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The aim of ICAEEdu 2017 is to provide a forum where academicians and professionals from various educational fields can share their knowledge and engage in dialogues on fostering innovation and excellence in Engineering Education. The conference is open to research and practice-oriented papers in all aspects of Engineering Education, including transdisciplinary research and active methodologies.

Contents

Building the Da Vinci's Self Supporting Bridge

Arthur Campanelli Scantamburlo[*], Evandro Lucas Moraes[♦], Gabriela Rocha Esteves[▲], Sheila Stravate Leonel[▼], Tiago Souza Rodrigues Reis[○] and Luiz Carlos de Campos[✲]

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Abstract

The building of the Da Vinci's self supporting bridge reply was a design handled by a team of students of the fourth semester of the Civil Engineering Course at Pontifícia Universidade Católica de São Paulo in combination with the Mechanics of Rigid Bodies course, given in a traditional manner, using the Project Based Learning (PjBL) approach. The project was part of the assessment process in such course. Leonardo Da Vinci was a master of innovation and Engineering. The history notes that he designed four types of bridges. The design of the self supporting bridge was the most simple and ingenious of them. Its design was developded from 1485 to 1487 attending the request of his patron Cesar Borgia, and it was to be of simple assembly by troops without woodworking skills. The design is held together by its own weight without requiring any ties or connections. When a downward force is applied to the structure the braced members are forced to interlock and tighten together through the structural concepts of shear and bending. This work was carried out in three steps. The first one was a bibliographic research on the issue. In the second step the students set up a prototype of the bridge where test and analysis were made to understand the structures behavior as result of a downward applied force, and presented it to the classmates. In the third and final step the students set up a bridge in real size and shown that it permitted and tolerated the weight of several people passing along the bridge. Each step of the work was recorded in a video, available in youtube, where the students report their opinions on the project and the main concepts, skills and competences acquired along the development of the project.

Keywords: Downward Force, Engineering Design, Project Based Learning, Self Supporting Bridge, Teamwork.

An Extension Project Experience for Engineering Students

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Abstract

This paper means to analyze the work with Engineering Students in a University extension project that propose teach robotics and automation applications for kids, improving their technological and programing interest. The project involves Mechanical, Mechatronic, Control and Automation Engineering students in a case study, the purpose is to examine if the university's classes prepare them to work with this project and how it impacts in their formation, which can be technical, personal (emotional), and/or professional.The society demonstrates the need for a graduated professional who has a formation more complete, not only technic, but also etic, humanistic and cultural, which can act with their profession in favor of the society. So, the participation of these students in this project contributes for their acting on the society with competence, responsibility and justice, helping for the construction of a prosperous, solidary and just country. This project is aligned with the Institutional Developing Plan (PDI) – PUC Minas (2011, p. 62): "This University vocation is the formation of a student competent, scientific and technically, who know act with strong professionalism and responsibility in their area and, besides, who has behavior based on the ideals of justice and solidarity." The job market for Engineering areas is inviting and the desire of the students of these areas in teaching is gradually becoming lower. The students were in direct contact with the class room, maybe for the first time as teachers, so, we can analyze if this wish for teaching was created, which is so profitable to the Academic's Institutions in Brazil, because it's a capacitation during the student's graduation. The students prepared and put in practical so many different applications using Arduino, their tasks were: prepare the content and resources to the classes, thinking in make the most of these resources; give classes and evaluate each class. The results show the values added to the students of the Engineering Courses in relation of humanistic training, didactics and social problems.

Keywords: Arduino, Engineering, Extension, Learning Objects, Robotic.

Electrical Engineering Introduction Course Using an Integrated Approach Via Group Work Viability Projects

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Abstract

This paper shows a case study about a different methodology of teaching applied in the Electrical Engineering Courses in a public university located in Minas Gerais. This document is justified by the need to reduce the student dropout rate in Engineering Courses. The article discusses the initiative that the Universidade Federal de Itajubá (UNIFEI) has used to motivate, orientate and prevent that freshmen students leave the course before finishing it, showing them the vast possibilities the Engineering can offer. For that, the university uses the course called Introduction to Electrical Engineering, which, by the instruction of the mentor of the class, is based in the formation of groups focused in the viability of Renewable Energy Sources projects. The groups are free to guide their researches and initiatives based on their needs, different of what traditionally occurs, where the master is the agent of the teaching and the pupil is the patient of this process (LEWIS, 1939). In 2015, a group called Photovoltaic Application in Needy Communities (PANC) was created, and has reached, at the end of the period, the implantation of the group's objective: a solar system in a Basic Health Center in Itajubá (MG). The methods used by the group: escalated filters on researches; integration of group with apps (Dropbox®); parallel researches to improve programmed chronogram; optimized meetings and Feedback Worksheets; Behavior Rules; development of mockups and logos, etc. are discussed in this paper.

Keywords: Renewable Energy Sources, Academic Education, Different Teaching Methodology.

Integrating Activity:

A Strategy for Development in Humanity Competences

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Abstract

Currently the job market requires a "new professional" who has a holistic formation and not just technical knowledge. In this way, Engineering Education needs to be developed under a new perspective that seeks the awakening to Engineering, making the process of teaching and learning more collaborative and promoting the integration between the disciplines through the initial periods. In this work was developed an Integrating Activity that brings a constant dialogue between theory and practice and the integration of knowledge and development of new skills. Based on the problem-based learning strategy (PBL) that builds knowledge from real problems that are open, complex and allow the student to construct new strategies to solve these problems. The activity consists of integrating all the disciplines of a semester in the solution of a practical problem, applying the interdisciplinary to motivate the student to understand the connection of all the subjects covered and how they relate in the course. The activity follows the format, starts with a dynamic for interaction of the participants and then the formation of the teams, later a real problem is provided and from it the students have to build a prototype. In order to remind or familiarize students with the concepts and phenomena involved in solving the problem, a question and answer game is carried out and to assist in the development of the prototype, a management tool is used. After the development and testing of the prototype as well as analysis of the results,

the teams create a presentation and in the round table form, where are discussed the knowledge and skills built and also shared difficulties in the development of the activity. It was tried to deal with the overcoming of the students in situations not found in the daily academic, but very seen in the companies, so that they could understand how the study of the subjects may be involved with the chemical engineer profession. From this activity it can be seen that, in the learning environment, it is vital to insert tools that prepare the student for experiences in the job market, where there won't be only idealizations, but practices that require a good technician, leader, solver of problems and with humanistic skills.

Keywords: Engineering, Education, Problem-based Learning, Integrating, Humanistic Skills.

Extension Projects and Partnerships with Companies:

Contributing to The Engineer's Professional and Humanistic Training

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Abstract

Studies have shown that continuous advances in technology and the increasing professional responsibilities of engineers require quality and skills in the practice of their activities that go beyond specific course content. The professional must have an all-inclusive vision of the potentialities and difficulties in the country. Education goes beyond the mere transmission of concepts, promoting intellectual and social development in order to stimulate creativity, critical thinking and the ability to learn continuously and autonomously by keeping abreast of changes in society. Scientific and technological development, which induces the creation and enhancement of new knowledge and techniques and their applications, requires all-inclusive human resources training programs at every level, thus explaining the reason for the development of this work. This article discusses the results of extension activities that contribute to the technical, ethical, and humanistic training of future electrical engineers, with a focus on teaching problem-solving skills, thereby enabling a transformative relationship between university and society. This analysis covers two case studies, as follows. Case 1 – an occupational safety and health management study conducted in partnership with the electromechanical workshop of the electric utility company, highlighting the importance of the university's interactions with the company and the student, and thus aligning theory with practice. Case 2 – involves a study group on Williams syndrome (a rare developmental disorder) and human genetics, which aims to provide assistance through the development of computational tools to monitor patients according to their individual diagnosis. The methodology adopted here was based on the following procedures: a) analysis of action priorities and work environment locations to identify existing risks; b) collection of field data; c) development of control measures and preventive systems in the field of workplace health & safety Engineering; d) creation of spreadsheets for monitoring the health status of patients with physical and intellectual disabilities, aiming at a complete diagnosis; e) implementation and orientation of strategic management actions; and f) result analysis and improvement proposals. This study provided satisfactory results, enabling reflections and studies in the fields of workplace health and safety, diagnostics and society, practical problem solving, and the development of improvement proposals. It can thus be stated that this work achieved its goal of analyzing the significant contribution of extension projects and interaction with companies, the development of teamwork skills, and the professional profile of the engineer, which are required in today's job market. This profile must encompass a comprehensive set of skills and knowledge in several areas of Engineering and related fields, aimed at practicing in all the fields that involve quality of life and development of the country.

Keywords: Diagnosis, Engineering Training, Extension Projects, Health, Workplace Safety.

Integrating Practice and Theory in Basic Physics Undergraduate Courses:

A New Physics Teaching Lab Proposal

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Abstract

The undergraduate basic physics courses performed in the traditional way, based in theoretical expository methods, is attracting an ever smaller contingent of students, which complain about the abstraction and lack of application of scientific knowledge. In addition, the positive impact that experimentation exerts on physics classes, when performed with a proper and well-planned didactic purpose, is largely known. Here we present a proposal that intends to insert experimental activities as support to the basic courses of physics, which is in resonance with the so-called active learning methodologies based on challenges, projects, open questions and experimental investigative practices that give students deeper levels of commitment and learning. The proposal also finds support in modern pedagogical projects of undergraduate courses in which the theoretical and practical knowledge are integrated in a concatenated and synergistic way. The first step is to employ usual physics classes to construct the knowledge based on problem solving, creating in the students the curiosity and the research spirit. After, some problems are selected, adapted to experimental projects and addressed to the research groups formed by students. As a prototype case we employed our hypothesis in an electromagnetism basic course, along one semester, where a voluntary student worked on an adapted problem about physics of capacitors and dielectrics. Based on the classical problem of a parallel plate capacitor with the inner volume equally filled with two different dielectrics, the student, under the supervision of professors, was able to expanded the canonical solution of the problem creating a solution that takes into account different filling dielectric profiles. Then, a new technique to measure the dielectric constant of liquids was proposed and implemented, employing a liquid and the air as the two dielectrics in in variable proportions. The chosen liquid was the hexane that has its dielectric properties well established in literature. The values measured in the present work for the dielectric constant of the hexane are very close the value reported in literature (less than 5% error). Furthermore, it is worth to mention that employing the new experimental approach a critical problem in dielectric constant measurements assigned to parasitic capacitance is solved. Concerning about the impacts on the student formation it is clear that, along the course, he developed sharp

scientific skills learning how to approach experimental problems from theoretical constructions. Besides the investigative approach this lab proposal incorporates demonstrative activities intending to show through simple practices qualitative and/or quantitative aspects of the physical phenomena presented in the classroom. The current stage of this proposal, which is in implementation at present days, involves theoretical refinement, adaptation of physical area and participation in calls for funding lab equipment. Finally, the results obtained up to now, support the idea that the present method constitutes both a new physics lab teaching approach as well as can be employed as an innovative proposal for the construction of a new curriculum structure of basic disciplines in the Engineering Courses. The authors are indebted with CNPq, CAPES, FAPESPA and Universidade Federal do Pará.

