

การศึกษาสถิติ

Concept of Eduometrics

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บทคัดย่อ

ศึกษาศาสตร์ เป็นสาขาวิชาที่กำลังได้รับการพัฒนาให้เป็นศาสตร์ที่มีลักษณะเด่นชัด เช่นเดียวกับ ศาสตร์ สาขาวิชาสังคมศาสตร์และพุทธิกรรมศาสตร์ ศึกษาศาสตร์เป็นกระบวนการสอนและการเรียนรู้ ซึ่งมีตัวแปรต่างๆ เข้ามาเกี่ยวข้อง บทความนี้เป็นความพยายามของผู้เขียนที่จะพัฒนาศาสตร์ที่เรียกว่า ศึกษาสถิติให้สามารถวัดตัวแปรต่างๆ ทางการศึกษา ศึกษาสถิติ หมายถึง จิตวิทยา สถิติ สังคมวิทยา และเศรษฐศาสตร์ และเครื่องมือทางสถิติประยุกต์ใช้วัดแบบทดสอบ สูตร กฎเกณฑ์ และมาตรฐาน ที่มีมาตรฐาน เพื่อใช้ ในการวิเคราะห์กระบวนการที่ขับขันของวิชาการศึกษา

คำสำคัญ : ศึกษาสถิติ จิตวิทยา สังคมวิทยา เศรษฐศาสตร์

Abstract

Education is a growing discipline seeking a place in its own right among the social and behavioral sciences of the information age. Education is a teaching-learning process in which several variables are involved. This paper attempts to make a strong argument for developing the so called Eduometrics to measure the variables in education. Eduometrics would include psychometrics, sociometrics and econometrics tools as well as the statistical application to develop tests, formulas, criteria, scales and standards which are needed in the analysis of the complex process of education.

Keyword : eduometrics psychometrics sociometrics econometrics

Concept of Eduometrics

Education is a growing discipline seeking a place in its own right among the social sciences in the information age. The modern theory incorporates the results of research and experimentation on the procedures of education. This has been

possible because the helps of psychometric tools developed in psychology is now easily available. For example, test of intelligence, aptitude and achievement, inventories of interests and preferences, scale attitude and personality, etc. enable a modern educator to make scientific judgments and take correct

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decisions on the psychological problems. However there are several other areas of educational problems in which psychometrics cannot help, although some use of sociometric tools has been made to study group behavior and interpersonal relationships of student. Several educational facts and phenomena, therefore, remain unanalyzed by any objective tools or measures. There are neither tested formula nor standard criteria for ascertaining, assessing and measuring all the dimensions of the comprehensive educational process which include many problems of study such as teacher efficiency workload, teacher-student relationship, staff management relationship, school performance, school building, effectiveness of co-curricular activities, efficient of school administration, student discipline curriculum effectiveness, textbooks effectiveness, the impact of education on society, etc.

One could add to the list given above indicating the areas where scientific measurement is essential. Until now, we have relied heavily on the experiences of person dealing with those aspects of education or have asked for the expert opinion of theoreticians. But we have not developed the special methodology of measurement for concepts in education, which we so vaguely and analyze so subjectively. This is the reason why two educators, unlike two scientists have not been able to see eye on problems or have never offered a similar

judgment for the same problems. There has been no attempt to take in common tools and reach common conclusions on the objective and scientific basis.

Hence, this paper attempts to make a strong plea for evolving what the author called "Eduometrics" Eduometrics would include psychometric, sociometric and tools as well as the basic statistical applications. But in addition to these it would also comprise many other measures, tests, formula, criteria, scales and standards which are significantly needed in the analysis of the complex process of education. Thus, it is as wide as the definition of education. Education is basically a teaching-learning in which several variables are involved, e.g. learner, teacher, curriculum, textbook, evaluation, guidance, supervision, and administration, etc. Eduometrics will help in analyzing of all these variables under different conditions and will enable educators to predict the result of certain situations or causes with a greater degree of confidence and correctness.

