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The aim of ICAEEdu 2019 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.

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Million Dollar Energy:

A Game to Get Rich Investing on Renewable Energy

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Abstract

In this article we will be presenting a board game developed during the second school semester of 2018 at Federal University of Goiás during administration discipline classes. This game was inspired on the management of a company of power generation and adapted for that the players could experiment different type of power generation plants and different type of consumers. Several events can be activated when the player reach determined board division, and these ones can influence on the power generation and on the user consumption chosen by the players. The winner will be decided when all the other players declare bankruptcy, or at any time of the play since it is an agreement made by all players. On this last case, the winner will be the player with the higher net financial assets between the players. Board games are, by nature, a big learning tool and logical reasoning development. In this way, the main purpose for the “Million Dollar Energy” is to develop abilities of company and patrimony management. The player is taken to a place where he is on constant contact with risks and opportunities and must take the correct decisions before them. Thus, we present a game which has a harmony between fun and learning.

Keywords: Renewable, Green, Energy, Game, Board, Management, Administration.

Guide-Me:

Engineering Education for Solving Real Social Problems

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Abstract

The main goal of Engineering is to make life better and more comfortable by solving its problems. As the society grows and get even more modern, its problems also get more complicated and complex, needing a multidisciplinary approach. This work intends to show how an Engineering student can return to society all the knowledge that he has received. According to a research made by IBGE, in 2010 there were in Brazil 528.624 visually impaired people and more than 13 thousand of them were at the state of Goiás. In the Federal University of Goiás (UFG), 55 students had low vision and 1 was completely blind. Becoming visually impaired is generally cause by diseases like Cataract, Glaucoma and Macular Degeneration as pointed by WHO (World Health Organization). One of the biggest difficulties faced by blind people is the locomotion in closed places like shopping, Universities, public agencies and others. The solution developed was a mobile application to communicate with Beacons via Bluetooth to help these people achieve independence even when visiting a place for the first time. Spreading strategically the Beacons inside the building intended to be mapped and using the Fingerprint method to make a list of the important points on the ambient (like doors, stairs, elevators, rooms, etc), it was possible to keep track of the user and guide him from one location to another. Through the year of 2018, it was developed, as a thesis of course conclusion, the app and its integration with the Beacons. It was used React Native as a language and Texas Instruments Beacons. Was proven throughout the development of the work that the Received Signal Strength Intensity (RSSI), used for locating the user of the mobile phone, is not stable enough at start to make the good estimation of the position and movement of the user of the app, needing some filter treatment. Knowledge and theories from telecommunication networks and numeric calculation were applied to find the best combination for filtering RSSI. Besides that, it was shown that it is possible to achieve the purpose wished, although it is still needed more work on the solution. During all the process there were interaction between the student and visually impaired people so that the solution could be exactly designed as the future users would like and need. This way, different abilities were developed n the student, giving him capabilities that only by solving problems outside the University it would be learned. Also, the possibility to see different subjects already studied now being used on a practical way gave the hole class of students a new and inspiring view of Engineering.

Keywords: Visually Impaired, Mobile, Engineering, Locomotion, Intern Places.

Educational Games for Making Math Learning More Popular: Approach with Design Thinking

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Abstract

Math has been, through several years, one of the most difficult disciplines for students. According to the results of the last survey published by Organização para Cooperação e Desenvolvimento Econômico (OCDE), Brazil occupies the 6th lowest position in mathematics in the ranking of 70 countries and economies surveyed and 70% of Brazilian students are below the level of mathematics knowledge considered basic for human learning and full participation in the social, economic and civic life. Numerous free apps, paid apps and board games exist to facilitate maths learning, for example, Math Kids and Kids Fun and Learn. All of them have the simple goal of catching students interest because, according to Vygotsky, people learn by playing. The problem is that most of these games often bring a traditional conception of mathematics teaching presented in most pedagogical and non-virtual games, that is, a decontextualized conception of more realistic childhood scenarios, not playful and not effective in terms of learning. Despite this reality, according to Barreto, games could have an important paper in this scenario. This paper proposes the creation of new Technologies for mathematics which provide effective and fun learning. In addition, the work aims to find ideal games capable of making players learn math without noticing it throughout the game journey. The methodology used for reaching this goal was Design Thinking, with tools such as map of empathy and personas. The tools help identifying the main user and his characteristics and provide opportunity for learning math with fun.

Keywords: Game, Educational, Math, Development, Design Thinking.

Board Game and Active Methodology:

Innovation Has Not Increased with More Time

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Abstract

The gamification was used as a pedagogical instrument in the discipline of Logistics Planning offered in the category of Free Nucleus in the semester 2018 2 by the Electrical Engineering course. The methodology of game's evaluation was presented with prominence, the first occurring in the 6th week (near the beginning of the semester) and the second in the 15th week (near the end of the semester). The major difference was the liberty of material (format, size, durability and etc.) to be used in the first evaluation and the mandatory (aesthetic) standardization of all materials in the second evaluation. The results of the first evaluation were sent to all students before the second evaluation, a fact that could suggest a hypothesis: the more time the better innovation. The research revealed that the systemic view in the 1st evaluation was a total of 69% and of 77% in the second evaluation, the innovation in the 1st evaluation was a total of 65% and 73% in the second evaluation; the element's harmony in the 1st evaluation were a total of 68% and of 67% in the second evaluation; the theoretical foundations in the 1st evaluation were a total of 50% and of 47% in the second evaluation. But in the five other topics evaluated there was no significant improvement in the second evaluation. Even with more time used, the results remained the same. It should be highlighted among the different aspects and circumstances that surround the students of the engineering day-to-day the anxiousness caused by the tests at the end of the semester, wich suggests a hypothesis: more time, more pressure and less innovation.

Keywords: Gamification, Board Game, Logistics, Active Methodology, Research.

