The SEstatNet Perspective - from a Statistical Applied Toll towards a Whole Educational Tool

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Abstract - **This paper describes and analyses the pedagogic project implemented by the Applied Statistical Laboratory (LEA) from Informatics Department of Federal University of Santa Catarina – Brazil, during the last ten years. The pedagogic project called Expert System for Supporting Statistics Data Analysis in the Web - SEstatNet, concerns to the development and implementation of a computer environment tool applied in education. It leads with virtual classes and pedagogical interactions looking to the Brazilian government perspective in terms of distance learning approach. Here it will be focused the SEstatNet pedagogic perspective at highlights of 'Complex Thought' in Education following UNESCO cathedra which defines a new profile to nowadays education under globalization perspective. Conclusion points out SEstatNet has a good educational structure supporting pedagogic directives in accordance with UNESCO perspective transforming this network tool in a complete educational implementation. However it is remarkable its potentiality is direct related with the adopted educational model because each tool is a part, and only a part, of a whole educational model.**

Index Terms – Complex Thought in Education, Educational Tool, Pedagogic Tool, SEstatNet Tool, Teaching/Learning Environment.

INTRODUCTION

The Statistics and Applied Lab – LEA belongs to Informatics and Statistics Department – INE from Federal University Santa Catarina – UFSC. It develops projects to increase statistical knowledge from graduate and undergraduate students in higher education. Since 1996 LEA includes multidisciplinary teams and students with the aim to develop softwares just supporting educational demands in statistical analysis of data. From classroom activities to distance learning, LEA answer to Brazilian demands in education. On the last years, Brazilian Education and Culture Ministry has stimulate the creation of distance learning undergraduate courses and / or disciplines under the order n° 2253/October 2001. On this direction, LEA migrates from classroom support statistical educational software to a complete distance learning model. The main objective is to expand the pedagogic application with coherence with new trends in education allowing reuse and extensibility to broad educational context vertical (several level of skills) and horizontal (several knowledge domains) sense.

SESTATNET HISTORIC OVERVIEW

SEstatNet is a web educational environment that gives support to statistical analysis of data in learning process. It allows the migration from traditional classroom activities to alternative virtual learning process.

The UFSC educational experience in statistical analysis refers to disciplinary demands occurring in several graduate and undergraduate courses. The first users of SEstatNet have came from Mechanical Engineering, Chemical and Food Engineering on undergraduate level. Both courses belong to Technological Center- CTC from UFSC.

The aim of SEstatNet experience is to offer the more complete supporting tool as possible. First of all it has covered pedagogic demands in Engineering courses, but, it can be adapted to be reused in other knowledge areas, like health and so on.

Since 1996 students from undergraduate and graduate courses have developed projects and thesis contributing to increase potentiality to teaching/ learning in statistics domain of knowledge with the support of this expert system. The first software version was called Statistics Expert Systems - SEstat. It has used Statistica, a soltware from Statsoft. This first version has dealt with face-to-face lab teaching/learning activities in engineering education in Engineering, Computer Sciences and Information Systems undergraduate courses from UFSC scope for several years. In the year 2002 the first collaborative work and distance learning version of SEstat is born. SEstat now migrates to a web version, titled SEstatNet. The first SEstatNet web version has incorporated Java 2 platform with several gains concerning flexibility. In the year 2005 it was implemented also in Pearl and PHP language. SEstatNet at least constitutes a dynamic environment, and, as times go by, it includes new performances by collaboration between internal and external users.

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SESTATNET PEDAGOGIC PROPOSAL

The pedagogic goal of SEstatNet is the student development in teaching/learning activities in statistics domain. It begins with the definition of a subject, a free theme. After the definition of theme of study, the data collection is structured in a data base and SEstatNet is able to interact with the student about the mathematical results and the statistical analysis of data base entrance. The SEtatNet offers to students a knowledge data base with rules representing a statistical data analysis of a specialist reasoning. This data base is generated by the system and student interacts with it using questions/answers to support self analysis of data. The demands of SEstatNet first implementation refer to contents of statistical disciplines and the range of implemented knowledge refers to this specific educational context. But the structure is generic to support whatever comes in the future in terms of knowledge area demands. SEstatNet has been implemented in a very traditional disciplinary curricula context. But it is now visible it can increase its potentiality as educational tool if it looks to the theoretical conceptualization referring to new educational paradigms. From disciplinary to interdisciplinary / complex paradigms, SEstatNet can suggest a kind of basic structure extensive to all kinds of educational models. Later it will be described the way this statistics tool can be converted in a whole educational tool, just by-passing pedagogic focus to cover directives in modern educational conceptions.