Hence, the basic assumptions of this paper for developing the concept of Eduometrics are as follows :

1. Purpose of Social Sciences is to study Man in social context (see Model No.1)
2. Education is in the process of becoming a social science in our age of science and technology.
3. As a social science, education has

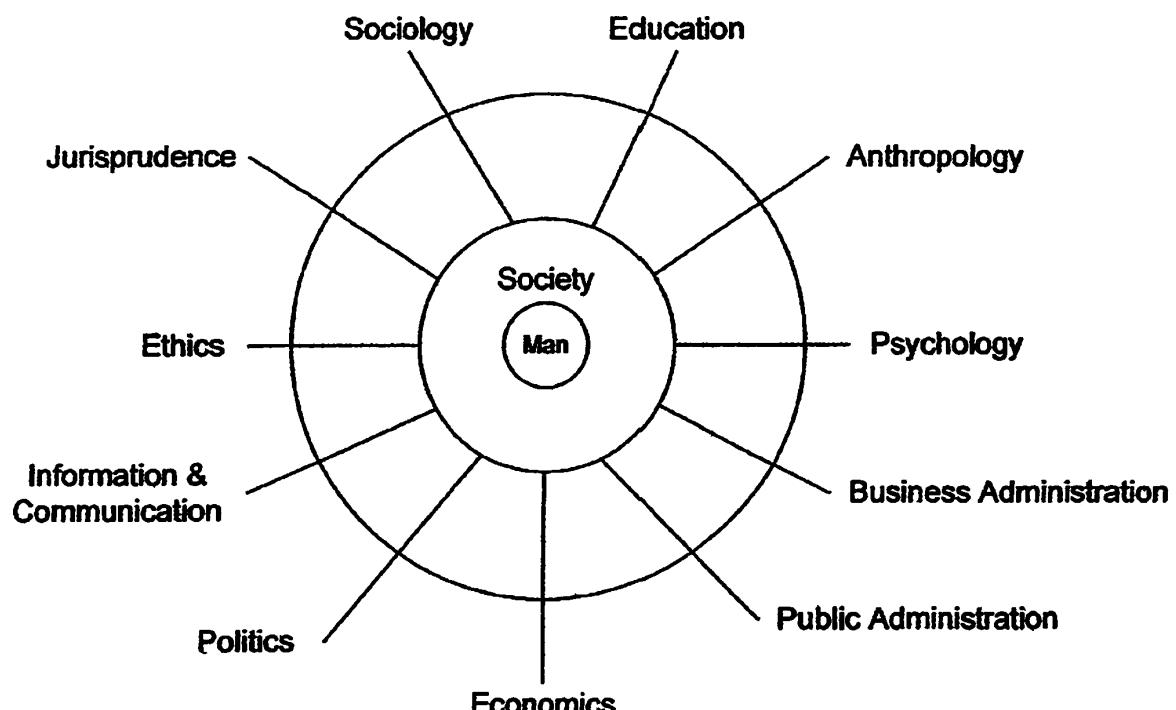
to develop adequate tools of measurement.

4. As a science, it needs an adequate amount of behavioral research, objective analysis and scientific experimentation with educational variables.

5. The use of psychometric tools and sociometric devices is important but is not

sufficient for the analysis of the comprehensive and complex educational process.

6. Adequate use of scientific research methodology and appropriate statistical tools are necessary to develop education as a social science or a behavioral science discipline.