Integrative Learning:

Interdisciplinary Methodological Innovation

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Abstract

The paper discusses the concept of Integrative Learning (IL) as a methodological strategy for the construction of interdisciplinarity and how the academic environment promotes interdisciplinarity in the attempt to produce meaningful knowledge for the complex context in which we live. IL is a strategy that has been used mainly by American Universities since the 2000s. Since then, economic globalization – as a result of advances in communication and transport technology – combined with a free market ideology have led to an increase in free trade between countries. This scenario of great and profound technological, economic and social changes requires improvement in product quality, increasing competitiveness and the need for more and better professional qualification. Institutions of higher education in the most diverse areas have felt the need to improve and diversify the skills of their graduates. The proposal of IL methodology can provide students with opportunities through which they can reflect on experiences and on great problems of society in which they are inserted. Institutions have realized that it is not enough to provide only specific knowledge of an area, but also a systemic vision, with the integration of knowledge from several areas in order to prepare students for a labor market that is more demanding and competitive every day. The text discusses the concept of IL and the results of a bibliometric study of the term. The papers were selected from Web of Science, Emerald, Scopus, Scielo, Spell and Ebsco. The criterion for choosing these bases took into account the fact that they are recognized by the quality of the publications stored and because they allow a better comprehensiveness of the research. The initial research featured numerous works by American researcher Julie Thompson Klein, a professor of human sciences in interdisciplinary studies at Wayne State University. Her article “Integrative Learning and Interdisciplinary studies”, drew attention to the IL movement that was gaining momentum in American Universities. As a result of the application of the IL concept, a research group on Sustainable Engineering was created at Escola de Engenharia de Minas Gerais– EMGE, School of Engineering located in Belo Horizonte, MG, Brazil. This group integrates Engineering and computer Sciences students with professors and researchers from different areas and institutions of higher education (EMGE, SKEMA, LATACI and Seattle University). At SKEMA Business School, Brazil, also located in Belo Horizonte, another IL project is being developed. Students and professors are developing their own price index, integrating disciplines from different areas of knowledge. The SKEMA Professors aim to multiply this project to other SKEMA campuses outside Brazil.

Keywords: Integrative Learning, Interdisciplinarity, Knowledge Management, Management of Higher Education, Transdisciplinary.

Analysis of The Influence of The Basic Mathematics Course, of The Escola Politécnica de Pernambuco, In The Disapproval Rate of The Discipline of Integral and Differential Calculus 1 with Emphasis on The Teaching Variables and Students Who Came from Public Schools

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Abstract

It is well known that the transition “High School – University” is not so simple, but in Engineering this change causes extreme difficulty. There are several factors that influence this, being the mainly ones: different professors for the same discipline, the arrival at the University of students coming from public schools and the absence of basic knowledge of the Mathematics discipline. Through this situation, the Escola Politécnica de Pernambuco, in order to reduce the initial difficulties, created the Basic Mathematics Course. In order to understand the indices of failure in the course of Differential and Integral

Calculus 1, the data referring to the first test scores of Calculus 1 of all students were collected to study, since it is similar to all the contents given in the Course , since 2017.1, the different types of professors per class, the grades in the assessments of the Basic Mathematics Course and which students are of “wide competition” and those who came from public school. Out of the information collected, it is analyzed which professors scored the highest failure rate and if they are – or not - part of the Basic Mathematics Course, as well as the failure rate of students who came from public schools and the importance of the Course for them in the first period, comparing both factors with the grades taken by those students in the tests of Basic Mathematics Course. In that perspective, we will have data about the importance of the Course for students and the degree of teacher professor interference. Finally, from the analysis performed on the classes and professor who had the highest percentage of failure from students, and the quantitative of those who came from public schools with big difficulties, new methodologies are in progress objectifying that the Basic Mathematics Course decreases the rate of disapproval in the mentioned subjects, and increase their Mathematical knowledge, covering, therefore, all the people involved in the process of teaching and learning, facilitating the student’s life in the first periods of the University.

Keywords: Basic Math, Curricular Gap, Obstacles, Professor, Satisfactory Performance.

Teaching of Railway Signaling Concepts Using PBL as Active Methodology

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Abstract

New teaching tools are emerging in order to encourage students to understand that the concepts, phenomena and theories presented in the classroom should be employed in the daily professional life. With the use of new teaching techniques, professors should also adapt the syllabus of the disciplines more and more to current issues in the professional field. In this way, the application of the Problem Based Learning (PBL) methodology, used in the discipline of Railway Signaling (since 2017), is part of the syllabus of Terrestrial Transportation undergraduate course of the Faculdade de Tecnologia de Barueri, located in the state of São Paulo (Brazil). The student who seeks this course aims to improve in the field of transportation (road and rail) and aims to expand technical knowledge inherent to the field. Many of our students already work in the field of transport and, in search of a solution; end up bringing some situations experienced in their professional life. This participation helps in the administration of classes and in the development of projects. Most of the cases presented involve case studies related to the construction of a railway. Therefore, it was proposed during the Railway Signaling classes the construction of a physical model, in scale 1/87, in which it should be capable of portraying the various situations of the infrastructure of the Brazilian railway network involving the fixed and mobile railway signals. This tool assisted visually in the issues of abstraction, in which regards, the identification and implantation of the railway network and its signaling. The use of this methodology allowed the student to understand the importance of railway signaling, as well as its application. It helped to emphasize the importance of good infrastructure when it comes to railroads. The students were very open to new knowledge and new teaching techniques. It is important to stress that students have learned to work in teams and managed their time very efficiently.

Keywords: Physical Model, Active Methodology, PBL Methodology; Railway Signaling, Teaching Technique.

Concept Teaching Involving Urban Mobility and Accessibility Using PLE as Active Methodology

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Abstract

The purpose of this article was to apply the Project Led Education (PLE) teaching methodology. The implementation of this tool has been observed year after year and every new form of employability, always aiming at understanding the importance of phenomena, concepts and techniques related to the development of projects in the classroom. During the classes of the Mobility Discipline of the Terrestrial Transportation under graduation course of Faculdade de Tecnologia de Barueri, located in the state of São Paulo, Brazil it was proposed for the students the elaboration of a project of a road terminal, with classification D. Thus, in this article a case study of the application of the PLE Teaching Methodology was approached using as goal the implementation of this bus terminal. The project was developed by students who considered the needs of the Brazilian urban region in relation to public and collective transportation. In the case study in question, the mobility and the internal and external accessibility of a road terminal, the location of the terrain (topography, local vegetation, economic investments, the capacity of the highways around the terminal, impact on the service of the surrounding highways, impact on the surrounding air quality, water use, energy use, population well-being) and also the creation of an area for vehicular parking and the circulation of buses inside and outside the bus terminal. This proposal of methodology of study contemplated the implantation of ecologically correct items in the daily operation of a terminal, such as, solar energy use, reuse of rainwater, green walls among others. The students' studies to understand the current norms and legislation were intense and helped in the elaboration of the project. Participating students were very keen to learn, observed that it is possible to apply the concepts learned in the classroom in their professional life and they also developed the ability to work in teams respecting divergent opinions.

Keywords: Accessibility, Active Methodology, PLE Methodology, Urban Mobility, Bus Terminal.

