Cross analysis of professor – student evaluations and the level of sincerity: a statistical approach

Análisis cruzado de las evaluaciones profesor - alumno y el nivel de sinceridad: un enfoque estadístico.

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Abstract

In this article, the topic of Teacher Hetero evaluation is addressed. The objective is to analyze whether the relationship of Teacher Hetero evaluation is congruent with values and sincerity of students. This academic research is Descriptive and has been done through a Quantitative Approach. The following instruments are used: Hetero-evaluation, Student's grades, Number of Students, Number of Fails, Fail Rate, Time Period and Subjects, as well as a Values Test. A statistical approach was performed, which includes hypothesis testing, correlations, significant differences and dependency tests. Some of the results show that teacher Heteroevaluations increase as Students grades increase as well. Moreover, there is statistical evidence that explains how number of students failing a course affects negatively Teacher Evaluation Score. Results from Study of Values Test indicate that students register low scores of Religious Value and with a high degree of Economic Value. This evidence may be harmful for the development of transcendental values such as sincerity and honesty. Therefore, Hetero evaluation could be distorted due to fragility of students' personality.

Keywords
Hetero-evaluation, quality education, sincerity, cross analysis, statistical analysis, personality, values.

Resumen

En este artículo, se aborda el tema de la evaluación del profesor Hetero. El objetivo es analizar si la relación entre el profesor Hetero y la evaluación es congruente con los valores y la sinceridad de los estudiantes. Esta investigación académica es descriptiva y se ha realizado a través de un enfoque cuantitativo. Se utilizan los siguientes instrumentos: Heteroevaluación, calificaciones de los alumnos, número de alumnos, número de fallos, tasa de fallos, período de tiempo y asignaturas, así como una prueba de valores. Se realizó un enfoque estadístico, que incluye pruebas de hipótesis, correlaciones, diferencias significativas y pruebas de dependencia. Algunos de los resultados muestran que las evaluaciones de los maestros a través de las evaluaciones hetero aumentan a medida que aumentan las calificaciones de los estudiantes. Además, hay evidencia estadística que explica cómo la cantidad de estudiantes que reprueban un curso afecta negativamente la puntuación de evaluación del profesor. Los resultados de la prueba de estudio de valores indican que los estudiantes registran puntuaciones bajas de valor religioso y con un alto grado de valor económico. Esta evidencia puede ser perjudicial para el desarrollo de valores trascendentales como la sinceridad y la honestidad. Por lo tanto, la evaluación hetero podría distorsionarse debido a la fragilidad de la personalidad de los estudiantes.

Palabras clave
Heteroevaluación, educación de calidad, sinceridad, análisis cruzado, análisis estadístico, personalidad, valores.

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Introduction

Quality education is vital for societies. When individuals are exposed to quality education, they are able to improve and master their attributes and abilities so they can achieve their potential as human beings and professional citizens, capable to make a difference. The Ecuadorian Higher Education System affirms that the quality of higher education is constituted in a principle that consists in the constant and systematic search for excellence, relevance, optimal production, transmission of knowledge and development of thought through self-criticism, external criticism and permanent improvement. (Presidencia de la República, 2010).

In accordance with the source, it is believed that quality includes a deep and careful analysis of the different structures that constitute the Higher Education System, such as universities, faculties, careers, teachers, students, methodologies, evaluations, controls. (Cevallos, 2016). It is worthy to mention the words for education importance by Nobel Peace Prize winner, Malala Yousafzai (2013): "One child, one teacher, one pen and one book can change the world". Therefore it is important to point out that teachers are one of the fundamental pillar in Higher Education System, and that's why Government organizations such as CEAACES evaluates the qualities of the teaching staff, as well as the working conditions, and their respective contracts in which they specify their activities, which must contribute to the development of substantive activities of teaching, research and connection with society.

One of the tools applied to track teacher performance within the universities and polytechnic institutes is Integral Evaluation that is stipulated in Article 64 of the *"Reglamento de Carrera y Escalafón del Profesor e Investigador"*. At UEES and other institutions of the Higher Education, the Teacher Hetero-evaluation is applied to all academic staff which is one of the three components of the Integral Evaluation.

But Teacher Hetero-evaluation has had a controversial approach from the teacher's point of view. This evaluation has led to positive and negative consequences. Professor Andrade B., Statistics Teacher at UEES, affirms that when results and comments are good the dean takes advantage of these comments to motivate the teacher; when comments are bad, the dean has a meeting with the teacher to investigate what occurred, and gives guidelines to improve his/her performance; and when comments denote resentment, they are not taken into consideration.

At the same time it, is believed that these results can also be altered by other factors such as distorted values from students, degree of affectivity and breadth of knowledge. This is why the following question arises: Are college students sufficiently sincere to provide useful and reliable comments for the improvement of teacher's performance? Millman (1981) cited in Fernández, Mateo, & Muñiz (1996) believes that this is not the only relevant system of evaluation**;** however it is the one that currently enjoys a greater number of guarantees concerning the reliability and validity of the information collected. (Marsh, 1987)

It is significant to provide a tool to the directors of the institution, in order to carry out the respective adjustments (if necessary) in the context of the questions raised in the Hetero-evaluation. Directors of higher institutions will be free to make decisions that improve the performance of teachers, and consequently obtaining better teaching techniques. Additionally, this research article serves to be replicated in different teachers of different faculties at UEES.

The general objective of this academic research is to analyze whether the relationship of Teacher Hetero-evaluation is congruent with values and sincerity of students. Thus, the following specific objectives have been established:

- To explore and find significant difference in the student's grades in different periods and subjects.
- To explore and find a significant difference in a Teacher Hetero-evaluations provided by students in different periods and subjects.
- To analyze the relationship between teacher-student and student-teacher evaluation.
- To analyze values test results per men and women students.

Literature Review

Quality Education

The Organic Law of Higher Education contemplates the Ecuadorian Higher Education as a strategic area where its main aims are oriented to the search for truth, the affirmation of identity, the cultural development and the mastery of scientific and technological knowledge, essential aspects derived from teaching, research and the connection with the community. These are priorities for the economic, social and cultural development of the country. Furthermore, Ecuadorian higher education must be relevant, and meet the terms of quality in order to help identifying and solving the problems of society, which means it has to act with responsibility and assurance in the creation, development and transmission of knowledge in all fields. (Consejo Nacional de Evaluación y Acreditación de la Educación Superior del Ecuador, 2003)

Quality plays an important role, which implies that all the actors linked to higher education must act responsibly in the generation and consolidation of a self-regulating attitude, seeking that this does not become an individual project, but a permanent, participatory process for everyone, which can also be turned into a common practice. (Consejo Nacional de Evaluación y Acreditación de la Educación Superior del Ecuador, 2003)

But how is it possible to get a quality system? What does it really require? Nagoba and Mantri (2015) believe that: "the success of any education system depends on the quality of teachers, which, in turn, depends on the effective teaching / learning process." Quality teachers are characterized by numerous skills. It is evident they have to manage a broad understanding of a specific subject and be able to transmit the content to the level of student knowledge. They also must assure effective learning while maintaining control of the class, one of the most arduous tasks for a teacher.