Model No.1: Aim of Social Sciences

Present Position of Education as a Science

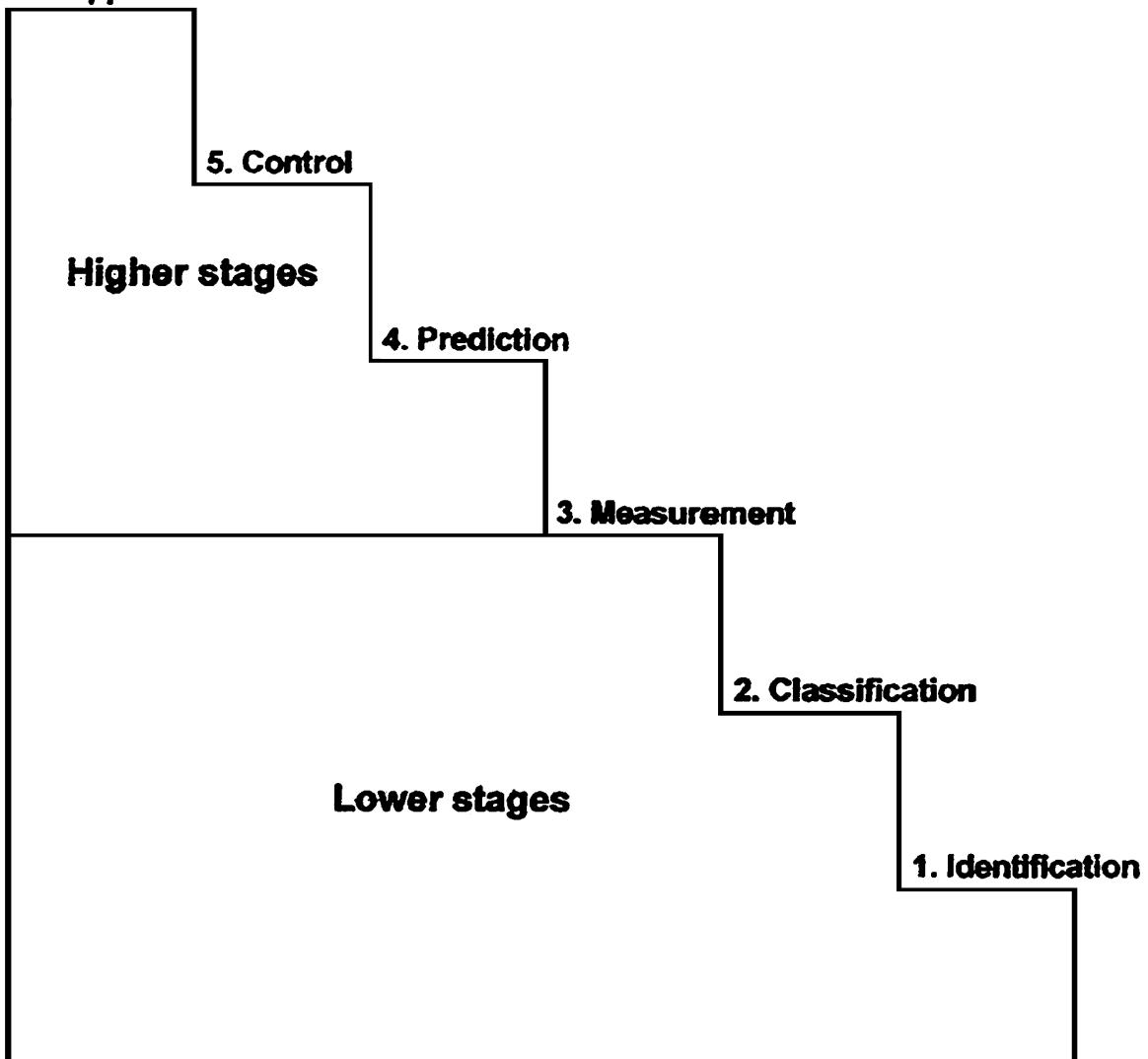
The need for developing education is as a social social science on the basis of some assumption. It is necessary to determine the present position of education in terms of the accepted stages of development of a discipline. The stage of scientific development of the discipline reveals six important stages as shown in Model No.2. A fully developed

discipline is one, which has attained almost all the six stages or can perform all the six functions precisely or accurately. A few physical sciences can boast to have reached such a maturity ; the social sciences are still far from it. The reason is obvious. They deal with human behavior in a society, which is a complex phenomenon to observe or to experiment with. But now there is an attempt to develop scientific tools and tests, to

evolve definite terms and concepts, and to predict on the basis of hypothesis-based research. Hence most of the social sciences now imitate the approaches of the behavioral sciences and develop measurement techniques and tools. Psychologists,

sociologists' and economists have given the lead by developing psychometrics, sociometrics and econometrics to provide some tools for analysis and measurement of the problem in their respective areas.

