Lo cuantitativo y cualitativo en la investigación. Un apoyo a su enseñanza

The quantitative and qualitative in research. Support for its teaching.

A pesquisa quantitativa e qualitativa. Suporte para o ensino

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Resumen

Lo cuantitativo y lo cualitativo son referentes que se utilizan para conocer y explicar la realidad científica. Han sido muchas las aportaciones que se han hecho sobre el tema, ofreciendo al investigador dos enfoques que se excluyen o incluyen entre sí. En esta exposición se sostiene la idea de que son dos técnicas con enfoques teóricos, epistemológicos y metodológicos distintos pero con los que se puede trabajar en conjunto apoyándose en la estadística. Este trabajo presenta la matriz de investigación científica que

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contiene la combinación de los cuatro criterios de clasificación de la investigación con sus diez tipos de diseño, estudios o proyectos de investigación científica cuantitativos y cualitativos de acuerdo a las variables y escalas de medición en cuestión.

Palabras clave: cualitativo y cuantitativo, matriz de investigación científica.

Abstract

The quantitative and qualitative are references utilized to know and explain the scientific reality. Many contributions have been made about the topic, offering the researcher two approaches that will exclude or include to each other. This exhibition holds the idea that these are two techniques with different theoretical, epistemological and methodological approaches which be can work together with the help of statistics. This work presents the scientific research matrix that that contains the combination of those four criteria of classification of research with its ten types of design, studies or projects of scientific research quantitative and qualitative according to the variables and scales of measurement in question.

Key Words: qualitative and quantitative, scientific research matrix.

Resumo

Referências quantitativas e qualitativas são usadas para compreender e explicar a realidade científica. Tem havido muitas contribuições que foram feitas sobre o assunto, oferecendo o pesquisador duas abordagens que incluem ou excluem mutuamente. Nesta exposição a ideia de que existem duas técnicas teóricas, epistemológicas e metodológicas diferentes, mas que podem trabalhar em conjunto depender de abordagens estatísticas é realizada. Este artigo apresenta a matriz de pesquisa científica que contém a combinação dos quatro

critérios de classificação de pesquisa com dez tipos de design, estudos ou projectos de investigação científica quantitativa e qualitativa de acordo com variáveis e escalas de medição envolvidos.

Palavras-chave: qualitativo e quantitativo, matriz de pesquisa científica.

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Introduction

Brief historical background

Science did not emerge from Academy, however, the last one has contributed with new and interesting perspectives for the understanding and explanation of reality.

Thousands of years ago these explanations were sought in religion, originating the philosophy and subsequently various Sciences: chemistry, physics, astronomy, architecture, agronomy, biology, etc, that later on were subdivided into natural sciences and social sciences.

During the second half of the 20th century the sciences began approaching each other with regard to its procedures, methods and techniques. In this way arose other branches of science, for example, biomedicine, biophysics, biochemistry, among others, that received a big statistical - mathematical influence (Martínez, 2001 and Méndez, 1987).

In such approach, statistics - mathematics played an important role. Some Sciences chose to use it, identifying it as a positivist trend. But as time went by allowed hermeneutic approaches, which led to statistic began to be utilized in science only such as economics, biology, psychology, sociology, among others. Even not few students opted for these careers to evade statistics - mathematics.

It is common that in the majority of investigations of young university students in the area of the Social Sciences and Humanities, tend to be qualitative, possibly because they do not possess the knowledge about the proper use and application of statistics, which represents a greater pedagogical challenge in the duality methodology - statistics.

In addition, the current behaviors of qualitative and quantitative techniques with the use of statistics must reviewed and analyzed, especially in school formation processes of a profession.

Current behavior of quantitative and qualitative techniques

Since the late twentieth century, behavioral scientists have become interested in using the qualitative method in their research area, leaving aside the quantitative and promoting conflicts and contradictions. Each term means something different and, therefore, represents a different theoretical, epistemological and methodological approach. This work commitment combination of both.

A small group of scholars work with two methods: statistics and methodology. The purpose is to use both and disseminate this new way of working.

To address an issue of paramount importance closely related to qualitative and quantitative need to talk about types of variables and measurement scales.

Types of variables and measurement scales

In any research project, types of variables, scales, statistical analysis and statistical tests are of paramount importance (Table 1). Nonparametric statistics is the most appropriate technique for menial scales (nominal and ordinal) and when the model assumptions are weak or are not met: normality, homogeneity of variance, independence of errors.

The independence of errors occurs when the data is randomized, a condition including making the experiment is reliable. Parametric statistics is most appropriate for high-class scales (interval and reason).