Automatic Correction of Discursive Question:

An Approach to Contexts with Limited Language

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Abstract

Distance learning platforms usually apply objective assessments to students, proposing and automatically correcting questions. A bank of issues enables this process. Although with recognized didactic value, this process is not ideal. Essay questions are too important because, in addition to testing students' knowledge, they develop their ability to produce textual content. The automatic correction of discursive issues is an unresolved problem by the Natural Language Processing (NLP) area, but there are several approaches with partial solutions. The language offers us several words and syntactic constructions. Thus, there are several ways to express an answer. This fact is the main obstacle to the automatic correction of subjective questions. This work starts from the hypotheses that a human being invests decades in the process of refinement of his communication capacity, giving him large capacity of text production. Thus, it is likely that in adolescence their capacity for textual expression is still limited. Proposing models to construct an answer can limit still more the variations of the textual expression. This work proposes an essay question corrector that acts in a restricted language context. The main restrictions applied in the context were the application aimed at adolescents with a mean age of 15 years, the limitation of the programmatic content that involves the issues and a template to structure the answers. These facts already reduce significantly the possibilities of textual expression. Other constraints imposed were (a) the creation of questions "what is", "when it arose", "what is the purpose of"; (b) establish the beginning of each answer; (c) the treatment of nominated entities; (d) the elimination of words without semantic value in the sentence and (e) the standardization of more frequent vocabularies used by the group of students. The correction process has the following steps: (a) the determination of the grammatical class of all words in the text; (b) the separation of sentences into clauses or noun phrase and (c) the creation of logical predicates representing the semantics contained in the analyzed phrase. It was observed that for each model of the phrase syntactic structure, one can derive a set of logical predicates that express the idea contained therein. With eighteen syntactic rules it was possible to map the knowledge contained in sixteen responses of the class. Some semantic problems were found inspiring the research continuity. The measure of similarity between the logical propositions that represent the answer given by the student and the propositions that represent the feedback of the

question defines the student grade. The initial results demonstrate that the proposed algorithm can correct the discursive issues of a second-year high school class. In some cases, it is necessary to know the semantic of words to mapping the logical predicates, however, in the most of them, the phrase structure is enough for such mapping. The small number of necessary rules for interpretation of the studied questions shows the viability of the proposed approach.

Keywords: Automatic Correction, Discursive Question, Delimitation of Language Context, NLP.

Proposal for Updating the Civil Engineering Program of the Universities Near the Pólo Gesseiro do Araripe:

A Critical Analysis of Current Curriculum Profiles

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Abstract

The Pólo Gesseiro do Araripe (PGA) accounts for about 97% of Brazil's plaster production. Thus, it becomes an important Local Productive Arrangement (LPA) of the Brazilian Northeast, since, in addition, it includes three states of this region: Pernambuco, Ceará and Piauí. Despite this importance, the region still suffers from numerous socioeconomic problems, with skilled labor and high rates of informality. These adversities result in a place of low technological development, so that the equipment used for calcination is developed in an empirical way, based on the great experience and creativity of local metallurgists, who have adapted the models that were imported by foreign companies, such as Grebex Technologies. Simultaneously, the curricular profiles of Brazilian Universities still do not follow the new curricular guidelines, launched in 2019, that seek to align theoretical content with local market reality. In this way, this work seeks to perform a critical analysis of twelve curricular profiles of the Civil Engineering courses of the main Universities of the states that make up the aforementioned LPA, in order to highlight which Higher Education Institutions form qualified Engineers to work in this sector. So, it was sought to quantify the curriculum profiles that present specific formation in the plaster area. In addition, two references were prepared: the first as a complement to the discipline of Construction Materials, contemplating the basic knowledge about the ore; and the second being more specific for the application of gypsum technology and its derivations. Finally, a reference map of the relationship between the researched Universities and their distance from the Pólo was also elaborated. Among the Universities analyzed in this production, in Pernambuco, only the Escola Politécnica da Universidade de Pernambuco (POLI/UPE) presented a discipline exclusively directed to the teaching of gypsum and

its applications, which is titled “Gypsum Technology Applied to Civil Construction”. The Universidade Federal do Vale do São Francisco (UNIVASF), being the University of Pernambuco closer to the PGA, only demonstrated something related to gypsum in a complementary bibliography. As for the other Universities, including those in Ceará and Piauí, no information was found on the teaching of the respective material, only “Construction Materials” subjects, which may mention it during the course, even though the specificity is not clear in the program. The Universidade Federal Rural de Pernambuco still presented, in a generalized way, walls made of gypsum board, present in the program of the discipline of “Technology of Civil Construction 1”.

Keywords: Civil Engineering, Curriculum Profiles, Education, Gypsum, Outreach.

Proposal for Integration between Computational Fluids Dynamics and Project Led Education:

Updating of Mechanical Engineering Curriculum Profiles in Pernambuco – Brazil

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Abstract

The vision that will guide the professional life of undergraduates is built during their academic education, and the way in which it is treated in the classroom is of short importance for student's future. The classical formation is given through the transmission of knowledge, formulas, definitions and precepts, among others. Such paradigm often makes difficult to student sees the application of those learnings in real life. So, Project Led Education (PLE) emerges as a response to this need and teaches the student through practical projects, being applicable mainly in the scope of Engineering. At the same time, it has Computational Fluids Dynamics (CFD), which is a computational tool that encompasses the disciplines of Numerical Calculus, Fluid Mechanics and Heat Transfer, as well as other associated phenomena. Its use grows more and more in the industry, as it is crucial in the execution and testing of new projects, with great reduction of cost and time. Despite this, few professionals in Brazil are qualified to work in this sector, since the access to this methodology is more restricted to postgraduate courses. This work aimed to develop a proposal of a didactic sequence for the integration of CFD and PLE in Fluid Mechanics discipline, present in the curriculum of almost every Engineering courses in Brazil. Initially, will be worked the previous knowledge necessary to understand the physics present in this software, and then, afterwards, the proposal presentation of the projects that students should prepare. For its more didactic packages, and for being a long time in the market, the software available free of charge

by ANSYSTM for fluid dynamics, becomes a great ally. The proposal was based mainly on the Mechanical Engineering courses of the Centro de Tecnologia e Geociências of the Universidade Federal de Pernambuco (CTG – UFPE) and the Escola Politécnica da Universidade de Pernambuco (POLI – UPE).

Keywords: ANSYS, Computational Fluids Dynamics, Mechanical Engineering, Project Led Education.