6. Application



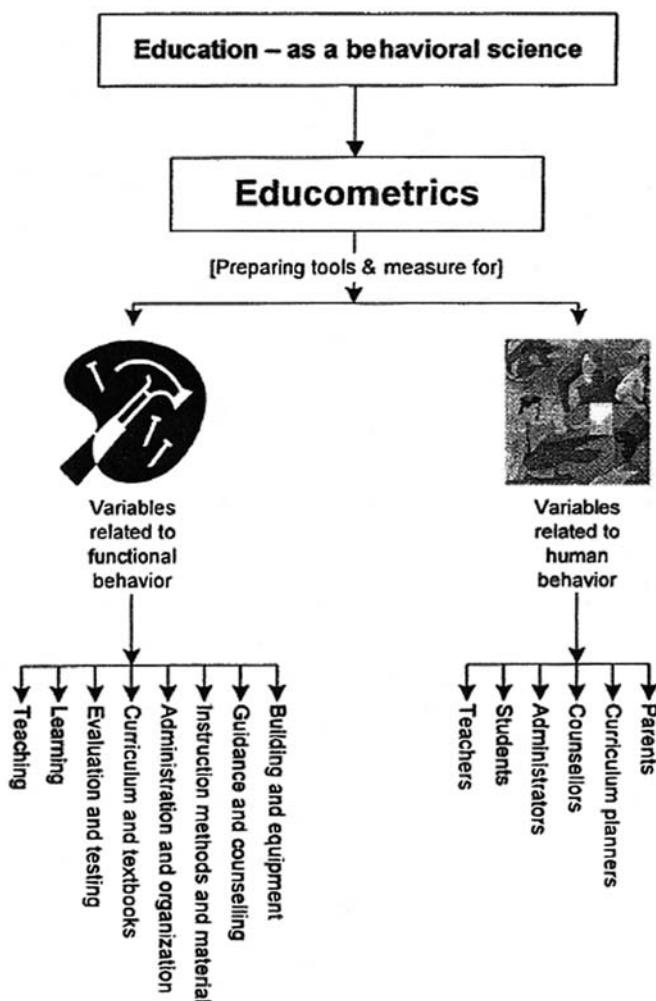
Model No.2: Stage of Scientific Development

Applying a similar logistic to the science of educations, one finds that it is still an undeveloped discipline since it has not evolved its own metrics or methodology of measurement and lives the borrowed use of psychometrics or sociometrics. It is regretted that the processes of definition, identification or classification or grouping are also not fully developed on scientific lines. Hence, education is still grouping in the lower stages of scientific development as shown

in Model No.2.

The main reason for this sad state of affair is the lack of an attempt to develop Eduometrics, which makes a demand for precise definitions, clear classification and adequate analyzes of the facts under study. Educators or educationists have therefore remained philosophers rather than scientists in the true sense of the terms.