Keywords: Active Learning Methodologies, Investigative and Demonstration Practices, Lab Proposal, Physics Teaching for Enginnering, Theory and Practice Integration.

Interaction Between Extension and Education:

The Game of Integration in The IFMT

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Abstract

The design presented exerted a strong role of integrating labor market and students. This was an opportunity stage and recognition of the actions of the students in the Association of Artisans from Sinop/MT. Project with bias in extension has been moved to the teaching aiming at providing an opportunity for students to participate in the various steps for preparing the business plan of the house of the Artisan of Sinop/MT: enterprising and innovating with art and science. The project included the implementation and coordination of a team that Extensionist oportunizou the interaction of classes of technical courses in human resources and technical support in subsequent trade in project development, providing the interaction of theoretical and practical knowledge in the Instituto Federal de Educação de Mato Grosso (IFMT), Advanced Campus of Sinop. The methodology used in the project presents characteristics of the concept of active methodology, where Mitre et al, (2007) tells you how characteristics the presence of actions directed to the student can deepen and expand the meanings produced by their participation and also requires the teacher to permanent reflection, availability for the monitoring, which involves the emergence of unforeseen situations and unknown.

Keywords: Entrepreneurship, Extension with Teaching, Active Methodology.

PBL and Collaborative Learning Applied in The Course of Engineering of Control and Automation:

Case Study at CEFET-MG

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Abstract

The labor market started to demand from the Engineering professional, in addition to technical skills, transversal competences such as communication skills, teamwork, creativity and innovation to solve problems. To enable learning according to this market demand some of the valid teaching methodologies are Problem-Based Learning (PBL) and Collaborative Learning. In these methodologies, the teaching and learning process should not only involve the teacher-student link, but also all those who are part of the learning group, as well as the processes that can stimulate it. The PBL methodology is based on the student as the center of learning and the teacher as a guide in this process, in which problem situations are used to initiate, direct and motivate the learning of contents and the development of students' skills and competences in the classroom context. In this context, the present work aims to present an analysis and description of the application of PBL and Collaborative Learning methods in the course of Engineering of Control and Automation at CEFET-MG. In this work, we also evaluate how efficient and motivating the methods are to achieve the objectives that they are proposed, based on the testimonies of students and teachers who participated in the process of application of the above-mentioned methods. The application of PBL and Collaborative Learning involved the disciplines of Digital Systems, Microcontrollers and Control I, so that the teachers who teach these subjects offered for the students problems and projects during the semester. Teachers, especially of the three disciplines mentioned above, were available for guidance and facilitation of the students' learning process. At the end of the semester, each student group presented the solution of the problems that were assigned, and the teachers of the subjects were the evaluators of the learning process. The evaluation was based on the Processual Type, where the evidences of skills and competences developed by the students in the teaching and learning process with application of the problems are observed and analyzed. Regarding the final average of the subjects' grades, there was an increase of approximately 10% in the overall average of students in the three disciplines that applied the method, compared to the previous semesters.

In addition to the increase in the average grades of students, there was a greater homogeneity of grades, indicating a greater isonomy in the process of learning and developing students' competences. At the end of the semester, questionnaires were used where the students were able to present their opinions and impressions regarding the innovative methodologies used, as well as the teachers' performance. Also, the teachers answered a questionnaire where they exposed their impressions, difficulties and experiences regarding these methodologies. Based on the analyzes carried out in this work, through the reports and experiences of teachers in some disciplines of the course of Engineering of Control and Automation at CEFET-MG that applied the methods, it is possible to observe that the PBL and Collaborative Learning methods can be applied in an integral way in the Engineering Course.

Keywords: Collaborative Learning, Education, Engineering, PBL.

Outcomes and Teaching Methodologies in Engineering, Food Sciences and Environmental Sciences Courses After Capacitation in Vocational Education Training

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Abstract

The present article aims to describe the main outcomes and methodologies used by the LiFe Team (Learning is Fun Educational Team) composed of five teachers from different Federal Institutes in Brazil after qualification under the Vocational Education Training (VET - Teacher for the Future III) Program at the Häme University of Applied Sciences (HAMK), in Hämeenlinna, Finland. The development work of the LiFe Team consisted of motivating actions involving student-centered and project-based learning (PBL), and the use of active learning tools as well. After a 3 month training period (from April/2016 to

June/2016) at the Häme University of Applied Sciences (HAMK), in Finland, empowering in Vocational Education Training (VET), the teachers members of LiFe came back to Brazil to put in practice the plan for a better learning environment and competences acquisition process. Workshops and activities were implemented in several Federal Institute campi, located in five states in Brazil: Espírito Santo, Minas Gerais, Paraíba, Rio de Janeiro and Rio Grande do Sul. Among the actions developed, there are the restructuring of vocational education courses, workshop development involving gamification and PBL, the training of teachers through the immersion in the Finnish educational system and the PBL and gamification application in Environmental Sciences, Food Sciences, and Engineering Courses. In only 6 months after coming back to Brazil, the teachers who received training under the VET program developed and performed workshops, collaborative works, multiplying activities and other innovating techniques, some of them experimented for the first time in classroom, especially in Engineering, Food Sciences and Environmental Sciences courses. The VET program contributed to teacher innovation in the classroom by applying student centered learning and active teaching methodologies, such as the PBL methodology, origami and digital tools. Regarding the execution of the learning in the teachers' institutes, there was research and solution of problems in the classroom, with the development of numerous products and innovative solutions by the students, in addition to increasing their motivation and consequently decreases of school dropout. The multiplying actions developed have contributed to improve the quality of vocational education in Brazil, but also have represented the hope for small but significant changes in the vocational teaching approach, for better.

Keywords: Engineering, Environmental Sciences, Food Sciences, Vocational Educational Training.

Electrical Engineering Graduates and Extension Projects:

A White Cane Collaborative Development Case Study

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Abstract

Engineering graduates are entering a world where the scale of professional challenges is enormous. To be competitive and take the role of leadership in the future, the students need to understand their ethical and professional responsibilities towards the well-being of the communities and the nation itself. The engineers of 2020 are supposed to, among other competences, be capable of being persuasive in multiple social contexts, to be fluent in working with different kinds of intellectual and social capitals, and to have a high level of cognitive flexibility. All these demands are scarcely addressed by the majority of undergraduate Engineering schools. This scenario motivated us to develop a non-classical academic experience where not only the technical aspects are deeply addressed, but new opportunities to improve creativity of the Engineering graduate emerges. The purpose of this paper is to report on a pedagogical strategy adopted by the Faculdade de Engenharia Elétrica at PUC-Campinas, where activities on extension projects are simultaneously conducted along with the regularly schedule classes as a way to better prepare the students. The study case is related to the knowledge and information sharing between students and laypeople (social technicians) dealing with the visually impaired. The method applied in this experience relies on the contribution of both sides to build a common innovative knowledge while applying a novel Information Appropriation Method (IAM). The participatory method, applied during conversation rounds, is based on a virtuous cyclic process which includes steps like information capture, validation, guidance and feedback. In the present case, the technicians were led to reinterpret, adapt and reinvent technology while contributing to the design and build of a low cost adaptive electronic sensing aid attachable to a white cane. The Engineering students, on the other hand, have the opportunity to develop their communication, analysis and interpretation skills in a way not available in the classroom. They also experience solving conflict situations and find creative uses and applications for they knowledge not otherwise foreseen. This method was applied with success in two local partner institutions, the Sociedade Campinas de Atendimento ao Deficiente Visual (PRÓ-VISÃO) and the Centro Cultural Louis Braille de Campinas (CCLBC), when proof of concepts of electronic white canes where collaboratively designed, developed and tested. Through this experience the Engineering graduates emerged with a greater sense of responsibility with the society and a better understanding of what means to be an engineer. Participation in the Extension Project also brought up several opportunities of professional recognition by the technicians and the visual impaired themselves, which stimulated the

students do achieve better performance in the course. The collaborative process allows the discovery of creativity skills and the recognition that laypeople can contribute to find a better technical solution for a given problem. From the case described it is possible to conclude that participating in extension projects while attending regular classes of Electrical Engineering may better prepare the students to face the challenges of the professional world and improve their performance during course attendance.

Keywords: Collaborative Education, Electrical Engineering, Extension Projects, Visually Impaired.

The Importance of Internationalization on Engineering Programs from Minas Gerais Universities:

UEMG's Case

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Abstract

Gradually instigated by cultural, economic and social transformations generated due to globalization, especially with regard to Engineering, both universities and students are looking for new forms of teaching and learning. Concomitantly, as institutions and the labor market increasingly aspire skilled professionals, this search seems to be directed outside the country where there is greater availability of technology and new qualifications, as well as the possibility of proficiency in another language. In this way, the implementation of academic mobility programs such as Science without Borders (CsF), have great importance for the internationalization of Engineering Courses in Brazil's universities. Through this exchange, undergraduates have the opportunity to train and study abroad in order to maintain contact with competitive education systems in relation to technology and innovation, bringing back such knowledge to universities and to the nation as a whole. In this sense, this work aims to measure and emphasize the importance of this program for Minas Gerais universities, with focus on the performance evaluation of the Universidade do Estado de Minas Gerais (UEMG) Engineering campus, based in João Monlevade city. With the help of the CsF Portal and support of the UEMG International Relations

Advisory, it was possible to collect general data about the program and find the number of students which were contemplated with scholarships in the four Engineering Courses of UEMG from 2011 to 2016. In addition, a questionnaire was applied to students who have already participated in this exchange for a qualitative effect. The results showed that Engineering was the most requested area and that Minas Gerais universities presented great potential in the number of scholarships contemplated by the program. In a closer evaluation of the UEMG, it was observed that there is a disparity between the Engineering Courses regarding the number of scholarship students, highlighting the Mining Engineering Course in detriment of the others. However, it should be noted that this program was very important since it has allowed students to acquire more knowledge in specific subjects of their courses, improve another language, experience new cultures as well as learn new methodologies of teaching and assessment, such techniques that they can bring into their Engineering programs in Brazil.

Keywords: Science without Borders, Education, Engineering, Internationalization, UEMG.

