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## THE STATE OF ART OF SOLID MECHANICS WEB PAGES

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***Resumo:** The objective of the present work is to present the state of art of solid mechanics web pages which are produced for mechanical engineering courses in Brazil. First, the paper shows the use of web pages as educational and research tools and the intensity of resources such web pages might provide. After, the focus will be to point out a general view of solid mechanics web pages already in activity and the needs demands by this discipline from the information technologies, showed issues and teaching methodology.*

***Palavras-chave:** Web page, Solid mechanics, Information technologies*

### 1. INTRODUCTION

Since the first moment that the man developed what called today "critical thought", the knowledge accumulation (it is for rudimentary experiences, attempt methods and mistake and discovery of the basic forces of the nature as starting point for their use for the humanity's advantage) it appeared as one of the basic beginnings for the construction of one of the factors that differ us of the great majority of the species that live together with us in the Earth: the culture. This culture that, in one of their first definitions it would serialize "the compound that it includes knowledge, faiths, art, moral, laws, habits and other aptitudes and acquired habits for the man as member of the society" (TYLOR, 1974).

With passing of the centuries, the appearance and the introduction of concepts that took to the civilization state, the social and technological revolutions and the denial of the theological concepts as only truth about the human evolution they altered the man's *modus vivendi*, and they took him the apprenticeship of great use of intellectual capacity, concentrating the acquired knowledge and using him/it to put the own man in the hegemony of the evolutionary apprenticeship (SILVA, 2003).

One of the basic premises for the formation and the development of the cognitive process is exactly the search and the strainer of that knowledge or acquired information.

ROUSSEAU (1999) affirms that the human intelligence possesses limits. Still according to the author, what must be chosen should be taught, what is really useful to be passed ahead in knowledge form. And the one that should be learned cannot be imposed, the need to learn should be worked in the measure in that the desire to acquire the knowledge blooms in each individual.

Jean Piaget was interested in the study of the cognitive processes, becoming a researcher of the theory of the knowledge (SILVA, 2003). According to the author, the construction of the knowledge it is an absorption procedure of the new to the already existent. Of this it sorts things out, there is a knowledge accumulation, always originating from the individual's interactive experiences with his half and of his own interpretation as for the new.

In the research about the construction of the knowledge, we should also mention a contemporary of Piaget, Vygotsky. He developed his theory tends as base the individual's interaction with the middle, the construction of the knowledge through the interactionism (SILVA, 2003).

Vygotsky proposes the internalizing of the knowledge through the cultural mediation. The functions psychological superiors are built along the man's social history, of his interaction with the world. They depend then on the learning. While I subject the man conscious does not have access to the knowledge, but just a mediated access.

In that way, the knowledge depends on an interaction mediated by several relationships. It is not seen as an action of the subject about a reality, but a mediation done by other subjects. It is the culture that supplies the systems of representation of the reality.

But how should that knowledge be transmitted? The how that knowledge is useful for the student's formation? Or better: being taken into account that in every thought line it possesses their considerations and limits, borders exist for such knowledge?

When the knowledge is not just used to delimit a border between the teacher and the student, when it is used to create bridges among subjects not only academics, but daily also, when the knowledge urges the student to expand their sensorial limits, grows up a bi-directional factor between the teacher and the student, doing with that the barriers that impeded the growth of this don't just eat a product of the imposed knowledge, but as a knowledge creator, break up and give place to the critical and renewable thought.

The will of establishing a teaching-learning bond cannot leave of a formal imposition of the educator. The induction to the expansion of the cognitive process should only happen if there is the curiosity and/or the student's will. The master should habituate the student to have perception and if it impresses with the sensitive truths, and for that it should put problems to leave him anxious and restless and make to him think. ROUSSEAU (1999) leaves that well delimited when affirming that the education should promote the spontaneous development of the sensibility.