Scope of Eduometrics



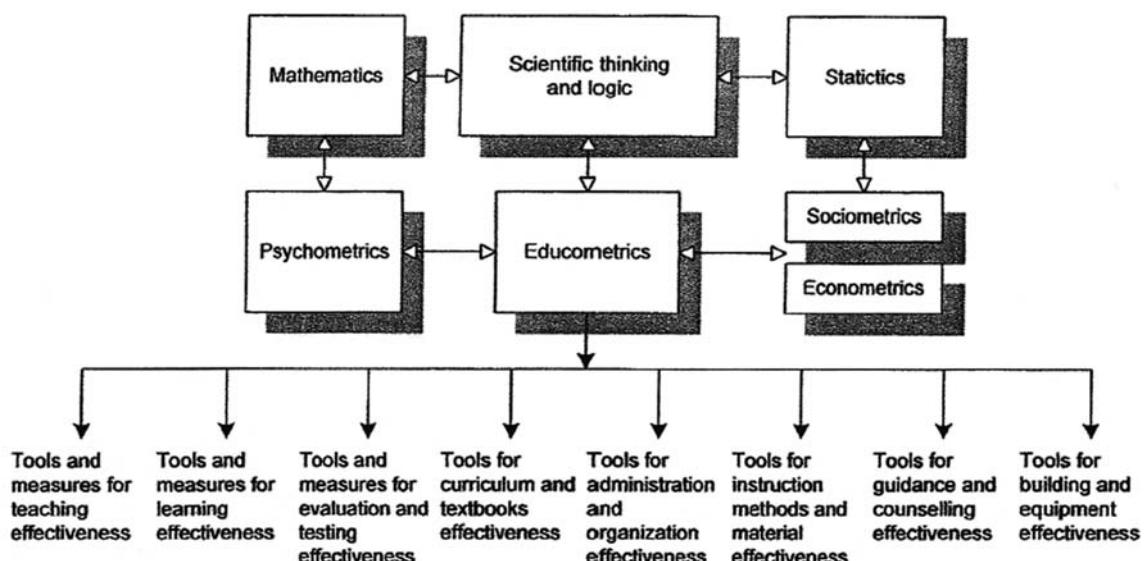
Model No.3: Variables for Eduometrics

The next step is to understand the definition and scope of Eduometrics in the scientific study of education as a total process. How far would it be different from psychometrics? What would be the areas of its application? These questions need a careful explanation.

Eduometrics deals with all types of variables (see Model No.3). It has to develop both qualitative and quantitative tools of measurement related to the process of education. All types of tests, scales, checklist criteria, standards, specifications, mathematical formulae, etc. would be within the scope of

Eduometrics. Even the tools of psychometrics of metrics of any other physical, normative or social science applied to educational procedures and problems will be within the scope of Eduometrics.

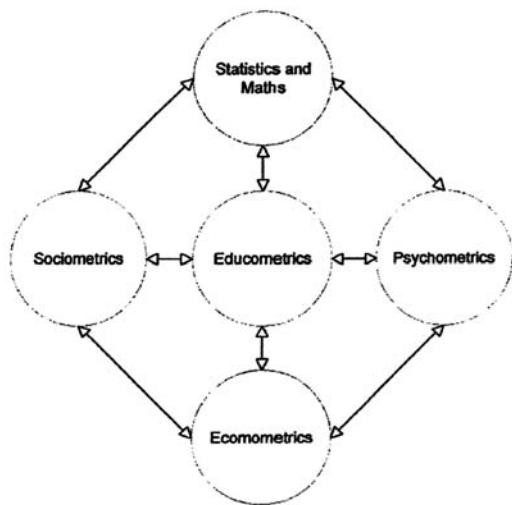
Eduometrics has its genesis in scientific thinking and logic as shown in Model No.4 Mathematics and statistics, which are two abstract measurements techniques only supply the basic tools, procedures and formulae for measurement in all the social sciences, including education. They serve as senior guards for all the measurement problems in every branch of knowledge.



Model No.4: The scope of Eduometrics and its bearings

They are the sources for evolving the methodologies of measurement in education, psychology, sociology, economics, etc. They are the creditors to the fields like

psychometrics, sociometrics, econometrics and Eduometrics. However they are interrelated to each other as shown Model No.5.



Model No.5: Inter-relationship of Eduometrics

While all the latter are the borrowers of the above normative disciplines, among themselves they have a peer-group relationship. Eduometrics will be considered as anew and junior most peer as it has yet to fully develop and grow in stature like other metrics.

So far as the application of Eduometrics is concern, it includes the preparation of various types of tools and measures for judging the effectiveness of teaching, learning, and testing. It also includes the preparation of criteria for effective curricula and textbooks, effective organization and administration, effective guidance and equipment, method and material. In fact, it will cover all the aspects of education wherever measures will start with identification and classification of variables and move forwards the precise measurement and prediction of results.

Some Applications of Eduometrics

An attempt is made to deal with the practical applications of the new discipline of eduometrics. We will see how eduometrics will help in developing appropriate tools, measures, criteria, standards, formulae, test and models to measure the different variables of education. These techniques of measurement can be both qualitative and quantitative. Let us be clear that these tools are hypothetical and so they should not be taken for granted as the standard tests of measuring educational variables. It needs to be noted that Psychology, Sociology and Economics also had to undergo the same procedure and then with objective research findings based on scientific investigation only, these behavioral sciences could develop their standard metrics and refined tools to measure their concept and different variables. However, all the tools and model of psychometrics, Sociometrics and econometrics are accepted as part of eduometrics wherever their application is possible.

Specifically, Eduometrics has to prepare tools in eight board areas that indicate the variable of the total educative process. It tries to measure effectiveness of these variables in a scientific manner of measurement. The steps are as follow:

- (1) Identification or location of variables or factors.

(2) Specification or definition of variables or factors.