Pushkar (2015) argues that even teacher's personality influences the quality of learning. A teacher must be friendly, sympathetic, self-assured, warm, approachable, cheerful, dedicated and motivated.

As it is mentioned before, qualities of an excellent teacher are countless, but it is clear that teachers play a crucial role in quality education. They are responsible for forming professional citizens, capable of shaping their futures, and the future and destiny of a nation.

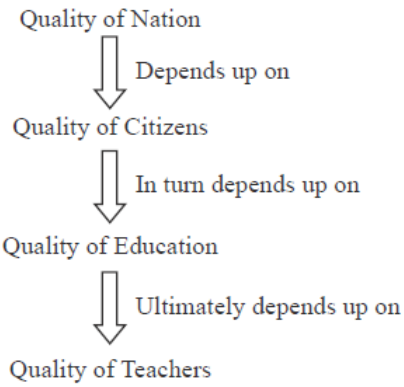

Figure 1. Teacher Quality and Impact
Source: Role of Teachers in Quality Enhancement in Higher Education

For this reason, the bodies in charge of the follow-up of higher education in Ecuador have established regulations to control teacher's performance. However, Torres (2011) points

out, in one of her articles called *"The model of teacher preparation that has not worked"*, that Higher Education Programs in Ecuador doesn't pay attention to real conditions off teaching, and instead it should focus on motivations, interests, concerns, knowledge, time and resources available for teaching. This can assure quality teachers. It's necessary to apply methodologies so that they start learning from themselves, to build on themselves (Fierro, 2017).

Educational Laws and Regulations

The Article 155 of The Organic Law of Higher Education (LOES, by its initials in Spanish), in regards to the evaluation of academic performance, mentions that:

> "Higher Education Professors will be evaluated periodically in their academic performance. "The Reglamento de Carrera y Escalafón del Profesor e Investigador" of the Higher Education System will establish the evaluation criteria and the forms of student participation in the evaluation mentioned previously" (Presidencia de la República, 2010)

In effect, higher-level institutions are required to apply an Integral Evaluation to all academic staff. This is stipulated in Article 64 of the "Reglamento de Carrera y Escalafón del Profesor e Investigador". It mentions as follows:

> "The integral evaluation of performance will be applied to all the academic staff of higher education institutions, public and private, with the exception of the honorary academic staff. The integral evaluation of performance covers the teaching activities, research and administration or academic management" (Consejo de Educación Superior, 2014)

In addition, Article 355 of the Ecuadorian Constitution is taken into consideration, which states that:

> "…Universities and polytechnic schools are recognized with the right to autonomy, exercised and understood in a solidary and responsible manner. This autonomy guarantees the exercise of academic freedom and the right to search for truth, without restrictions; government and self-management, in line with the principles of alternation, transparency and political rights; and the production of science, technology, culture and art." (Asamblea Constituyente, 2008)

Hetero-evaluation

With this in mind, one of the tools for evaluating teacher's performance is Teacher Hetero-evaluation, which is one of the three elements that are part of the Integral Evaluation for academic staff. Soleto and Vanga (2015) defined Hetero-evaluation as an external evaluation, which is materialized when each person, in correspondence with their results pattern, evaluates another. Similarly, according to Article 67 of the "Reglamento de Carrera y Escalafón del Profesor e Investigador", Hetero-evaluation is described as: "the evaluation made by students on the learning process taught by the academic staff" (Consejo de Educación Superior, 2014). But why is this type of evaluation so important to perform it?

Fernández, Mateo, & Muñiz (1996) state that Teacher Hetero-evaluation is useful to obtain both strengths and weaknesses in teachers' practices, thus they can understand what they need to polish to offer an improved teaching practice. Additionally, Gündüz and Fokoué argue that main goal of Hetero-evaluations is the extraction of knowledge; patterns and information, with the finality of providing useful feedback to help teachers apply better teaching techniques and give students a richer and more effective learning experience (Gündüz & Fokoué, 2015)

In this research article, Teacher Hetero-evaluation is considered as an evaluation or "survey" that measures the degree of satisfaction of

the students on the teacher's performance, work and performance. Since college students are the main actors of this evaluation, it is important that they do it with objectivity. According to Mr. Andrade's experience, this evaluation is altered by different factors, such as the lack of sincerity, resentment or affinity of the students with the teacher. Noriega, Bueno, Medina and Calderon (2018) explain that students usually evaluate teachers positively, placing him/her often in a group of overvalued or highly evaluated, so they strongly believe students have to evaluate fairly towards teachers.

With the purpose of fulfilling the aforementioned regulations, UEES has developed the following evaluation model which is proposed by Chickering & Gamson (1999), and covers good practices in higher education. This model evaluates behaviors and actions that allow associating them with teachers' excellent performance.

This hetero-evaluation includes 7 areas related to higher education, and also takes into account UEEScribe, a methodology that promotes a writing culture and learning excellence. The academic components and evaluation areas are specified as follows:

1) **About contact with students:** Teachers are seen as a motivational force. When teachers interact with students, they feel encouraged to keep working hard and think carefully about their decisions and achievements. Number of questions: 2, Assessment of the area: 8%

2) **Cooperation in the learning process (between students)**: Team work helps to improve communication skills and problem solving. It motivates students to participate and get involved in multiple tasks. Number of questions: 2, Assessment of the area: 8%.

3) **Active learning:** It's about how students are encouraged to use different methods of "learning by doing". Students take on their responsibility to make it part of their daily life thorough experiences. Number of questions: 2, Assessment of the area: 16%

Providing adequate feedback: Students learns to evaluate their and others' performance and improve it, to self-monitor and move towards professional autonomy. (Multiprofessional Faculty Development). Number of questions: 3, Assessment of the area: 20%.

Time dedicated to learning (task): It refers to non-contact activities, so students take advantage of time to improve their learning outside classrooms. Number of questions: 2, Assessment of the area: 20%.

Communication of high expectations: If the expectations of the teaching-learning process are high and achievable, students will be able to improve their learning. When teachers expect more from students, it implies a better academic performance which requires a clear communication of what is expected during the course. Number of questions: 2, Assessment of the area: 10%

Respect for different talents and ways of learning: Every individual has his/her own way of learning. That's why it is important take advantage of different experiences and knowledge of every person. Students and teachers can take advantage of those differences, so that they can improve the learning process in a better way. Number of questions: 2, Valuation of the area 10%.