LIBRE-LIBRAS:

A Tool with a "Free-Hands" Approach to Assist LIBRAS Translation and Learning

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Abstract

The Brazilian Signals Language (LIBRAS) is officially recognized as first language (L1) to the Brazilian deaf community. Since its officialization, its teaching is granted by law at public and private institutions. Just like is done in any other discipline, LIBRAS teaching needs specific courseware, as well as tools to assist teachers and students at classroom. We believe that the use of tools for aiding the correct LIBRAS signaling, considering correct hands configuration in each signal, is intended to potentialize the good LIBRAS learning at classes. Thus, this work presents LIBRE-LIBRAS, a web application software to aid simultaneous translation and verification of LIBRAS phrases, using Leap Motion sensor to capture signals from gestures provided by the student with his free hands. The software has a module for capturing and storing signals provided by a professional interpreter of LIBRAS. This module was developed using the MEAN stack, a set of technologies (MongoDB, Express, AngularJS, and Node.js) based

on JavaScript language that, together, help to leverage web development process. A signals database was created using MongoDB, where such signals are acquired from the interpreter with help of Leap Motion sensor and a web page developed with AngularJS. To send the acquired signals to the signals database, were developed RESTful web services, using Express and Node.js. It was also developed a module to query signals from the student into the signals database. This module uses the Euclidean distances between each hand palm and the fingertips, in addition to the Euclidean distances between the fingertips, to provide a signal descriptor that can be compared to signals stored into the database. We have already developed modules for storing and querying LIBRAS signals. Now, we are working in modules to provide signaling lessons and translation assistance of words and phrases in LIBRAS. To provide a better experience for the student while using LIBRE-LIBRAS, it was developed a 3D hands model that mirrors the student's hands movements, so the student can see his signals or imitate the movements proposed by LIBRE-LIBRAS lessons. LIBRE-LIBRAS development is still in course. Tests on the signals queries confidence are being performed to refine our querying module. Furthermore, we intend to perform tests with LIBRE-LIBRAS at the LIBRAS classes from our institution, in order to get a good LIBRAS teaching tool that helps and encourages students in this discipline.

Keywords: LIBRAS, Computer Aided Translation, Leap Motion Sensor, Languages Teaching, Courseware Tools.

Interdisciplinarity in Engineering Education:

The View of Course Coordinators in Vocational Training

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Abstract

In the current postmodern scenario, education has experienced difficulties whose proposals for solutions arise in a variety of ways. Among these paths, interdisciplinarity has become a subject present in most schools around the world. In the case of Engineering Education, the problems are not different, and interdisciplinarity has been studied as a possible innovative strategy to increase the results of the teaching and learning process. This article has as main objective to raise the domain perceived by coordinators of courses of a public higher education institution about interdisciplinarity and its role in the formation of the professional. The studied school offers 106 undergraduate courses, including technology and bachelor degrees; 50 of those courses are Engineering that are located in its 13 campus. The proposal to carry out this research is to know the vision that the coordinators of courses of the technological area of the studied institution has on interdisciplinarity and the role that it can represent in the improvement of the professional formation. This research can be classified as applied and exploratory type, with quantitative data treatment. It will be composed of a questionnaire that will be applied electronically to all 76 coordinators of Engineering and technology courses. The main topics defended will be: Interdisciplinarity concepts; How to operationalize it in technological teaching; The importance perceived by the coordinators in the Engineering professional qualification; Investigate if interdisciplinary is being practiced in the courses; And finally, how they think these practices could be implemented at the

courses coordinated by them. Data analysis will be done by tabulating the answers to closed questions and interpreting the content in open questions. The expected results of this study are the possibility of inserting the subject "interdisciplinarity" by the coordinators of the courses, as a strategy to improve the teaching and learning process, and as a suggestion to implement these pedagogical practices as a mean to reach a better knowledge appropriation of the student. It is also expected to provide support for the improvement of students' professional skills and their better development for the job market.

Keywords: Technological Teaching, Engineering Teaching, Interdisciplinarity, Innovative Practices in Education, Teaching-Learning Process.

Finite Element Method Use as Educational Appliance of Learning in Electrical Engineering

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Abstract

This paper presents a positive report on the use of the Finite Element Method (FEM) in Electrical Engineering, particularly in electrical materials discipline, involving the students of the DOCTUM institution in the city of Caratinga, Minas Gerais. FEM is about a mathematical analysis that consists in the fragmentation of a continuous device on smaller elements without altering the characterists of the original device. The elements are described by differential equations, and resolved by mathematical models to obtain the desired results Its feasibility happened only after computer advent, which turned possible the resolution of complex algebraic equations Through the great efficiency and applicability of FEM it was possible to use it in several areas, including biological and exact sciences. In the current economic scenario there is an increasingly demanding labor market searching for the most qualified professionals, showing the need to implementing in Electrical Engineering Course the training of the students about the calculation of static magnetic fields (Magnetostatic), improving the perception of the occurred effects in different types of electrical machines. It's known the difficulties of the students to learning of the content related to the study of the concepts of Electromagnetism used on learning of Electrical Machines. These difficulties are related to the abstract concepts, therefore, there is the need to offer new technological resources so the student can have a plainness about these effects. At first, Maxwell and Poisson equations are presented for the particular case of magnetostatic, after this, the solutions for these equations by the Finite Elements Method. Will be used the already consolidated FEM programs in this area to simulate the different phenomena that exists in electrical machines, which enables the academic to visualize these phenomena, and a numeric analysis of the effects. The reached results on this study were positive, generating a great impact in the learning of the students, which could be optimized by the simulation implementation.

Keywords: Finite Elements, Electromagnetics, Numerical Methods, Maxwell's Equations, Electric Machines.

Improvement of The Digital Systems Laboratory for Computer Engineering

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Abstract

The Computer Engineering undergraduated students, at the Universidade de São Paulo, in São Carlos, have some complaints about the lack of practical classes during the graduation. Also, these classes, they say, are many times limited to reproduce simple results already seen in theory classes, bringing nothing new and making them even more frustrated for not being able to explore new possibilities, functionalities, and that way expand their knowledge. The PBL (Problem-based Learning) can give this challenge to the students and it was chosen to be applied in Digital Systems Laboratory, a 4-semester discipline, trying to fix this problem. The purpose was to use digital logic concepts, already seen in theory, to build basic modules of a processor, seen as a digital logic circuit, using the concepts of: combinatory logic, studied through the implementation of an arithmetic logic unit (ALU); sequential logic, through the implementation of the registers and the register bank; and finite state machines, connecting both concepts, making possible to build a control unit. By doing that, the students were instigated to use all the knowledge they already had, once they received only the specification of input and output and were free to implement each module the way they wanted to. Making use of schematic editors and prototyping boards, they were able to build three main components of a processor and integrate everything in a test platform that was developed to allow them to test their modules in a full processor schematic and make it work properly. The feedback from the students (through a questionnaire) showed that, although they had some difficulties taking the course, it was motivating and it helped them understand different concepts that are seen during the graduation, like digital systems, computer organization and computer architecture, and how they are connected. The improvement of the laboratory classes by the use of an active learning method, like PBL, was very positive and it will be replicated in new classes.

Keywords: Computer Architecture, Digital Systems, Problem-based Learning, Computer Engineering, Engineering Education.

A Contribution on How to Set The Number of Evaluation Exams in An Electrical Engineering Undergraduate Course Based on Score of Students:

An Experience with Linear Systems Analysis at UFG

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Abstract

The act of planning an undergraduate course could be briefly described as an ability to adjust topics into themes of lessons, declare objectives and procedures to achieve them according to previous knowledge of students, encourage the desired skills on students, prepare related documents and a schedule. Educators must also think about what would be the most suitable evaluation scheme for an effective learning of their students. Many classical and recent mechanisms of evaluation have been proposed in Engineering Courses based on their successful experiences from different areas or institutions. In fact, all those evaluations schemes are fully reasonable and most of them are similar in order to justify their methods by performance improvements, cognitive theories and practical limitations of execution. Based on that, this work describes an experience applied at UFG with students from an Electrical Engineering undergraduate course called Linear Systems Analysis (ASL). During two consecutive semesters (2016-1 and 2016-2), different evaluation schemes were used to score the learning level of students according to academic policy from the university. The first evaluation scheme was based on classical three wide exams covering the main topics of course. The learning level of each student as a quantitative learning index (QLI) was equivalent to the simple average of scores obtained from exams. Although 26% and 5% of students achieved good and excellent results (QLI>80% or 90%) respectively, it was noticed that 38% of all the students achieved less than minimal acceptable (QLI<60%) for being classified as approved. Even most of individual scores in each of three exams were compatible with Gaussian distribution (which separately validates the applied exams as good reference of learning expectations in a group of people), all the students got an average QLI closed to minimal (58%) with a standard deviation of 16% at the end of semester. Although 11% of students left course, those verified standard deviation and number of rejected students induced the proposal of a second evaluation scheme. Based on continuous evaluation, the second scheme was proposed with seven short exams and covering the same topics of ASL course that were previously verified by the first scheme. Nevertheless, during the second evaluation scheme the QLI from each student was calculated as the weighted average of scores obtained from all exams. As some of covered topics during ASL course have 'more impact' on ahead courses, the weighted average had been chosen. By the second scheme and from all students, 30% was classified as rejected, 11% and 9% achieved good and excellent results (respectively), and 9% left course during semester. Besides the total average QLI was 62% with a standard deviation of 18%. From these values, it can be concluded that they achieved similar results for the same range of verified topics. However, students submitted

to continuous evaluation method got so much tired preparing themselves to exams that had declared a slight preference for the classical method with three distributed wide exams. Other issues were asked for the students from both semesters and the results are also presented.

Keywords: Education, Electrical Engineering, Undergraduate Evaluation Systems, Teaching-Learning Process, Engineering Scores.