(3) Determination of specific unit or terms of measurement.

(4) Formulation of tests or tools of measurement.

(5) Derivation of relationships or formulae for application or use.

The following list shows some broad areas in which Educometrical devices are to be developed.

1. Teaching Effectiveness

2. Learning Effectiveness

3. Evaluation and testing Effectiveness

4. Curriculum and textbook Effectiveness

5. Organization and administration Effectiveness

6. Instructional method and material Effectiveness

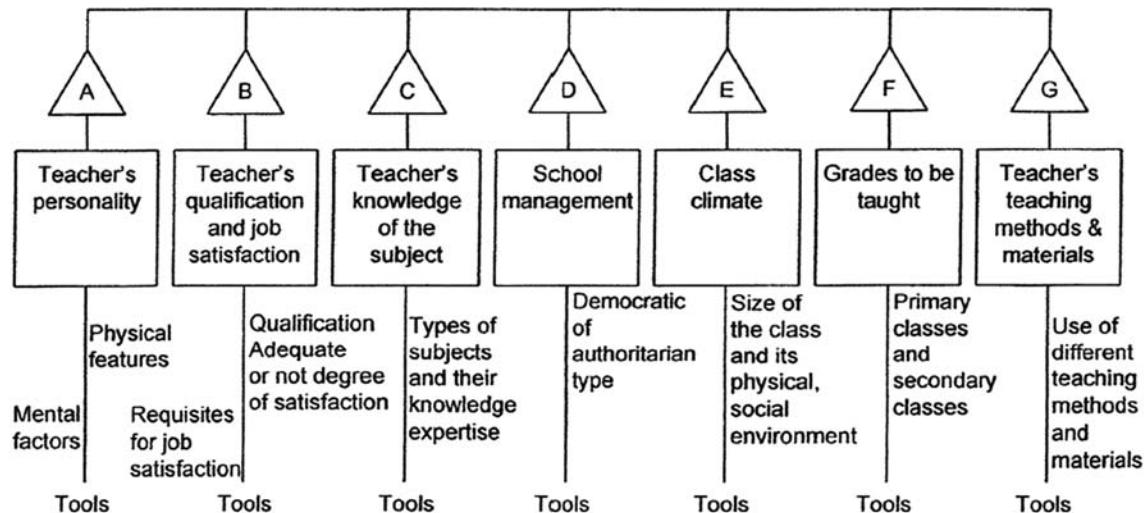
7. Guidance and Counseling

Effectiveness

8. Building and Equipment Effectiveness

In order to understand the general approach of Eduometrics in these eight areas, the first areas namely, Teaching Effectiveness, will be discussed in detail. Approach is practically the same for other seven areas.

In the first step, detailed identification and proper definition of effective teaching is to be worked out. For instance, teaching is effective to the extent that the teacher performs that are favorable to the development of basic skills, understanding, comprehension, desirable attitudes, accurate judgment and adequate personal adjustment to the student. The competent teaching is a complex phenomenon, which depend upon several factors like: Teacher's personality, Teacher's



Model No.6: Teaching Effectiveness

qualification, Teaching's experience, Knowledge. School climate, Classroom climate, grade-level of the student, methods and material use by teacher etc. are as shown in Model No.6.

The next step is to fix up the units. The tools, test and measurement techniques will be developed for different variables for the quantification of Teaching Effectiveness. Then total score will be calculated.

For better understanding and clarity, each of the component of Teacher Effectiveness is described as follows:

1. Teacher's Personality score (TP)

based on

- a) Measurement of physical features.
- b) Measurement of mental factors.

2. Teacher's Competency score (TC)

based on

a) Measurement of qualifications and achievements.

b) Measurement of job experience and skill.

3. Teacher's Subject Knowledge score (SK) based on

- Measurement of subject knowledge through various achievement tests.

4. School Management score (SM)

based on

- Measurement of democratic or authoritarian characteristics of school management.

5. Class Climate score (CC) based on

- Criteria for classroom environment (physical, social and cultural).

5. Grade Level score (GL) based on

- Measurement of aptitude and ability of student in grade to be taught.

6. Teacher's Teaching Methods and Materials score (MM) based on

- a) Measurement of efficacy of materials.

- b) Measurement of efficacy of methods.