UEES Methodology (UEEScribe): UEEScribe is a strategy aimed to promote a culture of writing and academic excellence. Number of questions: 3, Value of the area 16%.

Valuation of the areas: The total number of questions is 18 and each one has four possible answers listed below:

Table 1. Hetero-evaluation weighing

Answers	Weighing
Always	1.00
Most of the Time	0.75
Least Part of the Time	0.25
Never	0.10

Teacher Hetero-evaluation is calculated as follows: the total per area obtained by the teacher is multiplied by the weight assigned to each area. This is an example of how a final score would look like if the teacher obtained the maximum scores in all the areas (UEES , 2014):

Table 2. Hetero-evaluation weighing by area

Area	Maximum Score	Weighing
1	2	0.08
2	2	0.08
3	2	0.16
4	3	0.20
5	2	0.12
6	2	0.10
7	2	0.10
8	3	0.16
	18	1

On a scale of 100, the teacher's grade would be calculated as follows:

$$X: Teacher' assessment\ over\ 100$$

$$C_2: Maximum\ rating\ that\ the\ teacher\ could\ have\ that\ is\ 1$$

$$C_1: Qualification\ obtained\ from\ the\ teacher\ in\ the\ hererovaluation\ on\ 1$$

$$X: \frac{C_1}{C_2} x\ 100$$

Allport-Vernon-Lindzey Study of Values

This model proposed by Gordon W. Allport, Philip E. Vernon and Gardner Lindzey, is a psychological tool used to measure six types of values: theoretical, economic, aesthetic, social, political, and religious. This method is constituted in the philosophy of educator Eduard Spranger (1882–1963) who proposed six types of personalities oriented to beliefs, ways of thinking and life patterns. (Saavedra). Each of these type of ideal personality is oriented towards a basic value: 1) Theoretical: truth; 2) Economic: usefulness; 3) Aesthetic: harmony and beauty; 4) Social: love for people; 5) Political: power and leadership; 6) Religious: unity or moral excellence. (Young, 1942)

Allport (1961) argues that personal philosophy of life related to values is a core feature of personality implying direction of motivation, future goals, and current choices. It is important to add that Allport selected numerous words that would define a person, and then he classified them into three levels: cardinal, central and secondary traits. He mentions that central traits are the building blocks of our personality. These are the basic elements that make up most of our behavior. (Allport, 1930) Clear examples are **honesty** and **kindness**.

Methodology

This academic article has been developed through a descriptive research since it collects quantifiable information which is used to perform a statistical analysis and to describe the characteristics of the population being studied. Based on the objectives of this research, a correlational research is carried out to measure how strong is the relationship between a dependent variable (Teacher Hetero-evaluation) with more than two independent variables. In this case, the independent variables to be analyzed are: Subjects, Grade Average, Period Time, Year, Number of fails and Fail Rate. Additionally, it is important to mention that the current article follows a quantitative approach since this article contains statistical, mathematical and numerical analysis of pre-existing data provided by Mr. Andrade and the Dean of the School of International Studies. This approach measures all impacts with quantities.

The database, which is seen in Appendix A, is made up of the records of Mr. Andrade's students' grades from Winter 2015 to Spring 2017 periods, these are classified by subjects. It also contains total scores of Teacher Hetero-evaluation classified by subjects during the same period mentioned above. Students' grades were given by Professor Andrade, who has been in charge of collecting this information for the time mentioned previously. On the other hand, the hetero-evaluations scores are given by Dean Office of the School of International Studies. This data reflects the total average of the evaluation prescribed by the students towards Professor Andrade in each subject taught and during the specified period. The final scores of each evaluation is in terms of quantitative information.

Then a Study of Values Test, found in Appendix B, was performed to measure the different traits of six basic values that define the personality of students. This model was proposed by Gordon W. Allport, Philip E. Vernon and Gardner Lindzey. A convenience sampling was applied to carry out this test. That is, due to the convenient accessibility and proximity to the subjects; 36 students from two Mr Andrade's courses (Statistics II and Application in Quantitative Methods) took the test.

Population and Sample

For Cross Analysis Tests, this article used a population equal to all the subjects of Mr. Andrade and Sample = 41 records corresponding to the subjects taught from Winter 2015 to Spring I 2017. For Study of Values Test, the population used is equal to all the students in Mr. Andrade's classes, and a sample = 36 students corresponding to two different Mr. Andrade's subjects. The results of each individual are shown in Appendix C. The variables to be tested are described in table 3.

Table 3. *Description of Variables*

Variable	***Description***	***Units***	***Scale***
Hetero-evaluation	It consists of a person evaluating what another has done. In other words it's the assessment made by one person over another, in which questions are shown to measure their work, attitude, performance, among other characteristics. (Casanova, 1998) In this research article it is an evaluation performed by students towards teachers.	0 – 40	Scale
Subject	At UEES it is referred to the courses offered in the curriculum of every university career. Also it is defined as a department of knowledge or learning.(Merriam Webster Dictionary). In this academic research the subjects taken into consideration are: Calculus I, Calculus II, Project I, Projects II, Application in Quantitative Methods, Statistics I, Statistics II and Linear Algebra	---	Nominal
Grade Average	It's a number that represent the global academic grade of a course.	0 – 100	Scale
Number of fails	It's a number that represent the quantity of the students didn't pass the course.	students	Scale
Fail Rate	It's the percentage of students that didn't pass a course in a specific period.	%	Scale

Variable	*Description*	*Units*	*Scale*
Period	It refers to the period of time in which a specific subject was taught. The School of International Studies at UEES manage the following schedule of periods: • Winter: January – March • Spring I: March – April • Spring II: April – June • Summer: July – August • Fall I: August – October • Fall II: October – December	---	Nominal
Year	It's a period of 12 months, starting from January 1st and ending on the 31st December.	---	Ordinal

Statistical analysis to perform

It will be carried out descriptive statistics: hypothesis testing for two or more means, correlations, significant differences and dependency tests. It is expected that there are significant differences between the variables analyzed: Teacher - student - teacher evaluation. Likewise, a Values Test will be used to explore the degree students' sincerity when making the Teacher Hetero-evaluation.

Analysis of Results

Part 1: Final grades per subject, per time period and per year

Subject distribution

This research article have taken into account 41 Mr. Andrade courses which are distributed into 8 subjects taught from Winter 2015 to Spring I 2017. Next, Figure 2 shows the subjects distribution, where it can be seen that most of the subjects had similar proportions but Projects I with a few 4.9% of classes.