It owes if it takes into account also the discussion of the contents, that is a resource that contributes so that the students act on learning, once it provokes them, it urges them to elaborate hypotheses, to look for information, to confront different ideas, different explanations, to notice the limits of each explanation, besides of those that they already possessed, in the perspective of the construction of knowledge. In that sense, the knowledge cannot be divested of elements of the life personal, social and cultural. The academic contents win meaning when bridges are built among what is learned in the academy and the daily DALAL *et al.* (2000).

## 2. EDUCATION AND RESEARCH THROUGH WEB PAGES

Many of the youths that today give their first steps in the academic life probably never had contact with a duplicating machine and either they know what is a stencil. Today, the children and adolescents that begin their literacy courses and the medium teaching probably never had contact and nor they know as researching themes in a big library, out of the school circuit. Lately, until the carbon paper becomes more and more forgotten and quickly it is going stopping being an item in the material list that the schools distribute in the beginning of the school year.

To the nostalgic, the present: with the time that we lost with the duplicating machine, the carbon paper and the endless searches in having covered in dust encyclopedias, today, we can use to maximize our learning or even to keep for the tasks of the day by day. With the most important character's digital blessing of the it finishes industrial revolution, the computer, some services that demanded temporary and financial costs sometimes incompatible if they turned more accessible.

With the development of the services of information, in the beginning tends the radio and soon after television as increasing agents, the education programs were introduced and presented as a new middle of acquisition of knowledge, beginning to do part of the classroom, even this classroom being home, tuned in an educational channel.

The computer, introduced in the education system in the origins of the computer science, he almost had the same function of a typewriter (he eats advantage of the paper economy - when the fingering is wandered, which is used 'backspace' instead of playing the leaf in the garbage). Soon after, the first softwares returned to the pedagogic area were developed, but his use continued restricted. The relationship that existed in the education programs in the radio and in TV they were almost the same ones, the reference was still in the old pedagogic bases, in the teaching and in the evaluation of what was taught.

But, the computer started to be not only one more channel that repeated the information in a specific schedule, like TV study course. The popularization of the internet (in Brazil, the starting from 1995) it was key part in the change of this panorama.

As tool for the learning, the internet we met now is more than stipulated. Although, it is access is not guaranteed the all of the individuals (most of the time for fault of the social exclusion, that takes to the digital exclusion), at least in the great centers the schools under the state governments' aegis already use the digital means for the education. From the children school, with sites that use a playful language, until the great education portals, tends their content returned to the formal teaching or no, the capacity of the personal computers of their simplify tasks, mainly those that involve certain demand storm, allied to the current boom of the information (today tends the internet as it more famous representative), it is done every time - if no more necessary - more requested at the classrooms.

It is unquestionable the contribution that (as an auxiliary to the development of the cognitive process and communication road) the Great Net offers. But, when the focus of being a dynamic repository of information is "perverted", the discussion has beginning. In discussion forums, "Usenet" and in the "World Wide Web", it has an accessed to an enormous variety of content of the most several and it can grow up pages that speak from the Chinese cultural revolution to vectorial mechanics or of the solids. But that same amount of information hindered, in a recent past (from the popularization of the internet) the search for a specific subject.

With the coming and, later, the growth (or popularization) of the use of research tools in the internet, the possibility of we locate information that would need more refined filters and a larger time of search, today it is summarized in microseconds so that we obtain a colossal range of answers (vide the case Google, Yahoo Search, MSN Search, among other). With that

access easiness and of having resulted for search, students that they used these resources to enrich their home work and their exams, they started to copy all of the information and to give them to the teachers as if they were of own authorship. Anything plus, anything minus, that plagiarism.

In academic terms, the misrepresentation is so serious that some institutions already begin to invest in programs to avoid problems of that nature. As example can mention the system anti-plagiarism created by the University of Innsbruck (<http://www.uibk.ac.at>). According to the agency of news EFE (<http://www.efe.es>), in 4 of 9 evaluations, proofs or revised house works in an experimental way for the developed software, they were detected "appropriation of ideas in a fraudulent way". That software divides the exam investigated in parts and it seeks similar texts in other texts that are in the world wide web. In what it concerns the punishment for cheating, when the student is captured he is suspended automatically by one semester, tends study the same discipline that he cheated again.