CHARACTERISTICS OF SESTATNET TOOL

Considering the main objective of SEstatNet environment is to give support to teaching/learning process referring to statistical analysis of data, its structure must embed some essential characteristics to be potential transportable and expanded as times go by. They are four desirable characteristics:

- **To be a Flexible Data Base**: student establishes own data base. Several data sets are disposable. This way, students can easy practice the generalization of statistical knowledge;
- **To be an adequate tool of statistic data analysis**: SEstatNet not only recommends an adequate statistical method for each data characteristic, it also SEstat net implement each method and shows the statistic results contributing to develop student conceptual reasoning. Students go from the problems to definition and conceptualization aspects with SEstatNet support.
- **To show the way of each interaction of the learning tool**: from data type definition till statistical results, each way is transparent allowing student observation. Alternative paths are also presented to student stimulating generalization of knowledge in statistical reasoning.
- **To help student in accordance of different context demands**: students can each moment access several kind of information under system demands. Student can recognize and catch statistical contents in accordance with own reality.

Nowadays, disciplines covering Statistics domain ministered in department of Informatics for all UFSC context offer new pedagogic possibilities using SEstatNet support tool. Besides classroom activities, students can work by themselves calling teachers when it is necessary. Now the tool support not only face-to-face tasks but also distance learning tasks in education process. This way, disciplines, also following very traditional curricula trends, are open to new pedagogic implementations. In addition, this tool application facilitates migration from passive traditional classroom activities towards pro-active teaching/learning procedures. Students are stimulated to built self knowledge through observation, implementation and analyses of statistical problems. Figure 1 shows an example of output screen after data entrance in the statistical method using SEstatnet teaching/learning purpose.

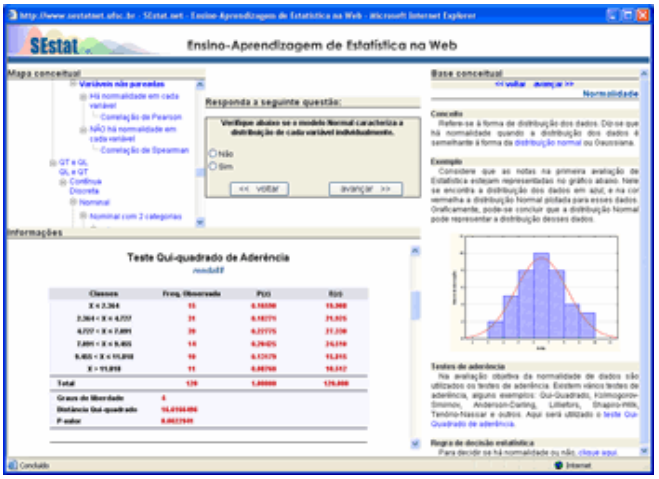

FIGURE 1
EXAMPLE OF SESTATNET OUTPUT SCREEN

USING SESTATNET TOOL IN THE UFSC EDUCATIONAL CONTEXT

The Informatics and Statistical department – INE belongs to the Technological Center of Federal University Santa Catarina. It offers about 14 disciplines concerning Statistics domain of knowledge, for practically all undergraduate courses and also post graduate programs. Those disciplines are divided in 9 correspondent statistics subjects. Table 1 illustrates a list of the several disciplines in undergraduate courses. They are divided in practical or theoretical focus spending an amount of time in classroom activities per semester. Those disciplines perform about 1602 hours/semester aggregating more than thousand students. The educational model, in the case of most totality of UFSC courses is disciplinary focused. The disciplines from Statistic domain are usually inserted in the early years of academic curricula. Nowadays, SEstatNet supports all disciplines, with

theoretical/practical, or even exclusive theoretical focus. SEstat version and SEstatNet web version are present as a pedagogic tool support for long years. And, recently, SEstatNet emerges as a support pedagogic tool also to new demands in education. Its scope is going to be extended to distance learning and other teaching/learning contexts. His pedagogic structure is dynamic allowing students, open way, to convert theoretical knowledge in practical resources under the virtual environment orientation in pro-active pedagogic development. Student can dispose time as own convenience and to adjust with the formal activities at university. After a decade of teaching support, SEstat and SEstatNet are available to all mentioned subjects referring to statistics disciplines of the curricula.