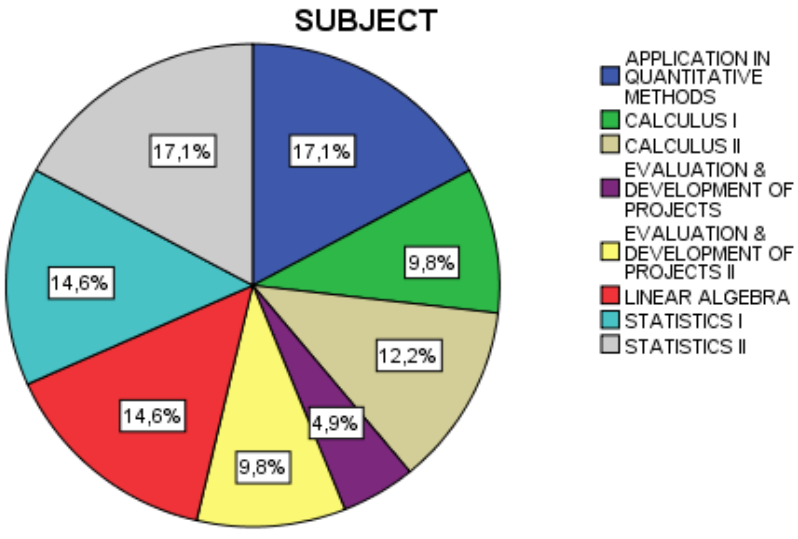

Figure 2. Subjects distribution from Winter 2015 to Spring I 2017.

Descriptives

Grade Average

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
APPLICATION IN QUANTITATIVE METHODS	7	86,6343	2,77728	1,04971	84,0657	89,2028	82,76	91,56
CALCULUS I	4	72,0400	3,31935	1,65967	66,7582	77,3218	67,84	75,55
CALCULUS II	5	76,1720	6,68693	2,99048	67,8691	84,4749	64,95	80,78
EVALUATION & DEVELOPMENT OF PROJECTS	2	89,8000	5,58614	3,95000	39,6105	139,9895	85,85	93,75
EVALUATION & DEVELOPMENT OF PROJECTS II	4	86,4375	3,89658	1,94829	80,2372	92,6378	83,36	91,69
LINEAR ALGEBRA	6	78,4233	3,79343	1,54866	74,4424	82,4043	71,40	81,95
STATISTICS I	6	77,9483	5,28553	2,15781	72,4015	83,4952	69,53	83,67
STATISTICS II	7	81,7443	3,88123	1,46697	78,1547	85,3338	75,33	88,45
Total	41	80,7622	6,45615	1,00828	78,7244	82,8000	64,95	93,75

Figure 3. Descriptive Statistics of Grade Average between Subjects

Grades Average per subject

Figure above shows that course with the highest Grade Average Mean (89.80) is Evaluation & Development of Projects, and the course with the lowest Grade Average Mean (72.04) is Calculus I. As it is shown in Figure 4, Tests of Normality for Grade Average by K-S test result (p-value=0.055) and Shapiro–Wilk test result (p-value=0.562), they both show that at 0.05 significance level the variable grade average is assumed to be normally distributed.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Grade Average	,136	41	,055	,977	41	,562

a. Lilliefors Significance Correction

Figure 4. Test of Normality for Grade Average Variable

Test of Homogeneity of Variances

Grade Average

Levene Statistic	df1	df2	Sig.
,929	7	33	,497

Figure 5. Test of Homogeneity of Variances for Grade Average

According to Levene's test p-value = 0.497 there is statistical evidence to assume homogeneous variances. Next the test of equality of means will be performed to find if there is significant difference in the mean of Grades Averages between Subjects.

$$H_1: At\ least\ one\ mean\ evaluation\ level\ is\ different.$$

$$H_0: \mu_{Calculus\ I} = \mu_{Calculus\ II} = \mu_{Linear\ Algebra} = \mu_{Statistics\ I} = \mu_{Statistics\ II} = \mu_{Projects\ I}$$

$$= \mu_{Projects\ II} = \mu_{Aplication\ in\ Quantitative\ Methods}$$

According ANOVA test p-value < 0.001, the null hypothesis is rejected and therefore a significant difference does exist in the mean grades average between subjects. Then Tukey HSD Analysis is proceed since there are statistically differences between the groups as a whole.

ANOVA

Grade Average

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1030,307	7	147,187	7,625	,000
Within Groups	636,967	33	19,302		
Total	1667,274	40			

Figure 6. ANOVA Test for Grade Average between Subjects

Table 4. **Multiple Comparisons for Grade Average between Subjects**

Multiple Comparisons

Dependent Variable:	Grade Average				
(I) SUBJECT			Mean Difference (I-J)	Std. Error	Sig.
Tukey	APPLICATION IN QUANTITATIVE METHODS	CALCULUS I	14,59429*	2,75371	,000
		CALCULUS II	10,46229*	2,57252	,006
		EVALUATION & DEVELOPMENT OF PROJECTS	-3,16571	3,52256	,984
		EVALUATION & DEVELOPMENT OF PROJECTS II	,19679	2,75371	1,000
		LINEAR ALGEBRA	8,21095*	2,44427	,037
		STATISTICS I	8,68595*	2,44427	,023
		STATISTICS II	4,89000	2,34837	,446
	CALCULUS I	CALCULUS II	-4,13200	2,94719	,850
		EVALUATION & DEVELOPMENT OF PROJECTS	-17,76000*	3,80480	,001
		EVALUATION & DEVELOPMENT OF PROJECTS II	-14,39750*	3,10661	,001
		LINEAR ALGEBRA	-6,38333	2,83593	,350
		STATISTICS I	-5,90833	2,83593	,446
		STATISTICS II	-9,70429*	2,75371	,025

Multiple Comparisons

Dependent Variable:	Grade Average				
(I) SUBJECT			Mean Difference (I-J)	Std. Error	Sig.
Tukey	CALCULUS II	EVALUATION & DEVELOPMENT OF PROJECTS	-13,62800*	3,67579	,016
		EVALUATION & DEVELOPMENT OF PROJECTS II	-10,26550*	2,94719	,027
		LINEAR ALGEBRA	-2,25133	2,66034	,989
		STATISTICS I	-1,77633	2,66034	,997
		STATISTICS II	-5,57229	2,57252	,397
	EVALUATION & DEVELOPMENT OF PROJECTS	EVALUATION & DEVELOPMENT OF PROJECTS II	3,36250	3,80480	,986
		LINEAR ALGEBRA	11,37667	3,58720	,058
		STATISTICS I	11,85167*	3,58720	,042
		STATISTICS II	8,05571	3,52256	,330
	EVALUATION & DEVELOPMENT OF PROJECTS II	LINEAR ALGEBRA	8,01417	2,83593	,123
		STATISTICS I	8,48917	2,83593	,086
		STATISTICS II	4,69321	2,75371	,685
	LINEAR ALGEBRA	STATISTICS I	,47500	2,53653	1,000
		STATISTICS II	-3,32095	2,44427	,869
	STATISTICS I	STATISTICS II	-3,79595	2,44427	,773

*. The mean difference is significant at the 0.05 level.

