables for the explanatory variables and the presence of significant correlation good with (x1,x3,x5, x6 ,x8,x9,x10) , And also having a significant correlation good high by for response variables (y1,y2).

4-we find that there is a strong correlation between the explanatory variables (x1,x2,x3,x4,x5,x6,x7,x8,x9,x10,x11) and response variables (y1,y2)

4 -3: Recommendations:-

1- Procedure similar studies on a larger scale to understand the relationship between the behaviors of students.

2- Whereas some of the variables in different areas of life with a non-linear behavior and possibly second-degree or more, when studied with other variables, there is no problem that we draw attention to an analysis of the canonical correlation so variables to understand the behavior of those variables and their relationship with each other.

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