Ontology to Mining Judicial Sentence's Big Data

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Abstract

The number of judiciary cases has increased exponentially and overcrowded services, hampering a fast attendance to society's rights. Researches on already rendered decisions on related matters is an essential step on lawsuit flow, that of sentences and decisions elaboration, carried out basically in court's sites. Most available filtering and searching tools are substantially textual, making it time-consuming, laborious and unproductive. Judicial advisers are responsible for internet research, wasting significant time in studying the lawsuit and finding similar judicial decisions like the current one, through textual search. Therefore, facing growing in judiciary demands, it is imperative to build fast, automatic and intelligent database mechanisms to search, filter and choose information, requiring less human actions in the search process. The aim of this paper is to present a semantic methodology, intelligent and automatic for data mining in judicial lawsuit sentences database, related to the one in trial, using ontology,

that is, measure and verify in a specialist software implemented, which receives lawsuits content (nature, action area, poles, subject, class and main part of initial petition content) and conduct database search of previous judicial decisions full content, finding the most appropriate decision for the current lawsuit, similar of many others judged cases. It's presented an intelligent and automatic method to search for sentences in lawsuits related to the one in trial. For this, four different types of data mining are used: data mining without ontology; data mining using judicial ontology with experts rules; data mining using judicial ontology without experts rules; data mining using judicial ontology with and without experts rules (hybrid). The term experts rules is used because it utilizes human knowledge, from a judicial field experts, which works for ten years on lawsuit decisions/sentences draft preparations. The term without expert rules is used because it makes use of mathematical and computational models to structure words similarity matrix, aiming to find words relation occurring more frequently in order to look for the desired one, within similar decisions/sentences to the current lawsuit universe. The term hybrid is used when employing ontology with and without expert rules. The software named Autosent, built to perform search and classification of large amount of judicial sentences, allows to apply mechanisms to measure the algorithm's data mining capability. The research use accuracy and recovery to value the propose algorithm. Simulations and tests have demonstrate that application of ontology is feasible for judicial decisions data mining, both in accuracy and information retrieval. Another important aspect is to be able to establish a standardization of searches in monocratic decisions full content's universe, avoiding related subjects to have divergent decisions. The method will provide speed in the Judiciary, seeking to quickly solve the yearning of society, as it will be able to simulate the judicial advisers work on decisions/sentences preparation. All studies and simulations were done with 2016 real data collected on judicial court of Goiânia city, located in Goiás, Brazil. We believe the same proposed semantic method can be applied to judge answers in subjective questions in big databases for Education.

Keywords: Artificial Intelligence, Court Decisions, Data Mining, Knowledge Management and Ontology.

An Approach for Mapping and Simulation of Didactic Games in the Internet

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Abstract

When educators are planning their classes, one of most challenge tasks is to awaken students' interest for the lesson content. The use of educational games may support teachers to reach this goal. However, the use of educational games requires high investments. This paper proposes that a formal model and a knowledge basis can map all necessary details of an educational game, permitting to simulation it in a computational environment. Also, this work shows a software able to understands this formal model and, using an inference engine, understand the knowledge basis. With these resources the software simulates the educational game, offering to students the game in the Internet. The students can play using any computer which Internet access. The first step for the game creation starts with the manufacture of the formal model and the knowledge basis. This work uses a state transition diagram (STD), which can map all possible paths in a specific game. This model mapped the dynamic of several educational games tested. Besides the STD, we used a knowledge basis, like an expert system, with the rules to game control. After map the game, the teacher must submit the model to the built program. The program reads the model and simulates the mapped game in a computational environment. It has an inference engine that controls the flow by the various states of the game. Students begin playing at the initial stage of the game. The start stage is equivalent to the initial state of the STD. Users can pass to the next stage only if their moves fulfill the game rules stored in knowledge base. Students play the game until they reach the final stage of the game. The final state of the state transition diagram is equivalent to the final stage of the game. To show a feasibility of the proposed approach, some educational games were developed and used in practical classes. Although the game creation is a hard task, the game can be used and improved indefinitely by the teacher. In addition, teachers can exchange their games between them, creating a gaming basis in their institution. The work conclude that the objectives were reached, because the proposed model can map all educational game idealized by the participating teachers, and the software is able to simulate all the games mapped in the proposed formal model.

Keywords: Educational Games, Expert Systems, Game Simulation, Process Modeling.

Evolution of A Familiar Company Using Lean Project Concepts Aiming to Make Part of A Multinational Group

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Abstract

This paper presents as the science application through Lean Project concepts can help and guide a company in its restructuration process. The analyzed company trades commodities and high technology orthopedic products used to wound treatment, compression therapy and orthopedics. The motivation for the project was due to the fact we would be able to see how processes involving areas of Lean Project and Production Planning and Control (PCP) are applicable in real companies and not just in academic examples or old cases of study. The changes and processes implemented in the company prepared the transition of a familiar structure to a multinational group with solid and trusty processes. To achieve the desired target in the organization, Lean Production and PCP concepts, besides a cultural change inside the company, were necessary to be successful implemented. Regarding the Lean Project the work was mainly emphasized in mitigate three of the six big wastes (inventory, waiting and overproduction) and became a company focused in customer needs. During the implementation of the process it was added in the organization several controls, processes, and Key Performance Indicator (KPI's) originated from PCP methodology, which are important highlight: production planning, production adherence and sales forecast. In the development of the research, a critical analysis over some challenges that appeared was made, looking for an active way to solve the problems, involving other required agents to analyze: commercial, manufacture, supply chain, statistic and graphic tools. After the process implementation and collected data our conclusion was that the familiar company had the habit of producing goods even thought they were not requested for the customer in that exactly time, instead of focus in the customer needs. Through the changes described above the company had a relevant increase in its revenues (due to the fact it had the goods requested for the clients available) and a decrease of back orders and inventory. The importance of this research is mainly in fact that it can be generalizable, serving as a model for other familiar or old vision companies that aim to improve their processes, restructuration or even have the intention of start an IPO (Initial Public Offering) implementation using this approach in their business.

Keywords: Familiar Company, Lean Production, Process Implementation, Production Planning and Control, Restructuration.

Discipline of Logistics:

Approaches to Teaching, Learning and Results Evaluation

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Abstract

The Engineering Courses offer to its curricular structure the technical disciplines that allow to extend the necessary competences to the management of the supply chain. It is noteworthy that most curricula - Engineering Courses - do not offer disciplines of logistics and supply chain between compulsory and elective disciplines. Faced with this context or methodological challenge to create a stimulating and innovative environment - with the increase in efficiency in learning - that was chosen from games, for them they can experience the real reality with immersion and motivation. This paper presents the results of the Free Nucleus Logistics course offer in 2016, with an open enrollment for all interested parties, including other graduates besides Engineering at the Universidade Federal de Goiás. The teaching approach focused its action on the development of skills Of students to optimize the resources of the logistics in the productive system, teaching methodology with learning of exercises, bibliographical research, field research, preparation of texts for students Presentation in the classroom) and end of semester. In this work there is a strong relationship with the research carried out with the fundamentals of action research, with the field research carried out during the whole elaboration process, but mainly, by team action in the construction of the game, with the prototype being delivered during a Event (previously scheduled), fact that a whole schedule (of each team) was adjusted in final delivery data, when the game rehearsed. The themes proposed for the elaboration of the topics related to the topics of the discipline's education - all students in the classroom and with broad participation of all enrolled students, that make it possible to apply the theoretical concepts specifically to the concrete cases identified by the students Doubts during all classes). In the elaboration of the games the students were able to insert into the structure - physical items of the games - the various aspects addressed in the room, even at different levels of complexity. All the prototypes were tested in an immersion environment, being perceived a high degree of motivation in the use of games.

Keywords: Engineering, Learning, Logistics, Methodology, Teaching.

Design Thinking Course

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Abstract

The nature of core competencies in training engineers involves technical, affective, and attitudinal areas as well as the development of interpersonal skills to coexist in multidisciplinary teams. Depending on the area of Engineering, the elaboration of projects seeks to solve real problems and projects, which can lead to technical recognition by the professional and even the creation of networking opportunities. The affective and attitudinal changes can promote self-knowledge, coping with adverse situations, resilience, ability to take risks, commitment and responsibility. The development of interpersonal skills involves assertiveness, flexibility, communication and business. In the pursuit of essential competences, the objectives of the course of Design Thinking in the formation of Engineers are structured in general, cognitive and attitudinal. The discipline uses active methodologies with emphasis on Problem-based Learning (PBL) and Project Led Education (PLE). The Design Thinking course is being offered through three modules or training axes: (1) Art, Science, Culture, Innovation and Marketing; (2) Business Plan, Intellectual Property and Industrial Property; and (3) Design Thinking. Thus, the teaching approaches of the course are transformative since in addition to using the active methodologies PBL and PLE they still use Texts Study, Brainstorm, Conceptual Maps, Portfolio, Canvas, Problems Solution, Philips 66, Dramatization, Workshops, Middle Study, Teaching with Research, Product Development, Plant Patent, and Integration Conferences. The first offer of the discipline occurred in 2016, which allowed the achievement of unprecedented results. For example, the evaluation instruments of the teaching methodology approved by the Research Ethics Committee of the Universidade Federal de Goiás (UFG). In addition, an application of the evaluation instruments of the methodology of basic education for the reinforcement and understanding of the methodology by the professors, as well as being part of the continuous evaluation proposed by them of the course. It is important to emphasize that as teaching approaches have been adjusted in weekly meetings among professors so that the objectives are achieved in an increasing way as internal and external conditions for learning and outcomes related to the various factors that are due to work. However, the success of the provision of the discipline by two professors in different classrooms is related to the rigor of the follow-up of the Lesson Plan and the adjustments made during an offer of the Design Thinking course, as well as force of the parties involved.

Keywords: Engineering Education, Active Methodologies, Problem-based Learning, Project Led Education, Design Thinking.

Institutional Evaluation Perceptions of UFG Engineering Students

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Abstract

The establishment of the Sinaes (Sistema Nacional de Avaliação da Educação Superior – National Higher Education Evaluation System), law nº 10,861 of April 14, 2004, has intensified the debate in the academic community on Higher Education, University and Institutional Evaluation. In relation to Institutional Evaluation, the Universidade Federal de Goiás (UFG) comes following a natural process of evolution and improvement. Deployed formally in 1994, has been going through significant changes resulting from periodic revaluations. In 2015, sensitive to the need for continuous improvement and that the evaluation has received increasingly highlighted in the context of the search for proposals and solutions, the CPA (Comissão Própria de Avaliação – Commission of Evaluation) of UFG submitted to the academic community a new project of institutional evaluation. In this new institutional evaluation project, evaluation processes are involved the entire academic community, in order to strengthen actions in favour of quality, offering multiple analyses able to subsidize the management of UFG. By involving the entire academic community, provides a complete and complex feedback about the institutional reality. This paper presents the undergraduate students perceptions of the Escola de Engenharia Elétrica, Mecânica e de Computação (EMC) of Universidade Federal de Goiás (UFG) on the academic environment in which they perform. From the assumption that self-knowledge is the first step towards the pursuit of improvement, not only institutional, but also of institutional actors, in 2016, UFG students evaluated the institution, themselves and their teachers. The Institutional Evaluation presents objective questions about academic policies, management policies and infrastructure. The self-evaluation of the students presents questions about their academic performance, interpersonal relationships, respect and compliance with institutional rules. The teachers were evaluated by the students on didactic performance issues, interpersonal relationships, respect and compliance with institutional rules. From the above and relevant literature review, this work presents the question: How to relate the dimensions assessed and UFG courses from the students' perception of EMC on the academic environment in which they are inserted? So, this paper aims to identify possible common factors (dormant), interests, weaknesses, potential of EMC courses, as well as of the institution, and from these, guide future actions in

order to promote the improvement of the University.