Therefore, there is a close relationship between the measurement scales, techniques parametric and nonparametric statistics and research four dichotomous criteria, with ten scientific research projects.

estimation and testing of hypotheses about the (mean and standard deviation) population parameters: the parametric inferences are made. Parametric statistics is the traditional, which is taught at the top level and at the graduate level. It's okay to teach, but why not nonparametric statistics is taught, especially in social sciences?

Nonparametric statistics as the name does not refer to parameters such as mean, standard deviation and others. Nor is it possible to perform arithmetic operations. For a better

understanding of this point, it is recommended to consult the meaning of: measure, measure, measure, size, number, number, cardinal number.

Measurement scales are all forms of scale: nominal, ordinal, interval and ratio, ie they comprise amounts and numbers.

The nominal scale responds to the type of data classified into categories or classes. For example, the variable (male and female) sex, each of them is a category or class. You can not perform arithmetic operations or establish order relation; but they can be obtained frequencies, percentages and counts on contingency tables.

The statistical test is appropriate for testing hypotheses chi-square and binomial, showing the frequency of each category. The most common measure of association for nominal data is the coefficient of contingency. The important property of the nominal scale is equality or equivalence.

All the elements that are part of a category according to their nature are same or equivalent. The properties of equality are as follows:

Reflexive: $x = x$, for any value of x.

Symmetric: $x = y \Rightarrow y = x$

Transitive: Sí, $x=y \quad y = z \Rightarrow x = z$, equivalent to the syllogism, to define hypotheses.

The elements of the male category (individuals, objects or things), exclude elements of the female category, ie, they are mutually exclusive: if one occurs, the other can not

occur. No order relation to one another male is not stronger or smarter than women. There is also no middle ground: either it is male or female is, and so with all nominal variables.

Regarding the ordinal scale: ordinal variable gives better information than the nominal. Tests and nonparametric statistical techniques for nominal variables, are also valid for the ordinals. On this scale, the items in a category are related by the concept of order, with the greater than (>) and less than (<) signs. Examples: intensity of a (strong, regular, low) pain; (High, medium, low) income; clearly: strong> Regular> low and high> medium> low.

Yes ordinal data with parametric techniques were used calculating means and standard deviations commit an error, being dubious conclusions and little or no reliable. In social sciences, most tests are nonparametric, although Parametric are also used. Its properties are:

Inequality: A > b and a < b; b > c and b < c..., property is,
Irreflexiva: It is not true for any x, that x>x
Asymmetrically: x > and, later, "y" It is not greater than "x".
Transitive: X > y y y > z $\Rightarrow$ x > z

Ordinal scales in the appropriate test is the median (with data up and down it). and contingency coefficients range statistics also apply. The only course range for some tests is that the data is continuous distribution, ie, they can take any value in certain interval.

The maximum level is reached measurement is the interval scale and the scale of reason. The interval scale uses in the line of real numbers.

The ordinal scale has the properties and characteristics of the nominal. The interval scale has the properties of nominal and ordinal and the other as ratios between two adjacent intervals.

On a scale of zero is arbitrary interval. To measure temperature scales most commonly used are: degrees Celsius (0C) and degrees Fahrenheit (0F). In both scales, the freezing point and boiling point are different: from 0 to 100 0C and 32 and 212 in 0F. 0 0C 0F 32 is equivalent to 100 0C and is equivalent to 212 0F. However, they provide the same information, as evidenced by the following example (Haber/runyon, 1973, p.16).

^{0}C:	0	20	60	100
^{0}F:	32	68	140	212

Has reason to be (in social sciences), excessive concern in work with interval scales. If you can not, either way; They will have to take advantage of the benefits and advantages of nonparametric statistics and qualitative techniques, among other tools.

For many years has been applied almost exclusively traditional statistics, which allows us to obtain: means, standard deviations, t tests, F, as well as analysis of variance, analysis of variance of regression and correlation strongly supported in the model assumptions satisfaction when these are met.

In these circumstances it should be clear that the non-parametric statistics should not be used (you can, but no satisfactory results are obtained) So if nonparametric statistics should

not be used, this does not mean that they can not inject the parametric model, variables (independent) in conjunction with quantitative variables in the same model. qualitative

The ratio scale or proportion has all the characteristics and properties of the interval scale, plus zero is real, although we saw that in practice having an arbitrary zero is not so decisive.

In scales reason, the measurement units have a real zero: tonnages, kilos and grams, so that the ratio of two units of any weight, is independent of the measuring unit. Arithmetic operations can be made more fully, as well as statistical tests, including the geometric mean and coefficient of variation.