Virtual 3D Learning Environment:

Development of Virtual Objects and Curricular Units for CNC

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Abstract

The model of traditional teaching, where students sit down, listen to their teacher, take notes and do tests, has been changing gradually according to technological advances. The present project deal with the development of a virtual model of a Computer Numeric Control (CNC) machine and curricular units to extend and support the traditional teaching-learning process by means of gamification and reinforcement learning. The motivation for the development of this virtual environment was the need of new methods and techniques to teach and learn at the new digital era. This project is part of a thematic project of distance learning in a remote access lab. The objective was create a 3D immersive virtual environment with high realism which the user has a dynamic learning experience, making the teaching-learning process more attractive, since technologies are increasingly present in people's lives. The project consists in using a real CNC created at CEFET-MG as model and free licenses software to virtualize and control the virtual object. For this, using Blender to create the virtual modeling. Through the Unity 3D, using a C-Sharp programming, the g-code be compiled and reproduced, creating movements and functions like the CNC used as reference. The lab was added to Moodle using the Unity-SCORM Integration Kit, enabling the remote user access to the simulator, direct interaction with the real CNC through activities implemented via SCORM and all the content available. The analysis of the results was carried out by testing at CEFET-MG lab on February 2019, where the g-code was executed in the real CNC and right after in the virtual environment. After comparing the obtained results, it was concluded that the virtual environment present results without deviations. The virtual environment optimizes lab resources, primarily by enabling remote access. The expected impacts of this project are the use of this remote lab methodology at Engineering and vocational training levels. It is also expected to add functions like drilling calculations, tools change and tool break simulation, as well new virtual objects that has been tested, like a five-degree of freedom robot arm and a three-degree of freedom delta robot coupled with a computer vision system. We would like to thank CEFET-MG, FAPEMIG and PET/SESu/FNDE for their support in this project.

Keywords: 3D, Distance Learning, Remote Lab, Teaching and Learning, Computer Numeric Control.

“Engenheiros da Infância” Takes Action in Early Childhood Education Centers:

An UFG’s Engineering School Extension Project Brings Improvements to Childhood Education

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Abstract

The present work concerns the participation of the extension project of the Universidade Federal de Goiás (UFG) “Integrated Education: The University back to early childhood education”, at the “Curta o Campus - Autumn Edition” Event, organized by Pró-Reitoria de Extensão e Cultura (PROEC/UFG). This event aims to bring the population closer to the dependencies of the University and activities developed by the academic community. Likewise, the extension project group, better known as “Engenheiros da Infância” (Childhood Engineers), seeks this approach by using theoretical knowledge, contact with University teachers and access to the laboratory structures of Universities to solve problems presented by the municipal Children’s school. The group acts suggesting improvements in infrastructure problems and developing pedagogic toys according to the need presented by the children’s teachers, promoting different activities and learning skills to their students. The team Childhood Engineers alongside with PROEC suggested a workshop of recreational toy development for children from ages of five to ten years old. Aspects of psychomotor development, social interaction, environmental impact and stimulation of scientific knowledge were taken into account, when manufacturing the toys. In order, to meet all requirements previously exposed the toy chosen was the “Vai e Vem”(Come and Go). Among with the

materials needed for the production of a “Vai e Vem” toy, are two plastic bottles cut in half. To collect the necessary material a campaign was carried out with the community through the social media from Childhood Engineers of PROEC, resulting in the collection of approximately one hundred and thirty bottles. During the workshops, it was also emphasized to the children the importance of the correct destination and reuse of recyclable materials present in our daily life. During the workshop, there were made forty-six toys providing an afternoon of fun, cultural rescue and interaction for children and their families.

Keywords: Early Childhood Education, “Engenheiros da Infância”, Engineer, Engineering Education.

“Engenheiros da Infância” in The 5th Entrepreneurship University Olympiad (OEU):

An UFG’s Engineering School Extension Project Learning How to Entrepreneuring

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Abstract

This work is related to the participation of the project “Integrated Education: the University back to the child education” created by undergraduate students at Universidade Federal de Goiás (UFG) on the 5th Entrepreneurship University Olympiad (OEU), organized by Centro de Inovação e Empreendedorismo (CEI) in partnership with the same University on October 2018. The project group, better known as “Engenheiros da Infância” (Childhood Engineering), was registered in this competition on the social category, which aims non-profits projects. The category was chosen due to the team’s interest in approaching Engineering students to act in order to improve and collaborate to child’s education. The main challenge was to suggest some practical solutions to structural problems, which affect the quality of education from Municipal Child Education Center (CMEI) in Goiânia, capital of the state of Goiás at Brazil. The project was registered in the 5th OEU looking for improving its structure and advertising the project, in order to mobilize more people and resources, making it more effective. The team “Engenheiros da Infância” participated in the competition at the same time as performed its first action in the

CMEI Cecilia Meireles. First act of the team was creating, pedagogic toys, using reduced financial costs, that encourage motor coordination development. The toys were designed by the team and used UFG's Mechanical Engineering School laboratories equipment for production, such as a laser cutting machine. Alongside with creating pedagogic learning toys, teachers working at the Municipal Center of Education presented problems not direct related to education, but also related to Engineering knowledge acquired by a graduate student in his academic experience, such as poor acoustic insulation between classrooms and high temperatures under the courtyard ceiling. While participating in the OEU, the group could notice several aspects concerning entrepreneur competences presented in this project. The participation in the Olympiad ended with a final report submission, which included details of project structuring as work plane and its actions, as well as all manufacturing processes and Engineering suggestions made in order to improve teacher's working conditions. There was also the inauguration from all toys manufactured during a special event to celebrate the children's day, organized by the municipal institution. In conclusion, the obtained results were satisfactory, with the team "Engenheiros da Infância" taking 6th place in the competition, which brought on the Engineering students growth and knowledge, also, the satisfaction of those benefited by the actions of this group, as well as to other parties involved in the process.

Keywords: Entrepreneurship, Learning skills, Pedagogic Toys, Competition, Olympiad.

“Engenheiros da Infância” Hold Workshops at “Curta o Campus - Autumn Edition” Event

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Abstract

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destination and reuse of recyclable materials present in our daily life. During the workshop, there were made forty-six toys providing an afternoon of fun, cultural rescue and interaction for children and their families.

Keywords: “Engenheiros da Infância”, “Curta o Campus”, Come and Go, Workshop, PROEC.

Knowledge Exchange and Skill Development:

Case Studies

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Abstract

Generally, the desired and required profile of the graduated student in Engineering, i.e., the professional trainee, or the Engineer, accounts for a generalist, humanistic, critical-thinking and reflexive