Table 4 shows which groups differ from each other. It can be observed that there is statistically significant difference in the Grade Average between the students who took Application in Quantitative Methods and Calculus I (p=0.000) and Calculus II (p-value=0.006). However there are no differences between the groups that took Calculus I and Calculus II (p-value =0.850). Also, it is clear to appreciate that there is a significant difference in the Grade Average between the groups that took Calculus II and Evaluation & Development of Projects (p-value =0.16), and Evaluation & Development of Projects II (p-value =0.27). Nonetheless there is no significant difference between the groups that took Projects I and Projects II (p=0.986), as well as between the Linear Algebra and Statistics II subject (p-value =0.869).

Grades Average per period

Figure 7 shows that the Periods with the highest Means Grade Average are Spring I (82.7156) and Spring II (82.2780), on the other hand the period with the lowest Grade Average Mean is Summer (78.42).

According Levene's test p-value = 0.070, there is statistical evidence to assumed homogeneous variances. Next the test of equality of

Descriptives

Grade Average

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
FALL I	6	78,5050	8,47914	3,46160	69,6067	87,4033	64,95	85,85
FALL II	6	80,2767	6,27200	2,56053	73,6946	86,8587	73,58	91,56
SPRING I	9	82,7156	3,16123	1,05374	80,2856	85,1455	77,08	87,45
SPRING II	5	82,2780	9,67850	4,32835	70,2606	94,2954	69,53	93,75
SUMMER	6	78,4200	5,36826	2,19158	72,7864	84,0536	67,84	82,76
WINTER	9	81,3567	7,05748	2,35249	75,9318	86,7815	71,19	91,69
Total	41	80,7622	6,45615	1,00828	78,7244	82,8000	64,95	93,75

Figure 7. Descriptive Statistics of Grade Average between Periods

Test of Homogeneity of Variances

Grade Average

Levene Statistic	df1	df2	Sig.
2,263	5	35	,070

Figure 8. Test of Homogeneity of Variances for Grade Average between Periods

ANOVA

Grade Average

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	113,909	5	22,782	,513	,764
Within Groups	1553,365	35	44,382		
Total	1667,274	40			

Figure 9. ANOVA Test for Grade Average between Periods

means will be performed to find if there is significant difference in the mean of Grades Averages between Periods.

$$H_0: \mu_{Fall\ I} = \mu_{Fall\ II} = \mu_{Spring\ I} = \mu_{Spring\ II} = \mu_{Summer} = \mu_{Winter}$$

$$H_1: At\ least\ one\ mean\ evaluation\ level\ is\ different.$$

Additionally, ANOVA p-value = 0.764 indicates that there is no significant difference in the mean grades average between the periods in which they were taught.

Grades Average per year

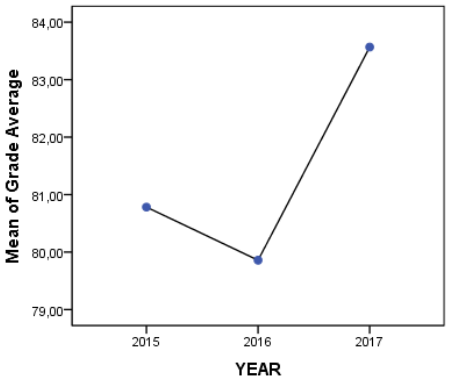

Figure 10. Means Plot for Grade Average between years

ANOVA

Grade Average

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	62,699	2	31,349	,742	,483
Within Groups	1604,575	38	42,226		
Total	1667,274	40			

Figure 11. ANOVA Test for Grade Average between years

Figure 10 shows that year with the highest Grade Average Mean is 2017 (83.5667), which means that students have shown a better performance through time. It also shows that the year with lowest Mean Grade Average is 2016. According to ANOVA test p-value=0.483, the null hypothesis of no difference between the means fails to reject, therefore a significant difference doesn't exist in the mean grades average between years. It can be predicted that for the existence of a significant difference the range of years has must be broader.

Part 2: Teacher Hetero-Evaluation per Subject and per time period
Teacher Evaluation per Subject

Descriptives

Teacher evaluation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
APPLICATION IN QUANTITATIVE METHODS	7	37,2057	1,77931	,67251	35,5601	38,8513	33,58	38,96
CALCULUS I	4	33,8900	3,13070	1,56535	28,9084	38,8716	30,99	38,14
CALCULUS II	5	33,9440	2,77335	1,24028	30,5004	37,3876	29,37	35,95
EVALUATION & DEVELOPMENT OF PROJECTS	2	37,7200	1,42836	1,01000	24,8867	50,5533	36,71	38,73
EVALUATION & DEVELOPMENT OF PROJECTS II	4	38,4250	1,67478	,83739	35,7600	41,0900	36,86	40,00
LINEAR ALGEBRA	6	35,9467	2,74325	1,11993	33,0678	38,8255	32,20	40,00
STATISTICS I	6	34,8717	2,64321	1,07908	32,0978	37,6455	32,15	39,44
STATISTICS II	7	36,1900	2,76839	1,04635	33,6297	38,7503	31,26	39,24
Total	41	35,9293	2,71306	,42371	35,0729	36,7856	29,37	40,00

Figure 12. Descriptive Statistics of Teacher Evaluation between Subjects

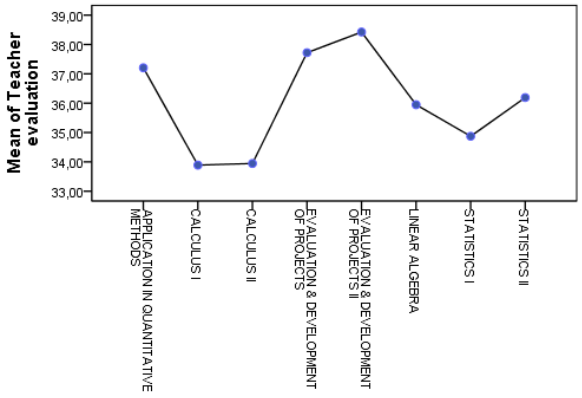

Figure 13. Means Plot for Teacher Evaluation between Subjects

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Teacher evaluation	,072	41	,200*	,965	41	,234

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 14. Tests of Normality for Teacher Evaluation

Figure 12, Descriptive Statistics, shows that Evaluation & Development of Projects II has the highest score of Teacher Evaluation (38.42), on the other hand Calculus I and Calculus II register the lowest scores. Figure 13 exposes the aforementioned. Aditionally Tests of Normality for Teacher Evaluation (Figure 14) by K-S test result Test (p-value=0.200) and Shapiro–Wilk test (p-value=0.234), they both indicate the variable teacher evaluation is not statically significantly different from a normal distribution, so Teacher Hetero-evaluation is assumed to be normally distributed. Based on ANOVA test p-value= 0.092, there are no significant differences in the mean teacher evaluation between subjects.