Keywords: Institutional Evaluation, Engineering Education, Commission of Evaluation, Teaching Evaluation, Interpersonal Relationships.

The Perceptions of Engineering Teachers on A "Practice What You Preach" PLE Training Program

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Abstract

This study means to contribute to the theoretical foundations and practical applications of the PLE (Project-Led Education) methodology, which is still very incipient, and requires much discussion about how and with what results it has been being used in Engineering programs throughout the world. This paper offers a conceptual model of Engineering teachers' necessary competencies in PLE developed by eight teachers from one of those three Universities studied by Tavares & Campos (2013), who decided to prepare themselves for the PLE methodology new teaching roles, through a training program designed on the basis of PLE methodology itself, which would allow them to experience the PLE methodology from their students' perspective. A synthesis on the teachers' perceptions about the training program, obtained through a Likert scale questionnaire, and confirmed through observation and unstructured interviews, indicated that a teachers training based on the PLE methodology can be an effective way for Universities to help them understand students' and teachers' roles in this new educational methodology.

Keywords: Engineering Teaching, Engineering Learning, Problem-Based Learning, Project-Led Education, Teachers Training.

Development of A Modular PLC Using A Low Cost Microcontroller Architecture

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Abstract

Programmable Logic Controllers (PLC) are computer-like devices used to control and monitor various procedures, being an efficient technology within automation and industrial processes. The main differences between them lay on the lack of friendly interface and peripherals and the languages used to program and operate them. It uses special languages, one of which is Ladder Language mainly employed due to its easiness, conciseness and robustness. Although very common in the industry sector, its teaching, however, faces some obstacles, mainly due to the price of the hardware or the software license. The need to find an accessible solution to this problem, without compromising the quality of the knowledge, has brought some Programmable Logic Controllers technologies up to teach young technicians and Engineering students by using microcontrollers as the hardware while still using Ladder language. Due to the shortage of a suitable PLC-like structure, this paper studies the application and implementation of an open source and hardware, modular and low cost PLC to be used in automation and industrial classes. We developed I/O modules to work with the main processor module, being able to interchange them, allowing the students to build different configurations based on the needs. All the modules are optically or magnetically insulated to protect the processor. The software used to program and upload the files to the PLC-like architecture are open source and free. The modular structure uses an ATMEL8L processor, similar to ones found in Arduino®. Results show the validation of the hardware and software architecture, with the most used functions in PLCs being tested, such as I/O,

comparators, timers and counters. This allows students to be in touch with active teaching methodology, as the students become able to understand not only how to program PLC, but also how it works and controls processes. There is the possibility to build new knowledge up from established know-how, besides being more affordable and easy to implement than the industrial solutions available currently. We would like to thank CEFET-MG and FNDE for their support in this project.

Keywords: Automation, Ladder Language, Low Cost, Microcontrollers, Programmable Logic Controllers.

Prototype of A Low Cost Neonatal Incubator Using The Arduino Platform and A Temperature Monitoring System from An Android App

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Abstract

The neonatal incubator is a developed project that has the purpose of to expand skills from the technical knowledge in Engineering and it is a challenge if we consider the needs in the health technology field. Thus, developing and executing strategies that optimize the learning process is the utmost importance to provide to the students some skills as pro-activity. Emphasizing the need to develop equipment for the improvement of medicine and biological sciences in general, we have that, acquire equipment capable of contributing to the technological evolution in the medical field has been comprehensive, because the advances of biological systems and apparatus that help the health professional became common worldwide. However, in general, medical equipments are really expensive. In view of this problem and the need for a new technological approach, a search was made to find some economically viable components in order to make easier the access for some professionals interested in technologies which could turn the diagnoses more fast and effective. With this project, we intend to explore several concepts of courses from the Biomedical Engineer department of UFPA (Universidade Federal do Pará), as well as to encourage the knowledge and development of new technologies. This article presents a prototype of a low cost neonatal incubator coupled to a newborn body temperature monitoring system from an android mobile application. The prototype was developed by a software, it has been tested and it follows some technical standards of installations and works from a dome made of acrylic with several intelligent sensors such as temperature and humidity (DHT11), piezoelectric sensor and sensor Of skin, those sensors contribute to increase the incubator's performance. The control of these sensors is made by a Arduino platform which is currently considered easily accessible for the creation of projects and prototypes for the insertion of knowledge in Engineering. In addition, the Arduino enabled the

monitoring process in a simplified way, a example of that is the creation of mobile applications in the Android language. For monitoring, the knowledge about the temperature of a newborn is extremely important because the baby needs a specific care, such as reading of weight and monitoring of temperature and pulse, which must be done constantly. The neonatal incubators for newborns are essential for this process, therefore, the development of the low cost prototype aims to make the measurements minimally invasive for the newborn, which helps in the treatment and recovery, and also contribute to an low and effective investment.

Keywords: Neonatal Incubator, Health Technology, Low Cost Prototype, Arduino, Engineering Education.

Application of The Flipped Classroom, Jigsaw Classroom and PBL Methodologies in An Electrical Engineering Course

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Abstract

This paper intends to demonstrate an application of three learning methodologies – Problem Based Learning (PBL), The Jigsaw Classroom and Flipped Classroom – in an Electrical Materials I class, present in the fourth semester curriculum of the Electrical Engineering Course at the Universidade Federal do Pará (UFPA). Such an application was considered innovative because, besides stimulating proactivity, it was able to intercalate several methodologies that show to the students, in a practical way, how to apply the theoretical knowledge acquired in class in common problems and projects find in Engineering. During the course, each evaluation (in a total of four) involved unique characteristics of the used methodologies, but traditional tests, about the course content, were still being applied by the teacher. Another measure adopted was the choice to use a main object of study, this being the transformer, extremely used and necessary equipment in electrical power systems, an electrical Engineering actuation field. Thus, during this work elaboration, a bibliographical research was done about these methodologies, besides a study about how the discipline in question was previously taught and the differences between his content at UFPA and other universities. After the last evaluation and the dissemination of the grades obtained by the students, an opinion survey was conducted (using the Likert scale) as a way to obtain a return about the level of acceptance regarding the way in which the discipline was presented. In addition, discursive questions were asked so that the students could give their opinion in a critical way, which would be considered for a better implementation in the subsequent classes. Finally, it is worth emphasize that the technique used during the course culminated in the production of articles written by the class, in order to exercise the scientific writing of the students. The set of these attributes contributed to the development and improvement of necessary skills that must be worked in an engineer's formation at the present time.

Keywords: Active Learning, Electrical Engineering, Flipped Classroom, Jigsaw Classroom, Project Based Learning.

Jigsaw Learning:

An Active Learning Strategy for Large Groups

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Abstract

This paper describes the application of educational dynamic known as "Jigsaw Learning" in Engineering Courses, presenting the results achieved in practice with several groups, since initial to more advanced series. A good professional performance requires, on the part of the students, some attitudes and postures that must be exercised within the academic environment, and that go beyond the contents (approached either in practical or lecture classes). Providing opportunities to simulate, experiment and evaluate some practices and situations are part of the school's role in educating Engineers. The application of the Jigsaw Learning technique can enable students to understand, practice, and improve in skills and attitudes considered important in the Engineering career, in addition to the content being developed. This practice seems to reinforce the effectiveness of peer instruction, since much of the methodology provides interaction between the students, allowing each one to assist in the construction of knowledge. Its execution is also highlighted by the effective application of active learning, since the students have an active posture in relation to the topic studied, seeking knowledge by their own resources and also in the interaction with colleagues and teachers, bases for a socio-constructivist learning. Jigsaw Learning is an active learning practice that performs well when working with large groups of students, unlike most active methodologies, which are most effective with small groups. In the applications described, this methodology was carried out with groups of 60 to 100 students. The results obtained in the proposed discussions, textual productions and reviews appear quite satisfactory and, in several cases, surpassing expectations in a positive way when compared to traditional approaches to the same concepts. The change in the role played by the student (and therefore by the teacher) during the practice of this activity seems important for a greater engagement of classes and better academic results.

Keywords: Active Learning, Interdisciplinary Teaching Approaches, Jigsaw Learning, Project-Led Education.

Canvas for Educational Project

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Abstract

Inspired by business model canvas and aiming a visual planning method, it was developed a canvas for educational applications, particularly efficient in the elaboration of interdisciplinary projects but that also can be used for planning classes or even at elaboration of competence-based curriculum matrices. Canvas are visual tools that help in the elaboration and structuring of ideas. Originally designed to create and structure innovative businesses, they obtained great visibility through Osterwalder and Pigneur work. Nowadays these tools gained several variations that seek to cover areas involved in the formation or structuring of an enterprise, trying to do so in a creative, participatory and comprehensive manner. The Educational Canvas goal is to organize and make clear, both for teachers and students: educational objectives, knowledge addressed and demanded skills during activities. That goal is possible to achieve by relating developed activities with the respective contents, trying to clarify and emphasise their relationships and also by planning evaluations, activities and deliverables students should do. The active student's participation in practical pedagogical activities is extremely important for competencies development such as proactivity, ability to work in a team (involving respect, leadership, organization), planning, observation of phenomena, as well as facilitating the connection of knowledges in several areas that is an eminently interdisciplinary activity. Therefore, it is important to know beforehand what pedagogical objectives are to be achieved with a given project, what are the contents and skills to be developed, which, in turn, allows for greater clarity in evaluating achieved results. Because of its visual characteristic and the fact that it favors interactions, the canvas offers a good response when applied with interdisciplinary groups, allowing teachers and coordinators to work synchronously (wo king together) or asynchronously (each one on its own time), expanding possibilities of collaboration in the planning of proposed project or activity. This educational model canvas seeks to encompass important aspects of a project, by using the approach proposed by Drexler and Sibbet. First, the "Why" of the project, justifying its importance, put in a very brief and direct way, then comes definition of the public involved ("To whom"). The project theme (that involves other areas and activities) should be defined only at the end of this planning stage and should take into account the Knowledge, Attitudes and Skills that are intended to develop during the proposed activities of the project. The central part of the canvas (the last to be made) defines the practical aspects of the project: the curricular components involved, its contents (which can be rearranged and adapted according to the project proposal), the ways of approaching each content, planning of the appropriate assessment (according to the proposal) and deliveries that students must perform during and after the activities.

Keywords: Active Learning, Education Model, Engineering Education, Project-Led Education, Canvas.