TABLE I
STATISTICS DISCIPLINES IN UNDERGRADUATE CONTEXT OF UFSC USING SESTATNET

DISCIPLINE	FOCUS THEORETICAL / PRACTICAL (T /P)	NUMBER OF HOURS PER SEMESTER (T/P)
1- Statistic methods	T / P	45 /9
2- Probability and Statistics for Technological Area	T	54 / 0
3- Applied tatistics for Human Sciences	T	72 /0
4-Applied Statistics	T / P	56/16
5- Applied Statistics for Social Sciences	T / P	60/30
6- Introduction to Statistics	T	72 /0
7-Applied Statistics to Biological Sciences	T / P	54/18
8-Probability, Statistics and Stochastic Processes	T	72 /0
9-Statistics and Informatics	T / P	64 /8

THE SESTATNET AND THE "COMPLEX THOUGHT" IN EDUCATION

As it was already mentioned, the SEstatNet born as a didactical tool for giving support to undergraduate disciplines. Because of this, the *complex approach* formulation [1] applied to education wed with SEstat proposal, increasing its potentiality without lack its already developed implemented pedagogic structure. Besides traditional curricula support, SEstatNet is able to expand educational possibilities. It can support also new kind of curricula proposals.

What is a complex model applied in education? How a pedagogic tool can be inserted, harmonic way, in complex thought proposal?

The complex view in education, including technological domain, presupposes broad themes as object of study. The object of study is then able to embed, from society to technological issues/projects. Following Morin [2], "*complexity means different, but inseparable elements,..., like the economic, the politic, the sociologic, the psychological, the affective and the mythological...*", and here, it can be added also the technological element. The technological project under globalization perspective must to be treated as a project belonging to a theme. A theme is a meta knowledge category which contains projects to be implemented. The meta level contains abstract categories present in the day-by-day classroom activities all together. Morin also refers to complexity as *what is treated together with its wide context*. The Thematic Orientation focus β] is a kind of Complex Thought implementation and it has been implemented in some disciplines from UFSC local context in disciplinary curricula implementations. This is an important aspect because it reinforces the generality of this theoretical formulation independent from curricula focus. The complex model considers education as a complex system. Education category contains members (both teachers and learners), methods and tools disposed around a central focus - the theme of study [4]. In this approach a tool is a category of the whole educational process. The model enhances tool is an aspect belonging to the whole process. This way, SEstatNet highlights as a resource to be combined with all other pedagogic instrumental resources, including traditional ones. Generic way, a tool, as a pedagogic resource, is independent from technological aspect but it is considered its presence is welcome just to support diversity in teaching/ learning instrumental options. The aim of a pedagogic support tool in complex educational model conception is to cover different styles of learning and, also, to offer multiple times dimension in students knowledge bind process [3].

Complex approach educational model considers knowledge as a central directive. It is remarkable that the traditional disciplinary curricula is not excluded referring to complex approach implementation. It all depends on the relationships between disciplines and teachers teams. However, potentiality of results will increase if curricula itself is treated as a complex knowledge approach system.

It appears it is possible to wed theoretical foundation of complex thought formulation and SEstatNet application. The SEstatNet central guideline is to stimulate students to propose and to develop projects in accordance with self interest. Usually, student can choose a free theme of study concerning a discipline from his curricula. Now this issue come to be very important to assure theme of study is already complex to

support the theoretical presupposes of Complex Thought. Now it is important to reinforce this character of broad themes to help students to define the complexity of object of study (theme). An educational environment points out it is necessary to combine the complex knowledge focus with the discipline contents, in the case of disciplinary curricula focus.

THE SESTATNET PERSPECTIVE IN EDUCATION – FROM A STATISTICAL APPLIED TOOL TILL A WHOLE EDUCATIONAL TOOL

Several forces are meeting point in educational perspective combining SEstatNet experience, Thematic Approach experience and decades of classroom experience from the teacher point of view and from the students demands. Some products of the SEstatNet project includes several academic works [5]-[8]. SEstatNet development is in accordance with nowadays professional profile demands which stimulates an open/interdisciplinary focus also in technological curricula. In the case of Computer Sciences domain, it is visible the migration to complex systems over the last decades. Consequently, Statistics knowledge subject demands are increasing in complex information systems. Statistics insertion in those models reinforces the theoretical importance of applied maths knowledge and its extensibility to all knowledge applied domains. If SEstat first versions contributed to give a practical support in classroom activities without discussing about educational model itself, nowadays it is visible its potentiality, as a pedagogic tool, will increase if it align with the complex approach in education.

CONCLUSIONS

SEstatNet pedagogic project is enough generic to support directives in accordance with UNESCO perspective transforming this pedagogic implemented tool in a complete educational implementation. However it is remarkable its potentiality is direct related with the adopted educational model because each instrumental pedagogic tool is a part, and only a part, of a whole educational model. SEstatNet is useful in traditional disciplinary curricula focus, and it will be still better if curricula focus migrates to a project/thematic focus because of the additional resources to lead with global view under thematic viewin education.

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