Chart 1:
Classification of variables according to their function. Types of measurement scale.

TIPO DE VARIABLES	ESCALAS DE MEDICIÓN	CARACTERÍSTICAS PRINCIPALES
CUALITATIVAS (DISCRETAS) Sus datos son categóricos, mutuamente excluyentes. No permiten operaciones aritméticas. Denotan cualidad (atributos y conteos) clasificados en un número fijo de categorías o clases. Se aplica estadística no paramétrica. Impera en la dicotomía observacional y en ciencias sociales.	*NOMINAL* Admite la propiedad de la igualdad (=): reflexiva; simétrica y transitiva. Medición: Mediante conteo (números naturales). *ORDINAL* *Expresa relación de orden.* Admite la igualdad y desigualdad: *a>b; a<b y es:* Irreflexiva, asimétrica, transitiva	Frecuencias, atributos, datos categóricos. Números, letras, símbolos color, sexo: χ^2 y binomial, proporción o porcentajes. Medida de asociación: Coeficiente de contingencia. Se determinan frecuencias. Prueba más apropiada: la mediana Ingresos: alto>medio> Bajo
CUANTITATIVAS (NUMÉRICAS) Conforman la dicotomía experimental con un solo proyecto: El *experimento.* Se permiten operaciones aritméticas. Cuando supuestos funcionan satisfactoriamente se aplica preferentemente la estadística paramétrica. Pueden presentarse datos cualitativos, como variables independientes.	*DE INTERVALO* *Datos continuos y discretos.* *Medición: c*uantitativo, cualitativo Cuantitativo: variables continuas. Cualitativo: variables discretas. *DE RAZÓN O RELACIÓN* *Datos continuos y discretos* *Medición:* cuantitativo, cualitativo Cuantitativo: variables continuas. Cualitativo: variables discretas.	El cero es arbitrario. Pide normalidad y otros supuestos**.** Ejemplos: a) Temperatura**:** 0^o C, no implica ausencia absoluta de calor**.** b) Cociente intelectual**.** El cero es real. Ejemplos: Km., cm ton., Kg., litro, cc., m^2, ingresos, edad, número de adultos**,** distancias, variedades genéticas.
INDEPENDIENTES: *La causa* cuantitativas y cualitativas, estadística paramétrica y no paramétrica	*Intervalo* y de razón. Continuas y tambié discretas**.** Categóricas (nominales y ordinales)	Definen la población. Factores de variación: controlados, no controlados y error experimental.
DEPENDIENTES: el e*fecto*. Para proyectos comparativos. Muestras apareadas, no apareadas.	*Escalas: intervalo y de razón* Cuantitativas, continuas. ¿También discretas?	Es la variable respuesta. La variable de interés. La variable que vamos a medir, el efecto.

For nominal:

Reflexive: For any value "x", x = x.

Symmetric: x = y, then y = x

Transitive: Sí x = y y y = z, *then:* x = z

For ordinal:

Unthinking: It is not true for any x, that x>x.

Asymmetrically: x>y, *then* "y" It is not greater than "x".

Transitive: Si x > y y y>z, *then,* x>z (silogismo)

In their research, they are presented variables and scales that can not be adapted to this scheme? Refer cases to which it has faced.

In general, textbooks classify the variables as completely as presented in Table 1, which could be improved. They accept and appreciate suggestions from readers and even modifications and extensions.

A quantitative and qualitative variables dramatically few authors are called "quantitative and qualitative paradigms paradigms". If it is numeric quantitative and the qualitative is categorical, we can call them paradigms ¿numerical and categorical paradigms? Apparently not, but we can call them either quantitative or numerical techniques and qualitative or quantitative or numerical techniques categorical variables and qualitative or categorical variables. Overall: quantitative research and qualitative research.

Not a few teachers and researchers claim that they should have clear advantages in each of the qualitative and quantitative "paradigms" (Giraldi 1998). But from our point of view what should be clear are the features and how they are used, their complementary points and league statistics and methodology of scientific research.

About two pictures closely related are presented:

- The indicated variables (quantitative and qualitative)
- The measurement scales (nominal, ordinal, interval and ratio)
- Statistical techniques (parametric and nonparametric)
- The statistical evidence from the binomial to t and F.
- The four dichotomous criteria of scientific research
- The ten types of research projects

For example, in the observational approach in survey projects (1, 2, 3, 4), both qualitative and quantitative applied; qualitatively, percentages and counts and so on the remaining projects.

In the experimental quantitative approach predominates but the qualitative is also present. In the latter case can be applied as independent variables usually qualitative, but also as dependent; Canadians have been applying the (Mendez R. I., 1984).