The plagiarism is the factor that serves base for the resistance of the "traditionalistic" calls of the pedagogic way (although some rivals prefer to call them of reactionaries), that possess a certain rejection for the use of the internet as a research base. The argument is, with the readiness of themes already ready and formatted, the student ends up copying the texts integrally or only changing some words (this is the famous technique "copy and grazes on").

But, that procedure actually is a very small problem if we weigh the fact that WWW is already supplying several needs that the old pedagogic systems didn't get to work. Now, how does the problem of the call "cheating" in a proof or work in the classroom is solved? Suppressing the talent of the speech or of the student's writing that gives or does it receive or censuring it through coercive actions?

The answer is obvious. Of course needed regulations, conventions but we should not leave that a grain of rice jams the great wheel of the pedagogic improvement.

It would be to foil the capacity of WWW if we just talked about it direct usefulness, with the content strictly education. Indirectly, almost all of the applications in net can be used for the education end. The services today offered on-line. They facilitate not only the life of the student, but of the teacher also. Off-line material (conventional books, for instance) that before was difficult finds in the country today can be ordered in some clicks of the mouse. Conferences and classes through webcams can be supplied for the whole world. That without speaking in the easiness that the e-mails brought when we spoke in communication...

No, the paper and the pencil won't leave (and nor they owe) of being used, in detriment the other materials that have their glorious moments. We will continue to buy books in the bookstores; the pleasure to browse a new book should be maintained by several decades. But there are also no doubts that the use of the computer science and the coming of the internet inside of the pedagogic plan, if no revolutionary, is extremely beneficial.

SILVA (2003) mentions the changes in the teaching-learning process, with the improvement of the teaching techniques at the distance. If yesterday, the focus was in the teacher's illustration, with expository classes, contents default, just based on the transmission of the information, in the autonomous work, with fixed schedule, centralized organization and local inclusion, today the focus is in the student, with the class model based on the student's discovery and in the change between the teacher and the friends and class, with custom contents, based on the facilitation of the access to the information and the work in group, with the flexible calendar, decentralized organization and local inclusion.

Teaching at the distance is not only set accessibility of texts and books. Teaching at the distance is not just to put an on-line system that it generates questions and it evaluates the results. Teaching at the distance is not only to approve for the knowledge of the specific content of the course. The interaction, the flowing verbalization, the contribution for the

growth and the adaptation of the offered material, all this should be taking into account, and all this should be part of the student's production and of the teacher's evaluation / tutor.

### 3. LEARNING EDUCATION AND SOLID MECHANICS

The electronic pages in the teaching of engineering mechanics are implemented in the intention of showing the contents of one or more disciplines, notes of class, exercises and links on the approached subjects (RIOS, 2003). The same ones are also used in the disponibilization of softwares and multimedia that allow forms of visualization of the contents, the ones which a lot of times need a certain abstraction degree on the part of the students for his learning (RIOS, 2003). Last, they stand out experiences of virtual laboratories, which are adopted for the students have contact with the procedures of the rehearsals and explore the possibilities of obtaining of results before the practical execution (GIL *et al.*, 2000) (SUK *et al.*, 2003).

We have to emphasize that the education computer science does not have the pretension of to transmit a larger amount of information to the students, but transform the education process and to facilitate the learning (CAPELI and LINDEENBERG NETO, 2003).

In solid mechanics, the use of the multimedia resources in the teaching of this content becomes very important, because several subjects of solid mechanics demand certain abstraction degree, which can be worth of these resources (DALAL *et al.*, 2000) (FERREIRA, 2004).

For web pages in solid mechanics, there is not the need of the sounds. With this, the media needs will be concentrated in the adoptions of images, videos, chats and discussion forums.

The use of images and videos (in the format of simple animations) are fundamentals for the understanding of the application of the loading of the system, as well as the evolution of the linear strain and rotational. Understanding these varied, the modeling of the system is processed in an easier way, because the problem of this subject is in the fact that the ways educational printed papers do not allow this visualization type, being very difficult the interpretation of the application of loading as the one of pure bending.