background formation, which make this professional capable of comprehending and developing new technologies, stimulating his critical and creative role in identifying and solving problems, bearing in mind its political, economic, social, environmental and cultural aspects, with an ethical and humanistic approaching, in accordance with the demands of society, and in accordance with the national curricular guidelines proposed by the Brazilian Ministry of Education (MEC). This way, this work aims to present and discuss the results of three extension projects (case studies) that have significantly added opportunities, in addition to those offered in class, during the formation of Engineering, aiming the innovative, educative and entrepreneurial activities. The first Project (study case) has provided the knowledge exchange and professional and graduation experience exchange between the Professionals/Engineers (ex-students) and the undergraduate students, including the undergraduate students' initiatives (as protagonists) in order to approximate the undergraduate students to their future career. All activities have been carried out highlighting the demands of the Engineer's career, interacting Engineering students and graduates, from the internal and external communities to the University. Yet, the second study case has promoted the learning in the educational area, where the undergraduate students have acted as a teacher at a preparatory class for the ENEM (the Brazilian national exam that promote the access to state Universities all over the country). In addition, this case has promoted the social integration of students of higher education with high school students. It must be emphasized the importance of this educational support, including the advising of each student according to his individuality, so that he could complement his studies and overcome possible academic difficulties. This advising process increased the knowledge, the didactic training of the undergraduate students, and improved the life in the campus and the contact to young students from different educational institutions of the region. Finally, the third one has been focused on improving the student's ability of speaking, discussing and solving problems in English language, aiming at expanding the studies of the area, preparing them to work in Brazil and abroad. The methodology used in this work has been based on the results presented by the participants (mainly the undergraduate students) and on the perceptions of the students, with impacts on the transformation, where they developed the skills of: speaking and written communication; team work; planning and teaching plans of the subjects that have been addressed; promoting/marketing the activities; execution; evaluation; and to present proposals for improvements for future projects. Therefore, the results were satisfactory and motivators (considering the variety of opportunities provided in the Engineering courses), and they contributed to the development of skills during the formation of Engineering students, aiming good academic performance (with incentives in the continuation of the course) and professional, facing the job market, which has challenging and innovative realities, with commitment to social responsibility and sustainable development.

Keywords: Engineering, Extension Project, Knowledge Exchange, Skills.

Coffee Project (Connections Knowledge):

Conversation Wheels

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Abstract

The Coffee Project (Connections Knowledge): Conversation Wheels is developed by Grupo PET - Engenharias (Conexões de Saberes) of the Universidade Federal de Goiás (UFG) located in Goiânia, Goiás, Brazil. The purpose of this project is to create foreign language conversation groups at the Escola de Engenharia Elétrica, Mecânica e de Computação (EMC) and also at the Escola de Engenharia Civil e Ambiental (EECA) so that the participants will develop their knowledge of the chosen language. Based on the answers obtained by a form elaborated in the tool 'Google Forms', the foreign languages that would be worked in this project were chosen. To reach potential participants, the form was sent to the EMC/UFG and EECA/UFG course coordinators where they were applied to the students. From the answers obtained, 94.3% of the students are interested in studying English. This result was already expected due to the relevance of the English language in the world. The study of French ranked second as the preferred language of the answers collected, and 28.3% were interested in groups of conversation of that language. Again, this result was also expected due to an exchange project for France present at the EMC/UFG, the BRAFITEC (from French language: (BRASIL France Ingénieur TECnologia). Por esses motivos, o inglês e o francês foram as línguas estrangeiras escolhidas para serem trabalhadas nesse projeto. For these reasons, English and French were the foreign languages chosen to work on this project. The second stage of this project has already been done with the English language. This stage was a meeting with students who were interested in the project. A dynamic was realized during an hour and a half. The second stage for the French language will be held at the end of June. The meetings must take place throughout the year 2019. The final step will be writing a final report of the project with the results obtained throughout the project development.

Keywords: BRAFITEC, Connections Knowledge, Conversation Wheels, English Language, French Language.

How Mathematics Lecturers Encourage Students to Understand

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Abstract

Nowadays, institutions of higher education focus on the quality of teaching. Understanding is a central concern of good teaching and an aim of mathematical teaching and learning. Previous studies have indicated several factors for good higher education teaching such as: clarity, providing motivation for learning, creating a pleasant classroom climate, lesson organization, using teaching aids, writing on the board, outlining and summarizing the lesson, and using humor. Nonetheless, little is known about the factors that can contribute to teaching for understanding. The purpose of the research is to characterize expert mathematicians' ways of encouraging students' understanding of the taught material. The research participants are five mathematicians, all of whom are experienced lecturers of mathematics courses at an academic college of Engineering. The research tool was a semi-structured interview. The data were analyzed according to a qualitative methodology. The results show two themes that are related to promoting students' understanding. The addressed themes are encouraging mathematical thinking and planning teaching. Encouraging mathematical thinking includes: asking profound/implementation questions, refraining from explaining every bit of the material and enabling the students to understand some parts of it by themselves, stressing the importance of understanding the theory; explaining where formulas come from; avoiding "recipes" – asking for a variety of possible answers; requesting to explain the answers (explaining why); calling for figuring out a definition after dealing with some examples, asking to prove or to refute a claim, ask to draw (to visualize) a concept. By conducting an initial analysis of the results, it seems that this theme includes aspects associated with active learning. Planning teaching contains two aspects – general planning and particular lesson planning. General planning is related to decreasing the amount of the material; planning and addressing possible difficulties related to the material; mixing between subjects, spiral teaching and giving challenging homework. Particular lesson planning consists of pausing and asking the students questions; checking for understanding of subjects that were previously taught; building and presenting mathematical models to everyday situations; using software. To sum up, the findings show that the mathematics lecturers recognize a variety of ways for promoting students' understanding. It can be suggested that those ways, for the most part, represent "traditional" methods of teaching. It can be assumed that promoting students' understanding using less 'traditional' methods imposes a bigger challenge for them.

Keywords: Higher Education, Mathematical Teaching, Mathematical Understanding.

Engineering Competition Project:

Insights of A Case Study

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Abstract

Project-Based Learning (PBL) is a well-known pedagogical approach and one of the active learning methods, which allows the students to develop a variety of different personal and professional skills, such as decision making, the ability to design, team working, interpersonal communications, and more. Among other traits, PBL contributes to Engineering Education by empowering the students to develop Engineering competencies and job-related skills during the learning process in academia. Many researches investigate different aspects of PBL such as motivation, improving academic achievements, reflecting on students' own understanding, and more. The current study aims to describe how a competition between groups of students who design and perform projects during a PBL process influences students' competencies. During the Fall semester of 2017, 17 students were involved in the elective course of Competitive Project. Groups of three students were asked to develop and build an autonomous carriage, based on electronic kits, that could navigate itself toward a given target. At the end of the course, a competition was conducted between all the carriages. The carriage must arrive at the target – a source of infrared radiation (IR LED) – through a field with obstacles. The time of arrival at the goal was measured, and the groups were evaluated and graded according to it. The group that took the first place got the grade 100. After finishing the project, the lecturer and five of the students were interviewed about their experience. The lecturer and students' answers were analyzed according to a qualitative methodology. The results show that the competitive PBL approach brings about a performance of meaningful learning through project work among the students. Additionally, a competition facet contributes to students' high motivation and development of Engineering competencies such as self-reliance, creativity, making decisions and taking responsibility for them, striving for the best yet reliable results, team-working skills and others.

Keywords: Active Learning, Competition, Project-based Learning, Students' Competencies, IR Led.