Electric Floor:

A CDIO Project for First Year Students

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Abstract

In this work we show the "Electric Floor", a device capable of transforming energy from the movement of the steps into electrical energy. It generates electricity when someone or something presses it, and can store that energy in batteries to be used when necessary, for example, if installed in the street, produce spare energy from street lighting or traffic signals, using a simple, clean and renewable energy. The developed prototype consists of a board that, when stepped, causes gears coupled to the lower part of the floor to turn, together with a system of turnstiles similar to those of bicycles, connected to a simple generator, producing energy every time it is pressed. From the small built prototype, it can be observed that it has the capacity to generate enough energy to supply a small quantity of LED lamps. It has been shown that it is feasible to build a system capable of supplying a traffic signal or a street lighting system, making it necessary to build a more robust and resistant set. Among other student creations, this device was conceived and built as part of "CDIO Project", developed in the second semester of Engineering Courses. Aiming an integral training to respond needs of future Engineering professional, Sao Judas Tadeu University (SP) adopted a methodology known as CDIO (Conceive - Design - Implement - Operate) in the initial semesters with the goal of instilling Engineer students, from the beginning of the course, with projects following a methodology that is both simple and complete. In the year 2016, students were motivated to propose solutions for the energy supply as a theme of the project. The CDIO methodology allows the development of various skills such as teamwork, planning and organization in the development of projects, as well as aspects related to the theme, such as energy forms, conversion and energy production, including aspects such as sustainability, clean energy and social responsibility.

Keywords: Active Learning, Project-Led Education, CDIO, Alternative Energy, Electric Floor.

Wave Power Plant Prototype:

A CDIO Project for First Year Students

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Abstract

This work describes the construction of a Wave Power Plant Prototype, that consists in the use of the mechanical energy produced by the ocean waves to generate electric power. This work is a part of a "CDIO Project", proposed in the initial semesters of Engineering Courses at Universidade São Judas Tadeu (SP). By using CDIO (Conceive-Design-Implement-Operate) technique, first year Engineering students conceived and developed prototypes according to the thematic axis "Innovative Solutions for Energy". The CDIO technique was adopted with the goal of motivate students to work following a simple and complete project methodology. CDIO technique shows to be very suitable for beginner students (due to its simplicity), but also interesting to be used for students in more advanced stages, because

of its completeness. In addition to that, CDIOs approach allows students to learn aspects related to the subject, such as the generation and the use of different forms of energy, its conversion, production and transmission, including aspects such as clean power, sustainability and social responsibility. CDIO also allows students to improve several skills, including, but not only, the ability of teamwork, project planning and organization. As result of students work, they were asked to build a prototype to demonstrate their conception. The Wave Power Plant was built from a floating system coupled to a fixed rod in which are placed two magnets with inverted polarities, in order to repel. The bottom magnet is attached to the buoy, and movesvertically along with the float, accompanying waves movement. As the bottom magnet moves, it repels the upper magnet, which acts as a magnetic core, moving inside a fixed coil, producing, by means of electromagnetic induction, the electrical voltage between its terminals. In the built prototype, the demonstration of the power generation was made using a set of LEDs, which were triggered as the mechanical waves were produced in a small artificial tank. Although the prototype was built on a small scale, the system proved to be efficient in generating small amounts of energy, however a commercial development is not viable due to elevate material and assembly costs.

Keywords: Active Learning, Alternative Energy, CDIO Project, Project-Led Education, Wave Power Plant.

Charging Device for Electric Vehicles:

A CDIO Project for First Year Students

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Abstract

In this paper we describe a simple and innovative device for charging batteries in electric vehicles. The work was made by using the CDIO (Design-Conceive-Implement-Operate) technique, adopted in the second semesters of Electrical and Computing Engineering Courses at Universidade São Judas Tadeu (SP). It was proposed a thematic axis, "Innovative Solutions for Energy", from which students conceived, developed and implemented prototypes related to the theme. The CDIO technique was adopted with the objective of motivating the students to work following the methodology that is both simple and complete, proving to be very suitable for beginner students (for its simplicity), but also can also be used for students in more advanced stages, for its completeness. In addition, CDIO methodology allows to improve several skills, such as the ability to work in teams, planning and organization throughout the development of projects, as well as aspects related to content related to the theme, such as the use of different forms of energy, conversion, production and transmission of energy, including aspects such as clean energy, sustainability and social responsibility. Among others projects, a group of students developed a prototype for charging electric vehicles. The device is done using transformers, in order to facilitate the electric contact of the vehicle with the power source. The primary transformer winding is fixed and connected to the power source. The secondary winding is located in the vehicle, as well as the electronic circuit que converts the AC signal to DC in order to charge the batteries. This eliminates the need to connect the car to the power source by means of sockets, requiring only an approximation of the secondary to primary winding for charging the vehicle. The prototype was built by using the miniature car driven with common rechargeable batteries (1.5 V). Charging was done by means of a transformer with the primary winding fixed and connected directly to the electric grid AC power and the secondary winding together with the battery charging circuit placed in the car itself, Which has undergone various adaptations to suit the charging method. The operation of the prototype showed the efficiency of the energy transmission between the transformer windings was satisfactory and it is possible to implement and it is therefore possible to be produced for commercial scale use. To do so, it is still necessary to improve the electromagnetic core of the transformer, for greater efficiency.

Keywords: Active Learning, Alternative Energy, CDIO Project, Electric Cars, Project-Led Education.

3D Virtual Laboratory for Learning Environments:

A New Learning Object

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Abstract

Over the years, teaching methods have not achieved significant changes to accompany advances in audiovisual media. Technologies could be implemented in order to create interactive platforms that would improve in quality of teaching, especially in practical disciplines offered in technical and Engineering Courses, with the purpose of enhance the learning process. In addition, many institutions do not have sufficient resources or quality technologies to meet the demand of students and teachers. This work presents a new resource for virtual learning object and virtual laboratory prototype with remote access to improve the quality of classes, in which students can get an immersive experience close to reality, and actually interact and test the knowledge acquired. The objective was to provide remote access to the control and automation laboratory and optimize practical experiments more safely. As pilot experiment, an environment consisting of a 3D model of the ARM-7220-4 arm robot was developed, presenting the majority of the robot movement functions, as well as mechanical accuracy, geometric and kinematic model of the Robot, and provided access in Moodle for the students of CEFET-MG, Campus Leopoldina. A real robot ARM-7220-4, connected to the virtual tool, responds to commands of manipulation by the environment and can also be monitored in real time through a camera installed in the physical laboratory. The teaching method is established through movement tasks in order to validate the knowledge acquired through bibliographic didactic resources, addressing theoretical aspects. Results

of usage analyzes demonstrate that the new resource provides a motivation for participation, interaction and collaboration among the students who have tested the system and presents itself as a promising resource for distance learning. We would like to thank CEFET-MG, CNPq and FNDE for their support in this project.

Keywords: Virtual Learning Environment, Virtual Learning Objects, Virtual Lab, Remote Access.

How An Educational Program Can Improve Learning for An Engineering Student

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Abstract

The evasion in Higher Education, especially in science courses, is a reality faced by Universities not only in Brazil, but also in several other countries around the world. The number of students who drop out of university is very expressive, resulting in academic, economic and social losses. To try to minimize this problem, the Universidade Federal do Pará (UFPA) together with the Institutto de Tecnologia (ITEC) created in 2011 the Levelling Courses Program in Basic Sciences for Engineering (LCPBSE), whose main area of action is to teach basic Mathematics, Physics and Chemistry for the newly enrolled students in Engineering Courses. These classes happen before the students have contact with the first subjects of the basic cycle, especially the discipline of Calculus 1, common to all Engineering Courses. Recent statistical studies have demonstrated that LCPBSE has a relevant role to reduce educational gaps in conceptual and operational fields in the basic sciences to Engineering, in addition to working essential topics to the basic courses of undergraduate. Recognizing the importance of LCPBSE as fundamental tool against evasion rate, the research is aiming to better understand its functionality and how it was able to increase the approval ratings. Thus, this paper has as objective to explain how the LCPBSE supports students and it tries to understand what epistemological learning mechanism under the factors contributing to students academic performance increasing. The methodology was based on the bibliographical research of several authors who study the cognitive learning. Among them, we studied those who had a philosophical cognitive/constructivist stance: Piaget, Vygotsky, Kelly, Ausubel and Vergnaud. As a result of this studies, we focus on David Ausubel's work, who proposes the Meaningful Learning Theory, a thesis that may be able to explain how LCPBSE is helping students to learn more efficiently. According to Ausubel, for learning to be meaningful, it is necessary for the new information to relate to a relevant aspect already existing in the learner's cognitive structure. These relevant aspects are called subsumers, which serve as an anchor for the new knowledge to be acquired. Based on this, the LCPBSE classes may be serving as an organizer of the students' subsumers, so that they can attend the Calculus classes already with the necessary prior knowledge. Finally, we concluded that the organization of subsumers can be a critical strategy used to improve learning and to decrease the evasion rates. Such strategy can be applied not only in the LCPBSE, but also in other programs of other Universities.

Keywords: Meaningful Learning, David Ausubel, Engineering, Evasion, Subsumers.

Retrofitting of A Robot Arm Controller

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Abstract

The present project deals with the development of a controller for a robot, with high processing capacity, at a low cost, using as computational platform the Raspberry Pi 3. The motivation for the development of this study was the need to find a way to coordinate a Robot Arm ED-7220-4, whose original controller suffered irreparable damage, causing its loss. This work becomes relevant since the rescue of the damaged controller is infeasible, but the electromechanical manipulator is in perfect condition. The choice of Raspberry Pi 3 was due to the versatility that this minicomputer has in relation to its computational capacity. The project consists of the use of Raspberry Pi 3, together with a drive and reading interface of the robot manipulator, to perform the control and dispense the damaged controller. For this connection to be established, a communication and motor drive interface has been developed. Through this interface were connected the motors and sensors of the arm, responsible for the movement. The programmable ports for input and output of Raspberry Pi 3 were also connected to this interface, thus closing the system control loop. The control of the robot manipulator was developed using the principle of retrofitting, allowing to discover its operation, as well as to dimension the structural components. The analysis of this structure of operation was carried out from tests of drive and readings of the sensors from the equipment itself. Therefore, the kinematic modeling of the movements was obtained analytically through the method developed by Denavit-Hartenberg. The expected impacts of this project are the use of the controller, together with the robot manipulator, in teaching-learning at technical and Engineering levels. It is also expected to use the manipulator for research related to kinematic modeling and robot dynamics, as well as technologies for remote access to laboratories. As teaching-learning methodology will be used active methods and maker culture. Finally, the formulation of the interface between the robot and the platform based on Raspberry Pi 3 was validated as well as the realization of the kinematic modeling. We would like to thank CEFET-MG and FNDE for their support in this project.

Keywords: Controller, Retrofitting, Robot Arm, Raspberry Pi 3, Engineering Education.