The chats use and discussion forums are fundamental so that the users have possibility to change ideas, to share and to solve doubts among them and with the responsible persons for the web page. These two tools facilitate the cognitive process, because they approach users and responsible for the propagation of that knowledge, allowing manages new knowledge perfectly shared for the internet.

Other important characteristic for learning in solid mechanics is change values in examples. This is make through field on the user put the desired values or for variable displacements for mouse drag.

FERREIRA and LÁZARO (2004) detach the use for Java, in format of the Java Applets, because this is an open platform and expansible for the education systems. The Java Applets allow the visualization in abacuses or graphics trace's and are automatically installed and executed as web page part.

Certainly, many doubts would be solved in solid mechanics with the help of the information technologies, because the visualization of the phenomena's occurred in the material's deformation and the possibility of sucessive repetitions, as well the act of consult several subjects at the same time, helps the student to construct his knowledge, conglomerating the mathematical shaping and its boundaries and initial conditions.

SORIANO and LIMA (2004) attest that the curriculum national guidelines of the degree course in engineering establishes that the whole engineering course, independent of

his/her modality, it should possess in the curriculum a nucleus of basic contents, a nucleus of vocational contents and a nucleus of specific contents that characterize the modality.

In the relative part to the nucleus of basic contents are related topics that should be included in whole the engineering course, independent of the modality. Among these topics it is had a denominated “solid mechanics”, to the which refers to the mechanics of the rigid bodies and the mechanics of the bodies deformed. The mechanics of the rigid bodies is offered under the denomination “mechanics” or “static” and the mechanics of the bodies deformed is offered through the title of “solid mechanics”, “strength of materials” or “mechanics of materials”.

The items studied in the solid mechanics common to all of the modalities are contained in the Table 1 and firstly understands the behavior of bars and beams deformed and structures originating from of the use of these components.

Table 1 - Basic contents in solid mechanics.

Tension, compression and shear
Axially loaded
Torsion
Shear forces and bending moments diagrams
Analysis of stress (Mohr’s circle, plane stress and plane strain)
Stresses in beams
Combined loadings
Deflections of beams
Failure criteria
Columns
Energy methods

#### 4. STATE OF ART OF SOLID MECHANICS WEB PAGES

First, the number of mechanical engineering courses in Brazil and their web pages are searched. The number is 79 and all courses have web pages.

The Table 2 shows to the low index of web pages that possess didactic material on solid mechanics. Lower still it is the number of courses that offer interactive didactic material, either through of download or on-line.

Is important to detach the collection of learning object educational described by SCHEER and GAMA (2004) which are produced by civil engineering courses and enclose all the contents described in the Table 1.

Table 2 – Contents of solid mechanics web pages.

Without informations	21,5 %
Contents of subject without details	40,5 %
Contents of subject with details	30,4 %
Contents of subject with details and teaching materials printed	5,1 %
Contents of subject with details, teaching materials printed and dowload of	2,5 %

We believe that this occurs because the mechanical engineering education more is destined the solid mechanics in mechanical structures. However, we believe that this agreement only occurs when the basic solid mechanics is dominated basic, that is, analysis of bars and beams.

The contents emphasized for the courses of civil engineering and that are used in the introductions of the courses in engineering mechanics are more easy to be programmed through animations and Java Applets.

## 5. CONCLUSIONS

The objective of this work was show the use of the web pages in solid mechanics teaching and their forms of utilization for Brazilian mechanical engineering courses. The results show the low adoption of this tool which represents a learning process mainly based in classroom.

Then, we will make a quantitative and qualitative research with students about the use of solid mechanics web pages and to compare with those ones obtained by the use of evaluation tool proposed for FERREIRA and LÁZARO (2004).

As the result was low for web pages produced for mechanical engineering courses, we will use the web pages described in SILVA (2003) as material assistant in the next stage of the research.

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