ANOVA

Teacher evaluation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	86,263	7	12,323	1,954	,092
Within Groups	208,164	33	6,308		
Total	294,427	40			

Figure 15. ANOVA test for Teacher evaluation between Subjects

Teacher-evaluation per period

Descriptives

Teacher evaluation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
FALL I	6	36,2217	2,91985	1,19202	33,1575	39,2859	31,26	40,00
FALL II	6	34,8033	2,40032	,97993	32,2843	37,3223	32,15	38,14
SPRING I	9	37,2167	2,20831	,73610	35,5192	38,9141	33,26	40,00
SPRING II	5	36,3360	2,87938	1,28770	32,7608	39,9112	32,45	38,96
SUMMER	6	34,6283	4,16361	1,69979	30,2589	38,9978	29,37	39,44
WINTER	9	35,8389	1,93798	,64599	34,3492	37,3286	32,21	39,09
Total	41	35,9293	2,71306	,42371	35,0729	36,7856	29,37	40,00

Figure 16. Descriptive Statistics of Teacher evaluation between periods

ANOVA

Teacher evaluation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	34,091	5	6,818	,917	,482
Within Groups	260,336	35	7,438		
Total	294,427	40			

Figure 17. ANOVA test for Teacher evaluation between periods

Based on Figure 16, Descriptive Statistics, teacher evaluation obtained better scores during Spring I (37.22), Spring II (36.34) and Fall I (36.22), meanwhile scores in Fall II (34.80) and Summer (34.63) are the lowest. Means Plot Figure 18 exposes the aforementioned and also it indicates that Winter has a relative positive score (35.84). According to ANOVA test (Figure 17) p-value = 0.482, there are no significant differences in the mean teacher evaluation between bimester periods.

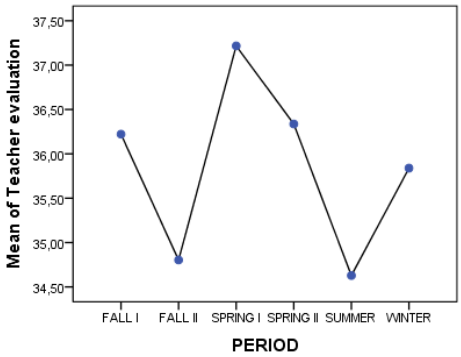

Figure 18. Means Plot of Teacher evaluation between periods

Teacher Evaluation per year

Descriptives

Teacher evaluation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
2015	16	35,3400	2,72186	,68047	33,8896	36,7904	30,99	39,44
2016	19	36,1647	3,02472	,69392	34,7069	37,6226	29,37	40,00
2017	6	36,7550	1,25842	,51375	35,4344	38,0756	35,55	38,57
Total	41	35,9293	2,71306	,42371	35,0729	36,7856	29,37	40,00

Figure 19. Descriptive Statistics of Teacher evaluation between years

ANOVA

Teacher evaluation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10,700	2	5,350	,717	,495
Within Groups	283,727	38	7,466		
Total	294,427	40			

Figure 20. ANOVA test for Teacher evaluation between years

Figure 19 shows that teacher evaluation has had a general improvement, where in 2015 had a mean of 35.34 and in 2017, 36.76, meaning that students have grade his teacher in a better perspective way, taking into consideration that instructor must fulfill the important points presented in the hetero-evaluation survey. However according to ANOVA test (Figure 20) p-value: 0.495, there are no significant differences in the teacher evaluation mean between years.

Figure 21 shows that course with the highest Fail Rate Mean is Calculus II (0.23), on the other hand Application in Quantitative Methods (0.00), Evaluation & Development of Projects I (0.00) and Evaluation & Development of Projects II represent the lowest Fail Rate Mean. According to Normality Tests for Fail Rate Variable, the data isn't t normally distributed.

Fail Rate per Subject

Descriptives

Fail Rate

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
APPLICATION IN QUANTITATIVE METHODS	7	,0000	,00000	,00000	,0000	,0000	,00	,00
CALCULUS I	4	,2019	,14126	,07063	-,0229	,4267	,09	,41
CALCULUS II	5	,2276	,16714	,07475	,0201	,4351	,08	,50
EVALUATION & DEVELOPMENT OF PROJECTS	2	,0000	,00000	,00000	,0000	,0000	,00	,00
EVALUATION & DEVELOPMENT OF PROJECTS II	4	,0000	,00000	,00000	,0000	,0000	,00	,00
LINEAR ALGEBRA	6	,0931	,11186	,04566	-,0243	,2104	,00	,27
STATISTICS I	6	,1582	,15832	,06463	-,0079	,3244	,00	,41
STATISTICS II	7	,1007	,12303	,04650	-,0131	,2145	,00	,33
Total	41	,1014	,13452	,02101	,0590	,1439	,00	,50

Figure 21. Descriptive Statistics of Fail Rate between Subjects

It can be illustrated in Figure 22 by both significance values returned by the K-S test result (p-value=0.000) and Shapiro–Wilk test result (p-value=0.000).

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Fail Rate	,287	41	,000	,775	41	,000

a. Lilliefors Significance Correction

Figure 22. Tests of Normality for Fail Rate

Test of Homogeneity of Variances

Fail Rate

Levene Statistic	df1	df2	Sig.
3,584	7	33	,006

Figure 23. Test of Homogeneity of Variances for Fail Rate

According to Levene's test p-value = 0.006, indicates homogeneous variances are not assumed. Following the test of equality of means will be performed to find if there is significant difference in the Fail Rate Mean between Subjects.

$$H_0: \mu_{Calculus\ I} = \mu_{Calculus\ II} = \mu_{Linear\ Algebra} = \mu_{Statistics\ I} = \mu_{Statistics\ II} = \mu_{Projects\ I} = \mu_{Projects\ II} = \mu_{Aplication\ in\ Quantitative\ Methods}$$

$$H_1: At\ least\ one\ mean\ evaluation\ level\ is\ different.$$

According ANOVA test p-value = 0.019, the null hypothesis of no difference is rejected, therefore a significant difference does exist in the mean fail rate between subjects. Then Tukey HSD Analysis is proceed since there are statistically differences between the groups as a whole