The Innovative and Multidisciplinary Environments in A Brazilian University:

A Case Study

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Abstract

The aim of this paper is to investigate how the innovative and multidisciplinary environments in a Brazilian public university can foster a new innovation culture. Several institutions around the world have different approaches to improve the teaching at universities to drive economic growth and to foster the entrepreneurship. Most of the Brazilian public universities do not teach entrepreneurship and innovation as part of their undergraduate general curriculum and the existing programs are disconnected and isolated initiatives. Nowadays, we can see the attempt of some universities or professors or state government to approximate the industry to the academy or trying to bring entrepreneurship to the classes at the universities. This article also highlights how the environment at universities can shape the undergraduate students' behaviors to achieve the long-term impact on the economy. The concepts of innovation, multidisciplinarity, open innovation and the role of the university are discussed on this paper. Furthermore, most of the theories of innovation suggest that multidisciplinarity is an important ingredient to promote innovation. This paper analyzes the impact of these multidisciplinary and innovative environments in students mindset, once they are exposed to the entrepreneurship ecosystem. In the view of this situation, the main aim of this study is to investigate the innovative and multidisciplinary environments in a Brazilian State university and how they can impact the innovative student's mindset. This case study was conducted with the use of mixed methods and procedures: surveys, interviews with students and professors, local spatial observation inside the university. 55 questionnaires were applied based on the Berkeley Innovation Index (BII) and new questions about multidisciplinarity, whose instruments used to measure innovation mindset and multidisciplinarity. The survey was applied to undergraduates from different majors at university. 11 interviews were conducted with undergraduate students, professors, workers from the entrepreneurship center, incubator, accelerator, Technological Transference Office and Technologic Park. The analysis method included content analysis for the qualitative data and correlation statistics methods for the quantitative data. Finally, the correlation relationship of innovation mindset and multidisciplinarity has been fully confirmed. However, the results of the interviews showed that there is a lack of connection between different areas of knowledge inside of university that could be more effective and closer to improving the results of the innovation at university. The result shows the complexity of the process to build an innovative and multidisciplinary environment at university. There may be a need for a creative analysis and to interpret the value of this subjects and the implications for new emerging methods of teaching and connecting people inside of universities to became closer to the society needs. Beyond that, this research is intended to develop a diagnosis model for the improvement

of the administration and maintenance of the innovative and multidisciplinary environments in the university.

Keywords: Berkeley Innovation Index, Innovation, Innovative environment, Multidisciplinarity, University.

OPEI - Workshop of Projects, Entrepreneurship and Innovation:

A Multidisciplinary Experience

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Abstract

The multidisciplinary teamwork is nowadays recognized as a challenge for innovation processes and also a necessary action. The University needs to include the multidisciplinary teamwork teaching approach into different levels, from undergraduate students to doctoral students, in order to improve value proposition thinking and wealth generation to society. In view of this situation, the aim of this article is to present an ongoing experience called OPEI: "Oficina de Projetos, Empreendedorismo e Inovação", which stands for "Workshop of Projects, Entrepreneurship and Innovation". The OPEI class has been developed since 1st semester of 2016 at UFMG, with the participation of five professors from different areas: Industrial Engineering, Electrical Engineering, Physics, Business, and Biology. There are also active participation and academic contribution from undergraduate and graduate students, from different knowledge areas. This experience integrates not only students from different fields, but also faculties as

well. Furthermore, this course connects the students with the local entrepreneurship ecosystem in the early stages of their project. This report includes each phase of class development: planning, execution and evaluation. We investigate the impact of this multidisciplinary class in student's change of mindset, once they are exposed to innovative environment at both, the University and local entrepreneurship ecosystem. This teamwork experience also shows opportunities for student's formation improvement in the innovation and entrepreneurship concepts. We develop the OPEI's case study on a qualitative basis conducted with the use of a mix of methods and procedures: interviews, local observation and analysis of the student's evaluations classes. The analytical method also includes content analysis. The results show how OPEI team is being translating multidisciplinary complexity into simplified and objective actions and content, adequate to its also multidisciplinary public, which spams students from dozens of knowledge courses and undergraduate freshmen to graduate students interacting at the same class. The results presented are intended to provide subsidies to other similar teaching experiences on the innovation and entrepreneurship subject, recognized as necessary for quality of life improvement in society.

Keywords: Multidisciplinary Teaching, Innovation, Innovative environment, University, Entrepreneurship.

Methods to Increase Freshmen Interest and Motivation:

Combating Retention and Evasion Among Biochemical Engineering Students

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Abstract

The highest levels of evasion and retention on the Biochemical Engineering major at Federal University of Rio Grande are observed during the first semesters of the undergraduate degree, in which are offered the courses that compose the basic cycle of Engineering and are the foundation for the advanced courses. Literature confirms that entering the university can be a very stressful and life changing process, reinforcing the need of special institutional attention to the freshmen. As an alternative to fight this negative scenario and promote integration among students, a series of activities were proposed through the Program of Incentive to Academic Activities of Biochemical Engineering Students

(PAIEB), supported by the Institutional Program of Student Development (PDE-FURG). During the school year of 2016, motivational speeches, and time management workshops were organized through the program, in addition of a series of testimonies of juniors and seniors about their experiences on college. To evaluate the activities, opinion surveys were conducted to all participating students. Surveys applied showed that a high number of freshmen desired to graduate on Biochemical Engineering (97.5%), felt more motivated to study (97.5%), could visualize new areas that they could work in (95%), and could visualize application for their current classes in the testimonies (92.5%). In addition, 62.5% of the freshmen considered their academic performance bellow expected. It was found that the evasion level in 2016 remained stable when compared to the 2015 level (about 17%) and decreased roughly 3% when compared to 2014, and the retention level within the freshmen year did not show significant decrease. Therefore, the answers to the surveys applied showed that the program is helping on freshman interest and motivation, and data collected from the university database implied that the program needs to be amplified and intensified to help decreasing evasion and retention on the Biochemical Engineering major.

Keywords: Exchange of Experiences, Institutional Program, Integration Among Students, Motivational Speeches, Testimonies.

Cooperative Learning Cell for Android Application Development

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Abstract

The drop-out rate in Engineering Courses represent a significant issue for higher education in Brazil. This reality is no different in electrical and computer engineer undergraduate courses at Universidade Federal do Ceará. A possible reason for this drawback may be a basic formation cycle (the first three semesters of the course) focused entirely on math and physics. Although calculus, physics and programming are fundamental to the understanding of the next subjects, they may discourage the students may discourage the students due its inherent abstraction and sometimes distant interconnection to field Engineering tasks. In order to tackle this problem, the present paper presents a case study developed within a project called Cooperative Learning Cell for Android Development at Electrical and Computer courses of Universidade Federal do Ceará, campus Sobral. The project main objective was promote learning and knowledge sharing through self-oriented groups of Engineering students on first and second semesters. The student selection method was a questionnaire about their personal and academic interests and the only required condition was available time to attend the meetings and activities. Nine meetings happened, in the period from September to December of 2016, and a cooperative learning methodology were applied on work groups where knowledge is generated through interaction among two or more people resulting in an active participation of the education process. The meetings were

divided in classes and lectures from professional and the themes discussed were basic introduction to Java and advanced content in Android development. The classes were planned with a focus on content exposition, challenges and small projects for small projects for group task solution. The lectures invited professionals which work in Engineering companies at the North region of Ceará, showing the current situation of the job market, focused on mobile applications.

Keywords: Cooperation, Engineering Teaching, Incentive, Android, Public Education.

Electromyographic Data Acquisition

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Abstract

This paper consists in the elaboration of a low-cost prototype for a electromyographic data capture. These signals come from the natural process of muscle movement, and can be captured by electrodes, which may be surface or invasive. The acquired data from the electrode are of the order of 5 mV, that are subject to all kinds of environmental interference and other unmoved muscle groups. In this way, the work in question approaches different methods of treatment of these signs, to identify them in association with movements that represent the specific muscle contraction. As a consequence of this study, it's possible to use interdisciplinary interactions within the pedagogical process of the Electrical Engineering and health courses, verifying the theoretical process associated to disciplines such as Anatomy, Physiology, Signal Processing, Microcontrollers, Electrical Circuits, among others. At Health Courses, this could be used in practical classes about muscle contraction to verify two process: the minimum stimulus capable of generating the action potential, called the threshold stimulus and the refractory period, in which the muscle is physiologically recomposed for a new contraction and the captured signal is negative. In Engineering Education, this is used at analog electronic class to evaluate the right values for resistors and capacitors for the right gain and cutoff frequency. And programming an analog/digital converter at microcontroller class. As a result of this study, we have created a functional prototype based on printed circuit that has a complete structure for laboratory application. Finally, experimental trials were carried out contemplating the movement of the biceps as a way of validating the designed experimental prototype.

Keywords: Electromyographic Signal, Filters, Interdisciplinary Interactions, Low-Cost, Prototype.

Educational Robotics as A Tool to Encourage Learning

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Abstract

The number of evasion of the students of the Engineering Courses, mainly in the first semesters, is increasing. Many studies and educational research are directed at studying the causes of this evasion. The absence of the correlation of the introductory disciplines with the practical activities of the Engineering can be considered one of the main causes. One way to connect basic science knowledge such as mathematics, physics and programming to practical and daily is to use interdisciplinarity, such as robotics that can be treated as a teaching medium and an object of learning. This encompasses from mechanics and electronics, to the elaboration of robots, to mathematical models, for the creation and execution of algorithms. In this way, an Educational Robotics project was developed with the purpose of awakening in the student the interest in the theoretical and practical parts of Engineering. This project also aims to bring students from public schools in the state of Ceará to the university environment. For this, robotics was implemented as a tool to stimulate logical reasoning and creativity. The focus of this process is that the student learn to do, and this begins when he associates the proposed problems with real situations, leading him to arrive at the most viable solution, and another fundamental part of this process is the construction of the robot, which allows it Not only understand but also know how to make the prototype. For the execution of the project, Robot prototypes were developed with low-cost, accessible and easy-to-use materials. Robot control and intelligence were developed based on the

Arduino electronic prototyping platform by having its programming language standardized and being considered an open-source system. The entire Robot confection and programming logic was passed on to students through handouts, video-lessons and regular periodic training. At the end of the training, a robotics competition was held in order to verify the development of different skills, such as collaborative work, logical reasoning, creativity and the expansion of electronic knowledge. With this, it was verified that the connection between basic and Engineering knowledge facilitates the understanding of contents, helps in the organization of the reasoning and in the way the student handles and solves routine problems, generating a significant improvement in learning. This connection of knowledge also influences undergraduate students in the permanence of Engineering Courses.

Keywords: Autonomy in Learning, Educational Robotics, Engineering Education, Evasion, Interdisciplinarity.