A Comparison between The Occupational Load of Excellent and Non-Excellent Engineering Students

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Abstract

The expansion of higher education accessibility during the last four decades invites more students with socioeconomic problems to the academia. These students must work for a living while studying toward their academic degree. Nowadays, the student worker status has become a trend, though more and more students, even those with better socioeconomic position, seek to get the socially accepted status of a working student. Maharshak and Pundak researched the Israeli Engineering students' preferences regarding the dilemma: financing their studies by taking loans, or by an occupational salary. Despite of prior explanations by the academy about the potential harms of working during studying towards academic degree to the academic achievements and suggesting comfortable loan, most of the Engineering students in Israel search for work during their study years. The current paper compares the occupational load of excellent students and the load of non-excellent students during the first and second studying years. The research consists of two stages. The first one is a qualitative stage, where deep interviews with 18 excellent students were conducted. Half of the interviewees state that they do not work at all, the others state that they work only on vacations or non-studying days. Based on the interview results, a questionnaire about the students working habits was composed. The second stage is a quantitative stage where students from two leading institutes of Engineering in Israel were asked to complete a questionnaire about their working habits during their first and second years of studying. 487 students completed the questionnaires, 161 of which are excellent students. A comparison between the occupational load of the two groups reveals a significantly lower occupational load of the excellent students in comparison to the non-excellent occupational load. Based on the research results, it is recommended that Engineering students who want to succeed in their studies avoid seeking jobs and concentrate on studying during their first and second years of studying. The current paper adds to the knowledge in the area by presenting both qualitative and quantitative results showing that the excellent students prefer to spend their time during the first and second studying years on learning rather than working. This result is statistically significant.

Keywords: Academic Achievement, Occupational Load, Excellent Students, Engineering Education.

Challenges and Experience with Multidisciplinary Capstone Projects in Mechanical Engineering

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Abstract

Mechanical Engineering is one of the oldest Engineering disciplines in higher education. Due to fast development of advanced technology, Mechanical Engineering becomes a multidisciplinary Engineering field. For the purpose of bridging theoretical knowledge and practical implementation, a one-year project-oriented capstone course, Special Topics in Mechanical and Electro-Mechanical Engineering, has been offered for the third year undergraduate students since 2015. Not like most capstone courses designed with one single project for all participating students, our capstone course needs to adapt to inherent multidisciplinary nature of the department and must have a unique framework with different mindset. It's highly believed that overall performance including sense of accomplishment and learning motivation can reach the maximum if students can work on the project that they are interested in. As a result, design of this capstone course stems from allowing all third-year undergraduate students have opportunity to conduct a project with strong motivation and personal interests. After the one-year capstone course comes to an end, all teams must participate in an annual departmental-level project exposition and competition. Both written reports and poster presentations are required for final demonstration. Versatile project contents verify multidisciplinary nature of the capstone project course. Course evaluation by questionnaire with ten questions was conducted to examine course performance from the viewpoint of students. The results display promising positive feedback from students especially on difficulty level, course effectiveness, as well as being helpful for Engineering practice, teamwork, and conflict management. Nevertheless, challenges still exist to be overcome to enhance course performance. The first challenge is that 12.5% of participating students could not find interest in the project they were working on. The second challenge appears to be the capstone course did not demonstrate sufficient helpfulness to both cost and time management for student teams. Consequently, over one-fourth negative feedback is shown on project achievement to be expected.

Keywords: Capstone Course, Engineering Education, Multidisciplinary Projects, Project-based Learning.

Comparative Study About Tests of Pervious Concrete as Learning Tool: Evolution of The Trait, Methods and Complementary Analysis

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Abstract

The execution of pervious concrete pavements has been used over the years as a pedagogical resource in the Civil Engineering course at UNEMAT - Universidade do Estado de Mato Grosso, campus of Tangará da Serra - MT - Brazil. With the purpose of aggregating scientific knowledge to the academics, providing advances in the technique used in the production of pervious concrete, as well to the development of the University's physical space. In this article, some of these studies will be presented in order to discuss the scientific observations made by academics in the development of practices and to evaluate the evolution in the methodologies of trait and execution. The characteristic that allow water infiltration has made porous concrete chosen to remedy problems due to the accumulation of water at several points on campus. In addition, another necessity was to promote the interconnection between classroom blocks. The works were evaluated taking into account the reports developed by the academics during the activities. In this analysis, the advancement of the techniques employed even when the students did not have the appropriate equipment. It was possible to observe modifications in the techniques of staining the concrete and the level of difficulty of the drainage process involved. The results were discussed in view of both the evolution of the technique of preparation of the pervious concrete pavement by the academics, as well as the practice as a didactic and social resource. Recently, besides the permeability, the thermal properties of porous concrete have also begun to be explored. Would the pervious concrete pavements presents better thermal performance than the conventional ones? In the state of Mato Grosso for presenting high annual average temperatures if, the pervious pavements contributes to a lower heat retention compared to the conventional one, this would show an excellent alternative for the substitution of the conventional pavements, prioritizing the thermal comfort of the academic community. Because of that, a comparative analysis was performed between the temperature values recorded in the porous pavements, in the conventional and green areas of the campus. The methodology of this research consisted in performance of temperature measurements with an infrared thermometer, the measurements was for 20 days distributed in four months, four times per day (8 a.m., 11 a.m., 5 p.m., and 7 p.m.). The rainy season in the region caused some variations in the results, since conventional concrete, when moist, takes longer to lose this moisture and absorb heat. The colors chosen in the painting also influenced results, because, in the pavements that the permeable concrete was not

painted, showed lower temperatures than the conventional. The development of activities related to the analysis and production of pervious concrete contribute to the academic training of students of the Civil Engineering course on two fronts: obtaining technical knowledge and capacity for teamwork, exploring all the basic procedures of the routine of a real work.

Keywords: Pervious Concrete, Conventional Concrete, Pavement, Thermal Analysis, Learning Tool.

Interdisciplinary Learning:

Development of Chicken Eggs Incubator for Scientific Testing

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Abstract

The estimate for new cancer cases until 2030 is 26 million and about 17 million deaths. Costs, in global economy, from cancer related illness alone reach one trillion dollars due to disablement and premature deaths, without accounting for medical costs. Considering this issue, UNIFEB (College of the Educational Foundation of Barretos) professors and students proposed an interdisciplinary approach between Electrical Engineer and Medical Physics courses and the Cancer Hospital of Barretos to improve research and development of cancer drugs. The Cancer Hospital of Barretos promotes specialized oncology treatment, nationwide, supporting prevention, research and learning programs such as this study. The Hospital requested the construction of a chicken egg incubator to the Technology Innovation Center (CIT) from UNIFEB. The incubator will be used to research new cancer drugs and treatments using in vivo chicken embryos chorioallantoic membrane (CAM) testing. CAM is a simple and cheap model to study the effects of tumor growth and migration. This study's objective was to produce an incubator that has electronic controlled and monitored temperature and humidity and could be sterilized through a germicidal ultraviolet light. A commercial cold chamber was used and adapted to serve this purpose. A digital controller from Full Gauge is responsible for monitoring and controlling the humidity and temperature inside the chamber and a ultraviolet light can sterilize it after use. The product development contributed to the Electrical Engineers' practical learning within the skills and competencies requirements necessary to today's professional in the industry. The microbicide capacity of this machine is an innovation, allowing researchers to study antiangiogenic substances following safety protocols for experiments. This equipment, after tests, should be available and widely used commercially. The good technical interaction between researchers at Hospital de Cancer de Barretos and UNIFEB teachers and students was key to the success of the initial proposal, making product development partnerships like this a step forward in Brazil's technological advance.