ANOVA

Fail Rate

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,274	7	,039	2,864	,019
Within Groups	,450	33	,014		
Total	,724	40			

Figure 24. ANOVA Test for Fail Rate between Subjects

Table 5. *Multiple Comparisons for Fail Rate between Subjects*

	(I) SUBJECT	(J) SUBJECT	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	APPLICATION IN QUANTITATIVE METHODS	CALCULUS I	-,20192	,07322	,141
		CALCULUS II	-,22761*	,06840	,040
		EVALUATION & DEV. OF PROJECTS	0,00000	,09366	1,000
		EVALUATION & DEV.OF PROJECTS II	0,00000	,07322	1,000
		LINEAR ALGEBRA	-,09306	,06499	,836
		STATISTICS I	-,15822	,06499	,259
		STATISTICS II	-,10068	,06244	,740
	CALCULUS I	CALCULUS II	-,02568	,07836	1,000
		EVALUATION & DEV.OF PROJECTS	,20192	,10116	,500
		EVALUATION & DEV.OF PROJECTS II	,20192	,08260	,254
		LINEAR ALGEBRA	,10887	,07540	,830
		STATISTICS I	,04370	,07540	,999
		STATISTICS II	,10124	,07322	,858
	CALCULUS II	EVALUATION & DEV.OF PROJECTS	,22761	,09773	,309
		EVALUATION & DEV.OF PROJECTS II	,22761	,07836	,104
		LINEAR ALGEBRA	,13455	,07073	,559
		STATISTICS I	,06938	,07073	,974
		STATISTICS II	,12693	,06840	,589
	EVALUATION & DEVELOPMENT OF PROJECTS	EVALUATION & DEV.OF PROJECTS II	0,00000	,10116	1,000
		LINEAR ALGEBRA	-,09306	,09538	,975
		STATISTICS I	-,15822	,09538	,712
		STATISTICS II	-,10068	,09366	,958

(I) SUBJECT	(J) SUBJECT		Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	EVALUATION & DEVELOPMENT OF PROJECTS II	LINEAR ALGEBRA	-,09306	,07540	,916
		STATISTICS I	-,15822	,07540	,437
		STATISTICS II	-,10068	,07322	,862
	LINEAR ALGEBRA	STATISTICS I	-,06517	,06744	,976
		STATISTICS II	-,00762	,06499	1,000
	STATISTICS I	STATISTICS II	,05754	,06499	,985

*. The mean difference is significant at the 0.05 level.

Table 5 shows that there is only one group which differs from another. It can be observed that there is statistically significant difference in the Fail Rate Mean between the students who fail in Application in Quantitative Methods and Calculus II (p-value=0.040). Based on the rest of the information, it can be verified that there are not significant differences between the subjects shown on the table.

Part 3. Cross Analysis Grades Average Vs Teacher Hetero-evaluation

Correlations

		Teacher evaluation	Fail Rate	Grade Average	# Students	# Fail	# Pass
Teacher evaluation	Pearson Correlation	1	-,495**	,462**	-,204	-,492**	-,014
	Sig. (2-tailed)		,001	,002	,202	,001	,932
	N	41	41	41	41	41	41
Fail Rate	Pearson Correlation		1				
	Sig. (2-tailed)						
	N		41				
Grade Average	Pearson Correlation		-,811**	1			
	Sig. (2-tailed)		,000				
	N		41	41			
# Students	Pearson Correlation		,157	-,023	1		
	Sig. (2-tailed)		,326	,884			
	N		41	41	41		
# Fail	Pearson Correlation		,904**	-,749**	,378*	1	
	Sig. (2-tailed)		,000	,000	,015		
	N		41	41	41	41	
# Pass	Pearson Correlation		-,209	,289	,922**	-,011	1
	Sig. (2-tailed)		,190	,067	,000	,945	
	N		41	41	41	41	41

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 25. Correlations between variables.

According to Figure 25, the variables Fail Rate, Grade Average and Number of Fails are highly correlated between them, for that reason a multiple linear regression Model cannot be performed. Therefore a simple regression analysis is preceded between Teacher evaluation and the three variables mentioned before, in order to explain individual changes over the dependent variable: teacher evaluation, as it is shown with the slope.

Teacher evaluation – Fail rate: The p-value=0.001 for correlation significant test gives evidence to conclude there is a significant correlation (r = -0.495), negative and moderate, between teacher evaluation and fail rate of students, meaning that greater the number of students who fail the courses, the less of the final score of teacher evaluation.

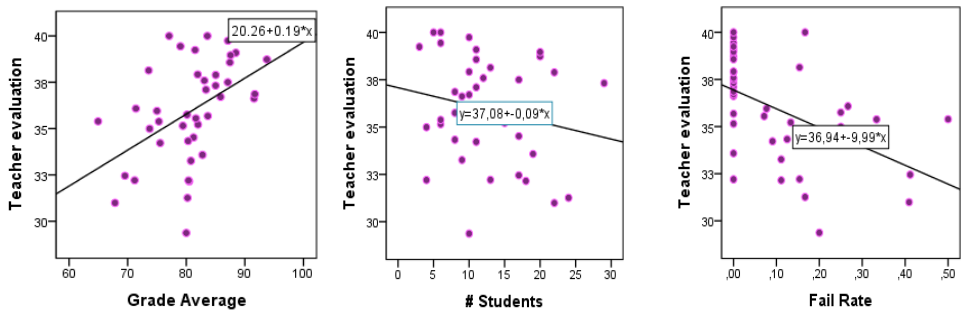

Figure 26. Scatter Plot of Teacher evaluation between variables

Teacher evaluation – Grade average: The p-value=0.002 for correlation significant test gives enough evidence to prove there is a significant correlation (r=0.462), positive and moderate, between teacher evaluation and grade average, meaning the greater the grade average of students in different subjects, greater the final score of teacher evaluation.

Teacher evaluation – Number of students: The p-value= 0.202 for correlation significant test gives no evidence for significant correlation between teacher evaluation and number of students. As it is shown on the figure, the correlation of teacher evaluation between the numbers of students reflects a negative and weak tendency, which means it's meaningless.