After getting the scores of these components and assume that each factor have equal weight. Teacher Effectiveness can be determined by the following formula:

$$TE = TP + TC + SK + SM + CC + GL + MM$$

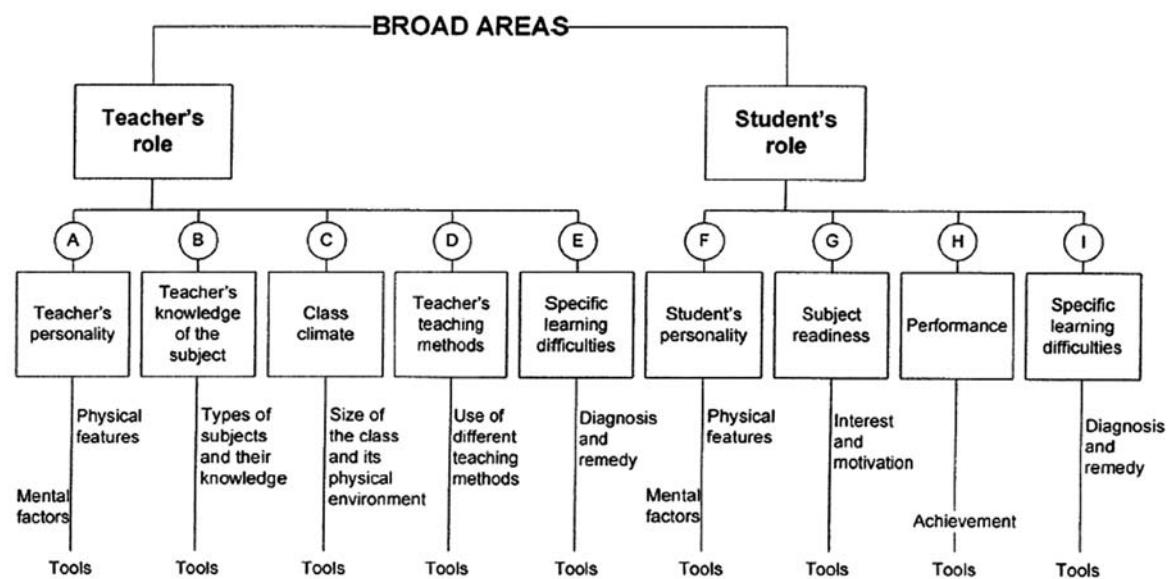
If we can put values for each factor, we can get Teacher Effectiveness in Figures. Teacher Effectiveness score (TE) in the school can be calculated on the following rating of seven factors listed below:

Factors	Level		
	High	Average	Low
Teacher's Personality	3	2	1
Teacher's Competency	3	2	1
Teacher's Subject Knowledge	3	2	1
School Management	3	2	1
Class Climate	3	2	1
Grade Level	3	2	1
Teacher's Teaching Methods and Materials	3	2	1
TOTAL	21	14	7

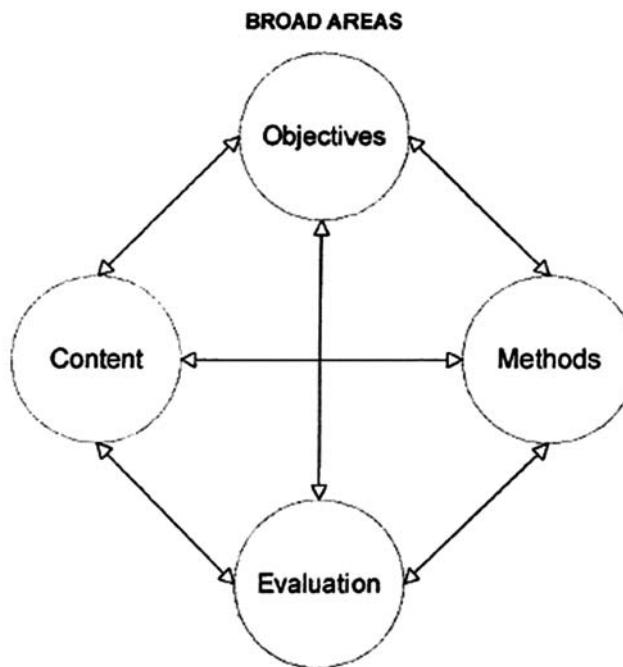
School with high TE has score of 21 points. School with above average TE has score between 14 and 21 points. School with average TE has score of 14 points. School with below average TE has score between 7 and 14 points. And school with low TE has score of 7 points.