The Importance of The Teaching Improvement Program in Different Kinds of Disciplines:

The Contribution of The Program in Several Areas of Education

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Abstract

The Teaching Improvement Program of Universidade de São Paulo (USP) aims to improve the academic skills (teaching, courses planning and production of teaching material) of the master and doctoral students. For reaching this purpose, the graduate students must complete a supervised internship at USP in a discipline of the undergraduate course, in which he/she can assist the teacher throughout the academic period. Taking this information into account, this work focuses in showing the importance of the students enrolled in this Teaching Improvement Program (referred here as trainees), comprising different types of disciplines of the Electrical Engineering Course, either practical, theoretical or mixed. The reports pointed out in this article are related to a trainee who has taken part of the program in four different disciplines, being responsible for supervising the undergraduate students during the experimental classes (laboratory activities), elaborating lists of exercises to be solved, and promoting weekly teaching-support meetings with tem whenever necessary. The results obtained from the inclusion of a trainee in the disciplines are quite encouraging, since it can be observed that in practical and mixed disciplines, with the aid of the trainee in the supervision and monitoring of the practical experiments, the responsible professor was able to dispense more time to explain better the theoretical part, in addition to that the monitoring became more personalized of each bench. Regarding theoretical subjects, with the lists of exercises elaborated by the trainee and made available with the material of the theoretical classes, the students were able to carry out a better follow-up of the contents throughout the academic

period. In addition, due to weekly meetings with the trainee, students' questions about the content did not accumulate for the dates close to the tests, as usually occurs. Therefore, due to the experience gained in these different types of disciplines, it is suggested that a larger number of positions can be opened in the program so that more trainees can join and, consequently, more disciplines may have a trainee to assist the responsible teacher. The benefits certainly reach all the agents and institution involved: the University, the trainee himself, the responsible teacher and, finally, the undergraduate students.

Keywords: Engineering Education, Practical Disciplines, Theoretical Disciplines, Supervised Internship, Teaching Improvement Program.

How to Raise and Keep Interest in Power Quality Lectures:

Methodology Adopted, Positive Aspects, Challenges, and Learning Opportunities

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Abstract

Considering the characteristics of electricity generation, transmission and distribution systems in Brazil, with or without distributed generation sources, Power Quality (PQ) is an appropriate subject, but still little inserted in the curriculum of Electrical Engineering undergraduate and postgraduate courses, especially in the courses related to the sub-area of Electrical Power Systems, and other related courses. In this context, this paper addresses the methodology adopted in the theoretical/expositive PQ lectures to undergraduate students at the Laboratory of Analysis of Power Quality Monitoring (LAMQEE), Escola de Engenharia de São Carlos (EESC), Universidade de São Paulo (USP) between 2014 and 2016. The material will cover the positive aspects of the methodology adopted, the challenges faced and the learning opportunities envisaged. During the course, in recent years, there were lectures to complement the theoretical classes and new tools of pedagogical aid were also introduced that served as a support and development to learning. Multi-media equipment and computer simulations, presentations and individual and group discussions of technical-scientific articles, as well as arbitrary digital generator of electrical signals and a PQ analyzer applied to various components (elements) and/or electrical circuits are some of the many tools used. In order to raise and keep the interest of the enrolled students,

practical exercises were included in the course, which are applied and evaluated in groups and/or individually in the classroom, with immediate feedback to students on their performance in the activities. It is worth emphasizing that the implemention of the methodology in use counts with the indispensable support of a student of the Program of Education Improvement (PAE) supported by Universidade de São Paulo (USP). In the way it is conducted, the course allows for a highly supervised involvement of the PAE scholarship holder with the teaching, greater interest and participation of undergraduate students on the activities, improvement in the quality of the teaching environment and the content lectured. The confidence of the students on the learned concepts and developed practices is evident and the number of interested students in topics related to PQ after the lectures, aiming for future works, such as end-of-course papers and at the post-graduation level, are reflecting positively. Despite some challenges and improvements that can still be implemented, the results obtained so far show that many of the tools, when properly applied, can enhance the exploration and interest of relevant topics related to PQ, stimulate and motivate the students to learn and lead them, even at the undergraduate level, to an academic research environment and at the same time very close to future professional activities.

Keywords: Laboratory Activities, Pedagogical Tools, Power Quality, Teaching Methodology, Engineering Education.

Genetic Algorithm Applied on Network Reconfiguration:

Implementation of A Multi-Objective Algorithm as An Undergraduate Interdisciplinary Project

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Abstract

The electric power distribution systems are, mostly, constructed as weakly meshed networks. However, they operate as radial systems, which means that the power flows in only one way: from the substations to the consumers and there is only one electrical circuit connecting those two points. Even though the system operates as radial, there are physical links connecting points that belong the same or a different feeder or substation. Those links are mechanical switches that can be used to isolate an area in the event of an electrical failure or maintenance or to supply electrical power to an area using another source. Besides the reliability incensement, by using the switches correctly the technical power losses may decrease and the consumer's voltage magnitude might be elevated. The manipulation of the electrical distribution system aiming an optimal operation point is called network reconfiguration and is a well spread concept. Due to the several possible reconfigurations, since there are many switches in the system, the algorithms based on exact methods demands too much time and computational effort, on the other hand, by using metaheuristics the efforts are reduced and the solutions are optimized. This paper presents the development of a metaheuristic algorithm created as the result of an undergraduate interdisciplinary project combining two courses from the Electrical Engineering major of the Instituto Federal de Goiás (IFG), Campus of Itumbiara: Introduction to the Electrical Power Systems and Topics on Artificial Intelligence. The presented tool uses a multi-objective Genetic Algorithm that uses an NSGA-II routine to evaluate voltage magnitude on the loads and the system's total power loss. The tool was tested using IEEE's test systems and presented satisfying results, however, the major gain is the strengthening of the multidisciplinary activities applied to the Engineering teaching. Interdisciplinarity has been the object of study to many research groups around the world. Thus, this paper salients the relevance of projects involving two or more courses as a mean to encourage the students to evolve a critical view of problems and the search for solutions using multiple course's subjects.

Keywords: Backward-forward Power Flow, Distribution Systems, Genetic Algorithm, Multi-objective Optimization, Network Reconfiguration.

The Mobilization of The Concept of Vector and Linear Transformation Concepts in Civil and Production Engineering:

A Dipcing Methodology Based Analysis

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Abstract

Motivated by the need of remodeling the way mathematical contents are developed in Engineering Courses in order to create bonds between these mathematical subjects, the context of the student forma-

tion area and the specificities of their future professional performance, a primary investigation has taken place, by the means of the theory "A Matemática no Contexto das Ciências (MCC)" (in Portuguese), searching for the connections between the disciplines of Linear Algebra (AL in Portuguese), Analytic Geometry (GA in Portuguese) and the non-mathematical disciplines that belong to the basic Engineering section ("Núcleo Básico" in Portuguese), such as specified in CNE/CES 1362/2001 (National Guidelines for Brazilian Engineering Courses), in the undergraduate courses in Civil Engineering and Production Engineering of two Brazilian Institutions. The research, which incorporates the use of the MCC, was based on an adaptation of the Central Step of the Dipcing Methodology ("Diseño de Programas de Estúdio de Matemáticas em Carreras de Ingeniería"), especially over the data collect period from textbooks. In this paper, were analyzed the mobilizations of the concepts of notions of vector, in the subjects "Operations Research I", "Electricity", "Thermal Sciences" (in the Production Engineering Course) and linear transformations, in the subjects "Transport Phenomena", "Electromagnetism", "Mechanic of Rigid Bodies" (in the Civil Engineering Course).

Keywords: Controller, Retrofitting, Robot Arm, Raspberry Pi 3, Engineering Education.

Scientific Initiation Project as Curricular Internship Activity:

The relevance for Undergraduate Students in Civil Engineering

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Abstract

This paper will discuss the importance of the scientific initiation accepted as internship activity for the Civil Engineering professional. Moreover, it will be pointed out the scientific initiation project that was developed by the author of this paper during his undergraduate in Civil Engineering at PUC Minas, in Brazil. To that end, it was observed that research activities contribute to intellectual, logical reasoning, critical reading ability, improved writing skills and orally speaking skills improvement, as well as they develop certain skills and competencies of fundamental importance to the professional. Because it is an internship activity and, above all, a project of scientific initiation, there is a range of knowledge and courses involved, specifically, in this project: Reading and production of texts, Scientific and Technological Methodology, Informatics II, Analytical Geometry and Linear Algebra, Calculus I, II and III, Theory of Structures I and II and Structures of Concrete I. It is also highlighted the Advanced Structural Analysis course and the subjects related to the thematic of the teaching-learning in Civil Engineering majors. Even though they are not related to a specific course studied in the baccalaureate of Civil Engineering, they have been constantly analyzed and studied due to their significance to the project. Thus, the relevance of such research project for the formation of the student as a citizen and as a future teacher must be emphasised. Furthermore, the experiences gained through the scientific initiation project are impacting in the formation as professionals of the area. In short, if the objective of the student is to do masters and doctorates, conducting research projects encourages and contributes significantly to the achievement of this objective. Hence, the indisputable gain in the possibility of theoretical deepening, as well as the daily living with the challenges, and the search for overcoming them, and the constant improvement of skills and competences previously explained, show how relevant scientific initiation accepted as internship activity is because it allows the conversion of practice and theory.

Keywords: Competences, Internship, Scientific Initiation Projects, Skills, Undergraduate in Civil Engineering.

Regression Analysis Applied to Soil Mechanics

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Abstract

The present dissertation aims to demonstrate the results from the scientific initiation project that proposes the use of MS-Excel to determine the coefficients of the soil shear equation: cohesion and the angle of internal friction. This project has two main objectives. First, the development of a computational analytical method with the use of computational techniques of regression analysis in MS-Excel to determine the equation of shear strength. Second, this project was attended by four students from the second term (first year) of Civil Engineering of PUC Minas, in Brazil, under the supervision of a student of the last year and three professors of PUC Minas. These four students only had previous knowledge of the basic disciplines, without knowledge about Mechanic of Materials and Soil Mechanics, which are primordial for the project's development. The interdisciplinary that has occurred between the disciplines of Soil Mechanics, Laboratory and Field Tests, Mechanic of Materials, Calculus, Analytical Geometry and Linear Algebra was detected with the accomplishment of this work. It was observed that the values obtained using MS-Excel are reliable, and using MS-Excel solved the difficulties of precision found in the determination of the cohesion and the angle of internal friction. Hence, it is possible to conclude that the automation of the procedure behaved in a very effective way, and it can be clearly applied and used by students and professors. In addition, such computational analytical method proved to be viable and indicated option to gain time savings and optimization of works, since the program proved to be highly efficient and reliable in obtaining the shear equation, meeting the expectations and the objectives established by the project.

Keywords: Computational Tool, Equation of Shear Strength, Excel, Linear Regression, Soil Mechanics.

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