Keywords: Angiogenesis, Cancer, Incubator, Interdisciplinary Teaching, SUS.

Determination of the Physical and Mechanical Properties of Concrete with Partial Replacement of The Small Aggregate by Glass:

Developed For the City of Vitória da Conquista,
Bahia, Brazil

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Abstract

As Brazil is a country with continental proportions and with an abundance of inputs, civil construction develops easily, to the point of representing a significant share of national GDP (6.2%). However, this abundance of resources generates a certain negligence regarding the reuse of this material. The example of this is the glass industry, with a daily production of 6950 tons², but this high production value is not reflected in the reuse of waste from the industry, as far as recycling is concerned the numbers are below what would be a value ideal, only 40% of it is discarded is reused. In the city of victory of the conquest located in the northeastern region of Brazil the situation is similar, most of the tailings generated are simply discarded in a landfill, not using them for recycling is due to the lack of specialized collection and the difficulty different types of glass for proper recycling. The present work aims to verify the technical feasibility of the use of discarded glass in the city of Vitória da Conquista as a small aggregate in replacement of sand in concrete through the determination of its physical and mechanical properties. The obtained waste was obtained by collecting in glassworks of the city, the material collected is made of ordinary glass (float) shavings in the shape of blades with a thickness varying between 2mm, 3mm and 5mm and varied length. After the collection, the glass was ground with the help of a jug mill until a material with a grain size similar to that of the sand to be used in the manufacture of the concrete was obtained. Concrete specimens were produced and their aggregate was replaced with ground glass in 2%, 5%, 10% and 15% values. After being submitted to the compression test it is expected to obtain results compatible with the values of conventional concrete provided in the literature and thus to prove the effectiveness of glass as a small aggregate in concrete. It is a research of the experimental type that allowed applications of theoretical notions and aggregate valuable knowledge in the field of research.

Keywords: Concrete, Glass, Reuse, Vitória da Conquista, ABNT.

Analysis of The Technical Feasibility of The Reuse of Plaster in The Manufacture of Lining Plates:

Developed For the City of
Vitória da Conquista, Bahia, Brazil

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Abstract

Civil construction is one of the sectors that strengthen the Brazilian economy, with an average annual contribution of 6.2% of the national GDP. And due to its demand for inputs is consequently a large generator of waste. One such waste is gypsum, with Brazil having an annual consumption of 30 kg/inhabitant, and with the arrival of new construction techniques the trend is an increase of this value. The impacts of this type of waste in the nature are severe, since one of its main constituents the calcium sulfate, causes the sulfurization of the soil and contamination of groundwater. In the city of Vitória da Conquista, located in the northeastern region of Brazil, it is no different, it has a large market in the construction sector, but with few environmental policies, which is reflected in the scarcity of materials reuse programs. In this particular city the plaster tailings are simply disposed of in landfills or irregularly in vacant lots. The present work has as main objective to demonstrate the feasibility of the reuse of gypsum waste from the city of Vitoria da Conquista in the manufacture of lining plates by means of the comparison of its properties with conventional plates. The material used in the recycling was collected in works by the city and in trade specialized in the manufacture and sale of plasterboard. The wastes were micronized and duly characterized, determining for this their values of unit mass, fineness modulus and grain size. After the calcination of the samples, the test specimens were prepared using a homogeneous mixture of the pulverized tailings and virgin gypsum, to be submitted to the tests of compressive strength and tensile strength in flexion, taking as parameters the values determined by NBR 13207/94 (Plasterboard - Specification). The results obtained demonstrate the feasibility of the reuse of gypsum waste in the manufacture of new lining plates, since its values of compressive strength and tensile strength in flexion correspond to the expected parameters. For Bauer (2001), hardened gypsum pastes can reach compressive strengths between 5 and 15 MPa and tensile strengths between 0.7 and 3.5 MPa.

Keywords: Plaster, Plates, Reuse, Vitória da Conquista, ABNT.

Calculus I in Engineering Courses:

An Inventory of Adopted Measures to Mitigate the Students' Difficulties

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Abstract

The Engineering courses have in their school programs the subject of Calculus I, which provides a wide range of tools to solve numerous practical problems. However, a significant part of the students present difficulties in the initial contact with that subject. Which makes that issue is discussed in a recurrent way and referenced in the literature under different perspectives. Overall, these papers reveal the concern with the learning of contents inherent to the Calculus I (limits, derivatives and integrals) which if does not occur in a satisfactory way materializes by disapproval of students in the subject. But, in the face of mentioned difficulties in the studies, what have been effectively done by educational institutions to assist the students? Focusing on this issue, this work aims to investigate the initiatives adopted by higher education institutions aiming to mitigate the difficulties of Engineering students in the subject of Calculus I. In addition, we intend to find out the results obtained from the implementation of the strategies outlined with respect to the performance of the students in the subject in question. We start from the premise that reflections aiming at a greater understanding about the disapprovals and the low academic performance in Calculus I are important, but they must foment effective actions. This is a descriptive bibliographical research, based on 4.672 papers published in the Brazilian Congress of Engineering Education (COBENGE) in the period of 2009-2018. Through the reading of titles and abstracts, 292 papers were previously selected. These papers were read integrally and, at the end of the process, it was found that 134 papers had relevant information in their scope, that is, that would contribute to the purpose of the investigation. For the analysis of the results, two categories were established: (a) previous interventions to the discipline of Calculus I, and (b) concomitant interventions to the discipline of Calculus. The main initiatives were: provision of monitoring in a variety of formats ($n = 22$ institutions), provision of leveling courses ($n = 17$ institutions), diagnostic tests to infer previous students' knowledge ($n = 11$ institutions) and adoption of introductory courses to Calculus I ($n = 8$ institutions). Moreover, it was identified that several initiatives were not characterized as isolated interventions, but were subject to institutional programs or projects. Finally, it was possible to observe that a small number of studies analyzed, from some perspective, the influence of these initiatives on the students' performance in Calculus I. Although many variables compete and, in some way, interfere with student performance in the discipline of Calculus I the discussions and initiatives listed are deeply rooted in a single variable: lack of mathematical baggage. Literature is abundant - if not unanimous - in pointing out the deficiency in relation to previous mathematical knowledge as one of the great causes for the low performance of Engineering students in Calculus I. Evidently, this variable is relevant, but

it is necessary to investigate and implement initiatives related to other fields, such as innovations in pedagogical practices implemented in the classroom.