In the same manner of all the remaining seven areas can be determined. Board areas of Learning Effectiveness, Curriculum Effectiveness, Administration and Organization Effectiveness, Method and Material Effectiveness are shown in Model no. 7, 8, 9 and 10.

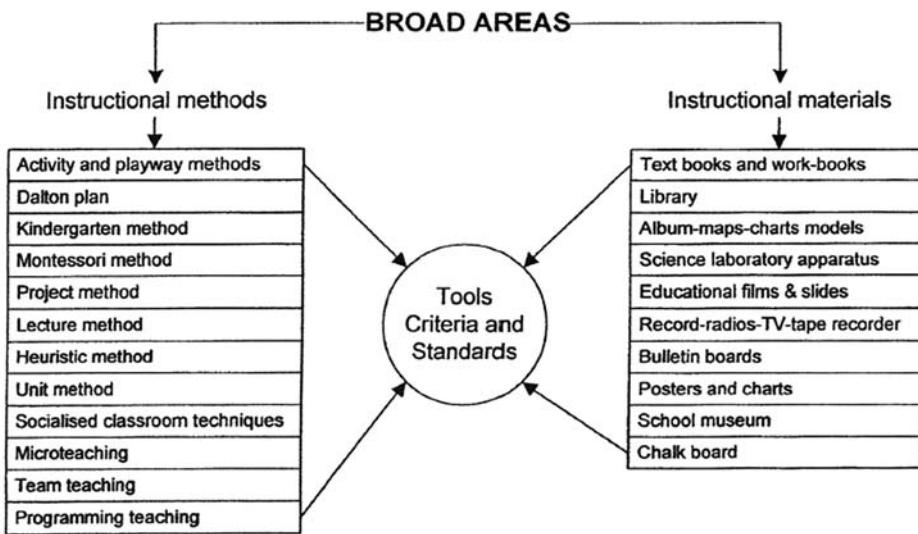
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Class Climate	3	2	1
Grade Level	3	2	1
Teacher's Teaching Methods and Materials	3	2	1
TOTAL	21	14	7



Model No.7: Learning Effectiveness

Elements of Curriculum construction

Model No.8: Variables of curriculum effectiveness



Model No.10: Instructional methods and materials Effectiveness

Some Educometrical tools developed are listed below:

1. A tool to measure the Organizational Climate of Schools (Halpin's OCDQ)
2. Carlson's tool to measure rate of adoption
3. Mill's inventory of change-proneness
4. Roosa's scale of adoption
5. Tools to measure educational system planning (Kaufman)
6. Interaction analysis matrix (Flanders)
7. Marion's scale of innovations
8. Taxonomy od educational objectives (Bloom)

Suggestion for further development

In order to see what new concept of Educometrics get proper recognition and becomes a useful branch of education, there

is a great need that the different agencies and organizations at different level should take up this idea and make popular. Educometics is an infant discipline to be developed by the educational thinkers and researchers. It should grow well to stand on its feet and then gradually grow to achieve that vitality that will make it strong and energetic branch of education. Once it is developed, it will serve the cause of education in the most scientific manner and place education in the category of the other behavioral sciences.

There are some steps which suggested for development of the new branch of Educometrics as given below: Faculty of Education.

3. Educometrician, as the behavioral scientists, can be a topic for scientific enquiry in order to decide his or her role, qualification and duties.

1. A detailed and comprehensive study of Eduometrics should be undertaken at M.Ed. and Ph.D. level.
2. An investigation should be made into the areas comprising Eduometrics and its bearing to various aspects of education.
3. The systematic work of constructing and standardizing some of the tools of Eduometrics should be immediately start by the Faculty of Education.
4. Eduometrician, as the behavioral scientists, can be a topic for scientific enquiry in order to decide his or her role, qualification and duties.
5. Encouragement should come from different public and private agencies to start systematic research project in the different aspects of Eduometrics.

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