Table 6 *Simple Linear Regression Analysis*

SIMPLE LINEAR REGRESSION ANALYSIS FOR TEACHER EVALUATION							
	Model	R	R-square	Unstandardized Coefficients		t	Sig.
				B	Std. Error		
1	(Constant)	0,462	0,213	20,255	4,835	4,189	,000
	Grade Average			,194	,060	3,252	**,002**
2	(Constant)	0,495	0,245	36,942	,469	78,772	,000
	Fail Rate			-9,988	2,806	-3,560	**,001**
3	(Constant)	0,492	0,242	36,727	,437	84,092	,000
	# Fail			-,564	,160	-3,527	**,001**
a. Dependent Variable: Teacher evaluation							

Regression analysis for number of fails: According to Table 6, where Beta Coefficient for number of fails is -0.564, this means that for each student who fails the course, the teacher evaluation score will be reduced by almost half a point. Additionally, this variable as predictor explains 24% of teacher evaluation.

Regression analysis for fail rate: For every percentage point increase in the fail rate, the teacher evaluation score will be reduced by 10 points. The significance value for fail rate (0.001) indicates that this model is significant. It is also important to add that this variable explains 25% of teacher evaluation.

Regression analysis for grade average: Based on table 6, the Beta Coefficient for grade average is 0.194, meaning that for every point increase in the course grade average; the teacher evaluation will be increased in 0.2 points. Moreover grade average explains 21% of teacher evaluation.

As shown above, it is important to highlight that an increase in the grade average of the

course would increase the Teacher Hetero-evaluation score, instead an increase on the number of students who fail a course or on the fail rate would decrease the Teacher Hetero-evaluation score.

Part 4: Results of Allport-Vernon-Lindzey Study of Values

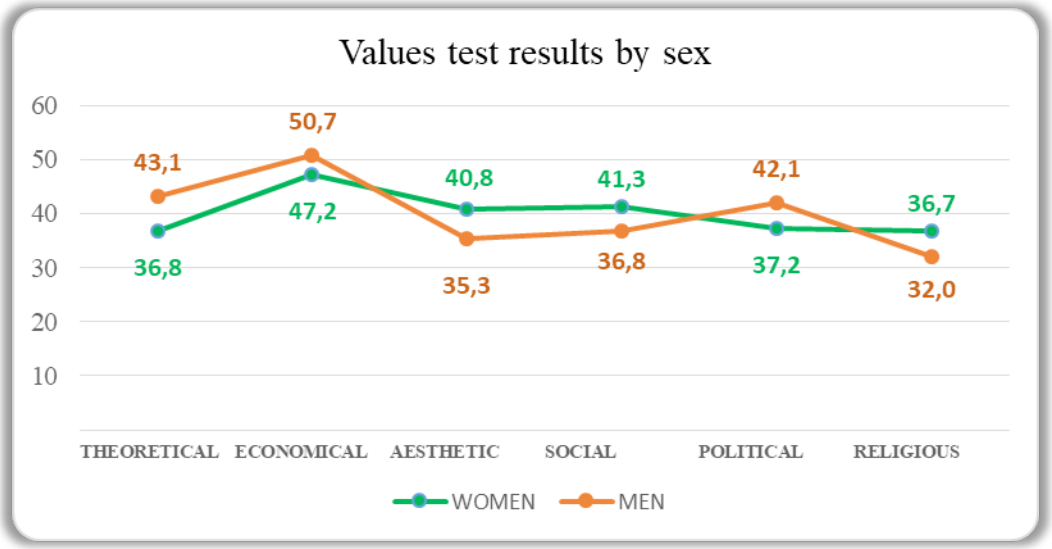

Figure 27. Results of Allport-Vernon-Lindzey Study of Values Test

Figure 27 shows that, on the religious value, the mean score for boys and girls were 36.69 and 31.96 respectively. Both are classified under a low score. On the contrary, the mean score for boys on the economic value was 50.74; for the girls 47.2. Both scores for economic value are considered high. The mean score for boys on the theoretical value was 43.13; for girls 36.77. On the aesthetic value, the mean score for boys and girls were 35.30 and 40.85 respectively. Additionally, the mean score for boys on the social value was 36.78; for the girls 41.31. On the political value, the mean score for boys and girls were 42.09 and 37.15 respectively. The scores of economic, aesthetic, social and political values, in both sexes fall under an average range. A high economic value in both sexes explains that individuals are characterized by dimensions of practical returns, efficiency, production, capitalism and maximizing gains. (Klassen, Pomeroy, & Hartman, 2009) A low religious value (also called regulatory value) in boys and girl, describe that these individuals aren't driven to establish order, routine and structure (Klassen, Pomeroy, & Hartman, 2009)

Conclusions

It was shown that Calculus I is the subject with the lowest grade average; according to Mr. Andrade's experience, it is due to the degree of difficulty presented by the subject as it involves a lot of mathematical analysis. The relationship of the students' grades and the grades of the Hetero-evaluation is directly proportional, which means the higher the students' grades the higher the score of Hetero-evaluation. Another important aspect to mention is that for each student who fails the course, the teacher evaluation score will be reduced by almost half a point.

Some interesting results from descriptive analysis is that in Spring I, students tend to

grade better their teacher, not to mention that students have a better performance in the same subject with a Mean Grade Average of 82.72. Additionally, Evaluation & Development of Projects II is the subject with the highest Mean Teacher Evaluation (38.42), meaning that students tend to grade better their teacher in that subject. By contrast, students tend to grad worst their teacher in Calculus I. This may affirm the suspicion that students show their resentment through hetero-evaluation since they have low grades in a specific subject, in this case Calculus I follows this trend.

Even though significant differences weren't found between Teacher Hetero-evaluation and other academic variables, this evaluation could be altered by the great empathy of the students with Mr. Andrade, their feelings towards the teacher and above all by the lack of sincerity. Results on the Values Test deduces men and women have a low mean score on the religious value, and a high mean score on the economic value. This may explain that their morality has a nuance of fragility which cannot allow the development of transcendental values such as honesty, an essential dimension to have a healthier human coexistence. After taking into account these results, it is evident that students aren't sincere enough when evaluating a teacher; some of them think they don't do it with objectivity, and instead, sometimes they think they provide useless information.

One of the limitations this academic research faced was the limited number of samples. Therefore for future researches it is recommended to increase the number of samples in regards of Students grades and Hetero-evaluation scores so that results are more accurate. The same recommendation is for the number of individuals in taking the Values Test. It is hoped that this study will be replicated with other teachers of different faculties at UEES.

To conclude it, Hetero-evaluation and other type of evaluations, in which students and teachers are involved, should be modified in a way the instrument focuses on evaluating the development of personality. It should not be an evaluation of control, but a useful tool to develop values, leading to a better effective teaching-learning process. Likewise, it is more important to emphasize in the process, not in the results. Additionally, Hetero-evaluation should not be mandatory; instead students must be offered to take it in a voluntary manner. When it is imposed, it creates distortion on honesty and sincerity of individuals. Future research is encouraged to continue to find significant variables may have a greater impact on the superficiality of Hetero-evaluation.

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