Then the matrix of scientific research, methodological and statistical content which is not taught at senior and graduate schools all scientific disciplines, so it is important to reconsider its importance is described.

Matrix scientific research and projects

Although it is not the purpose of this paragraph explaining the operation of the Matrix Scientific Research, projects containing such a matrix to understand what follows are presented. the number for the project, according to Table 2 is retained.

a) it contains pseudo experiments, the following three studies or research projects, necessarily comparative, plus surveys 3 and 4, comparisons, which are also pseudo experiments.

- Design 6: cases and controls (cause-effect)
- Design 7: historical perspective (cause and effect)
- Design 9: several cohorts

b) Contains projects not experiments or pseudo experiments such as the following that are monogrupales also surveys 1 and 2, also monogrupales, which are either pseudo experiments or experiments.

- Design 5: Case Review
- Design 8 projects a cohort.

c) It contains projects via sample survey. They are the following four:

- Design 1: prospective survey monkey group
- Design 2: retrospective survey monkey group
- Design 3: prospective comparative survey
- Design 4: comparative retrospective survey

d) It contains the experiment (the diseño10) experimental approach, which is traditionally taught at the professional level and at the graduate level, which occupy most attention of teachers and researchers in the execution of research projects and academic theses (not always rightly), especially in mathematics and natural sciences.

Of the ten research projects, the first nine not appear in curriculum curriculum of institutions of higher education, if anything sample surveys 1 and 3, comparative and prospective (statistical sampling or introduction to sampling), misnamed in agricultural engineering (FESC-UNAM) statistical inference, because the inference is not exclusive sampling as experimental designs are also inferential.

Chart 2. Matrix scientific research

Combinación de los cuatro criterios de clasificación de la investigación: diez tipos de diseño, estudios o proyectos de investigación científica y nombre común.					
Criterios de clasificación dicotómica					
1	2	3	**4**	**Diseño, estudio o Proyecto (nombre común)**	
Observacional o Experimental	**Prospectivo o Retrospectivo**	**Transversal o Longitudinal**	**Monogrupal o Comparativo**		
Observacional	**Prospectivo**	**Transversal**	**Monogrupal**	**Encuesta Monogrupal**	**1**
Observacional	**Retrospectivo**	**Transversal**	**Monogrupal**	**Encuesta Monogrupal**	**2**
Observacional	**Prospectivo**	**Transversal**	**Comparativo**	**Encuesta Comparativa**	**3**
Observacional	**Retrospectivo**	**Transversal**	**Comparativo**	**Encuesta Comparativa**	**4**
Observacional	**Retrospectivo**	**Longitudinal**	**Monogrupal**	**Revisión de casos**	**5**
Observacional	**Retrospectivo**	**Longitudinal**	**Comparativo Efecto-causa**	**Casos y controles**	**6**
Observacional	**Retrospectivo**	**Longitudinal**	**Comparativo Causa-efecto**	**Perspectiva histórica**	**7**
Observacional	**Prospectivo**	**Longitudinal**	**Monogrupal**	**Una cohorte**	**8**
Observacional	**Prospectivo**	**Longitudinal**	**Comparativo**	**Varias cohortes**	**9**
Experimental	***Prospectivo***	***Longitudinal*** *o Transversal*	***Comparativo***	***Experimento***	***10***

Source: Ignacio Méndez.

In the last row in gray italics are the characteristics of the experiment project. The most important dichotomies are 1 and 4. Surveys based on questionnaires is a way of doing research.

From this view, you have to avoid open questions: the answers are long, complicated and non-functional. Of them, you will have to be well justified use; possibly be answered

hermeneutical research value type where the beliefs and opinions are given greater depth, the meaning becomes important.

Therefore, in this perspective closed questions statistic is ideal: the answers are here, concrete, precise, and perfectly functional codifiable for statistical analysis.

Not the same qualitative objectives defined social, political, religious, quantitative targets as height, length or weight. A politician is interested totals, averages, percentages. The researcher also seeks to define the above diagnoses and conclusions by comparing results and association between variables.

Modern experimentation (by experiment) is traditional. It is modern because it was consolidated in the thirties of the last century with Ronald Fisher (1890-1967), creator of concepts and block randomization unduly still in force (such as conceived Fisher).

However, Galileo is likely problems and hypotheses tested by experiments, creating laws and theories of scientific significance mentally set. A feat.

Fisher refined and adjusted the Galilean methodology, improving research techniques, a link to the scientific chain that has permitted the statistics more efficiently. Research (scientific) is present in the ten projects in Table 2, the experiment only a tenth of the box. The pseudo experiment lacks some important properties and characteristics of the experiment. Which? Mainly randomization, but also the fact that the research material is not manipulated or changed by the investigator.

Professor and researcher often confuse pseudo-experiments with experiments. Not infrequently they are dealing with experiments without it and are not aware of it. Obviously, the results are not reliable and no one notices.

It is also important to differentiate between the concepts research and experimentation: Experiments run when research is done, but when research is not necessarily done with experiments.

In general, the experiment and quantitative concept is too rooted in the scientific community. The right thing for experiments is: research via experiment. However, the custom becomes law?

Special suggestion for students, teachers, counselors and researchers: preferably use the research concept and not the experimental concept, and the latter only apply in cases where the research project is actually an investigation via experiment.

Paradigm

It is a philosophical term that has become popular in the scientific field. Overall, researchers, teachers and methodologists have adopted and given scientific naturalization letter. It has been abused in its use to inject some writings the elegance as well as to meet some vanity in all of us.

The term is difficult, it is not easy to understand the different interpretations that give philosophers, few of them not contradictory (now everyone uses it and very lightly).

Thomas Kuhn in 1962 who introduced the term. Psychologists, sociologists, politicians and in all fields of natural science is used practically for all: is a familiar paradigm, Algebraic, love, art, sports? Thomas Kuhn says "the paradigm is something subtle and inconsistent (with lack of strength or stability)".

So paradigm is a set of principles knowable (known), some assumptions that define (first) the type of data you are able to observe. Ken Wilber (1989 and 1991) also made a long presentation on five different levels and sublevels of paradigms that explain them philosophically.

Very interesting and entertaining narration Wilber, who displayed the paradigm as absolutely philosophical (not scientific), each level with a different perspective of reality, like the rungs of a ladder philosophical infinite extension. Each step corresponds to each of the levels and sublevels: the first matter, the last to the spirit.

Wilber's philosophy is related to the quantitative and qualitative "paradigm". The current conflict in educational research is not a conflict of competing paradigms, because the views do not differ supposedly competing; there is simply no competition between paradigms in the scientific discourse in social sciences and natural sciences (Lakatos, 1978).

Quantitative against the qualitative??

On the distinction between natural sciences and social sciences, Marlin C. Wittrock (1989) points out that this notion was first proposed by the German historian and social philosopher Whilhem Dilthey (1914-1976), based on the work of his contemporary, Polish Malinowski (1922-1966). This distinction or differentiation increased with the work of Winch (1958), Berger and Luckmann (1967), Giddens (1976), among many others.

In the mid-nineteenth century (1850), what is now known as social sciences and behavioral sciences began to be defined as areas. Later, A. Comte created and coined the term sociology in 1920, date in which began to be studied as a science. However, it was the psychology rather than sociology discipline the positivist model of the natural sciences is welcomed, experimental.

Campbell and Stanley (1966) released to the scientific community the pseudo experiment, which opened the door to qualitative research as a research tool. Campbell himself proposed in 1978 as a research project case study, which he called research method. Thereafter qualitative she began to prevail.

For 20 years it has grown the eagerness of social researchers to investigate only qualitatively, hoping to have found the "alternative" quantitative. So, Carmen Merino (1995), behavioral researcher says that the qualitative do not share the natural sciences, so experimental. the possibility that both techniques can be complementary and also denies the presence of qualitative variables in the phenomena of experimental criterion, particularly because the experiment was denied.

Indeed, educational institutions and higher secondary education are expressed about it but without delving into the problem, ie without a full, statistical and methodological justification.

Conclusion

Knowledge of, nonparametric methods, scales, types of variables, dichotomous criteria and types of projects, parametric statistical provides a wide range of possibilities to manage jointly the quantitative and qualitative statistically.

Scientists in the social sciences have created their own laws and theories, also making significant progress. But the bet from this vision is to assume the ability to work them not only individually but also together with statistical basis.

In logical positivism, the way research has been so far the experiment (experimental approach). Currently one must consider not only the observational-experimental dichotomy but also the rest of the dichotomies (four), the combination of which makes up the ten types of research projects, nine of which in general are not yet covered for scientific research and thesis academic.

According to Carmen Merino, the "paradigm" quantitative is based on deductive logic (from the general to the particular) and qualitative "paradigm" (qualitative technique) in inductive logic (from the particular to the general). This is false: both paradigms are complementary. On the other hand, say that the deductive goes from the general to the particular and the inductively from the particular to the general, is not entirely acceptable because the right is the tendency is to approach (probabilistically) to the truth. How much? Both the magnitude of the selected significance level alpha (α) permits.

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