Keywords: Academic Performance, Calculus I, Implemented Strategies, Incoming Students, Cobenge.

Active Methodologies in The Teaching of Mathematics in Engineering Courses:

An Analysis from Productions in COBENGES 2017-2018

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Abstract

Disciplines in the area of Mathematics have remarkable importance as essential tools in the training quality of future Engineers. These disciplines are currently part of the first periods of Engineering courses in Brazil and are responsible for high levels of evasion and disapproval. The recurrence of such facts has led to discussions and paradigmatic changes in higher education, such as the quality of the programs and/or how teachers can innovate their pedagogical practice. In this sense, an alternative that has been emerging in recent times, is the use of strategies of active methodologies in teaching mathematics at all levels of education. Based on this premise, the questionnaire that guided the present research was established: Does the teaching of mathematics in Engineering courses in Brazilian institutions have used active methodologies? In particular, what methodological strategies, considered as active, were used in research work aimed at the teaching of mathematics in Engineering courses? In order to answer these questions, we opted to investigate the academic production published in the COBENGE (Brazilian Congress of Engineering Education - organized by the Brazilian Association of Engineering Teaching - ABENGE) in the last two years, through bibliographical, basic, descriptive and of a qualitative nature. COBENGE is considered the main discussion forum on Engineering education in the country. Thus, our intention is to identify “if” and “how” the active methodological strategies are being used by the authors to minimize the difficulties presented by the Engineering students in the mathematics disciplines, as well as to identify potentialities and limits of the use of these methodologies. The collection of the works happened through the insertion of the terms “teaching of mathematics” and “active methodologies” in the search filter of the electronic page (http://www.abenge.org.br/sis_artigos.php) in which the annals of the COBENGE are available. The initial analyzes indicated that: the majority of the studies (both in the context of regular classes and in the projects) focus on mathematics disciplines from the initial stages - such as Calculus, Analytical Geometry and Linear Algebra; the technological tools are an essential part for the development of active methodologies; despite some initial resistance on the part of the students, the learning and the use of them was extended with the active methodological strategies applied.

Keywords: Active Methodologies, Teaching Mathematics in Engineering, Cobenge, Abenge.

The INCOMM Research Group and The Science Day C:

An Interaction between University and Society in Telecommunications Research Context

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Abstract

Brazilian public Universities work with the Teaching-Research-Extension tripod. In addition to the teaching role, training professionals in various areas of higher education, several professors develop research in different branches of knowledge. Scientific research is essential for the economic and social development of the country, because it directly affects the life of the citizen, but much of society does not know the scientific work developed by teachers and students of public Universities. With that in mind, the College of Pro-Rectors of Research, Graduate and Innovation of the Federal Institutions of Education (COPROPI) and the Forum of Vice Presidents for Research and Graduate Studies (FOPROP) proposed on October 25, 2017 the “Science Day C”, a day of national mobilization where activities are carried out in museums, schools, public spaces, with the aim of showing society the importance of scientific research and how it influences everyday life. INCOMM (Information and Communication Research Group), a group within the School of Electrical, Mechanical and Computer Engineering of Universidade Federal de Goiás, actively researches in the areas of telecommunications and digital signal processing. Thus, in this edition of Science Day C, INCOMM proposed activities to the students of the Marista School of Goiânia, in order to show the importance of its research by for the society and also to encourage the children and teenagers to take an interest in Science and Technology by developing their scientific spirit. Lectures and demonstrations were held with the students of the 6th, 7th, 8th and 9th grades of elementary school, counting on the support of their teachers and locally coordinated by the Math teacher. Videos were prepared demonstrating the concepts and applications of INCOMM-related research, such as applications for digital signal processing in people’s lives (games, health, cell phones)

and mathematical demonstrations of signal processing that showed the importance of mathematics and other Sciences. Students were enthusiastic and amazed with the research and discovery possibilities. The response of the classes to the event was measured by the large volume of questions and individual conversations with the students after the presentation. 77% of students did not know the impact of research in society and 82% did not know about the work done by Universities. The reports of the young people after the events revealed their interest in the scientific career and their discovery of new topics of study. They also realized the importance of basic education as a foundation for scientific development and that even in school it is already possible to use the scientific method during the courses. The lectures also helped students getting to know the work developed by INCOMM in the area of telecommunications and everyday applications. We observed that scientific interest should be stimulated since childhood as a way to create future researchers with continuing education. With the event, the importance of the dissemination of the researches of the different laboratories and groups of the Universities was perceived as it encourages the study and interest in the sciences.

Keywords: Brazilian Public Universities, Science, Scientific Research, Education, INCOMM.

Community Summaê:

An Experience in The Telecommunications Classes

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Abstract

Active Methodologies are tools that stimulate students how to learn in an autonomous and participatory way. In traditional classroom model, students usually only listen and take notes, whereas with Active Methodologies the passive learning is replaced by an autonomous process which searches for the stimulation of students with real problems and real situations. The first use of Active Methodology refers to Netherlands and Canadian experiences. In Brazil, while Active Methodologies are highly recommended in medical schools, the use in Engineering is pretty recent and published works show that most of its applications are in the Mathematics field with few experiences out of pure Mathematics. Based on that, Professor Ricardo Fragelli idealized Summaê after searching for a solution to minimize the high failure rates in Mathematics related subjects in Engineering courses. Summaê consists of a creative environment for learning. Due to the high engagement of students and the participation of both the professors and area specialists, this successful experience has been replicated for the most different courses and subjects, mostly in Higher Education. Summaê has as one of its main characteristics the ease of being adapted to virtual environments since the action itself stimulates the usage of technologies, for example video recording. Summaê provides an emotional safe environment, with entertainment and ludic activities. Until now, it is considered a huge success among students and professors because it improves the relation between these two parties, often seen as antagonists. In November 2018, Community Summaê was applied at the Universidade Federal de Goiás, specifically in the Escola de Engenharia Elétrica, Mecânica e de Computação (EMC), in the Telecommunications Theory Course of the Electrical Engineering degree. The Community Summaê uses the Project Led Education (PLE) methodology and the Problem-based Learning (PBL). In fact, the climax of the Community Summaê consists of a creative environment for learning in specific day. However, many activities are developed throughout

the semester before the “big day”. There is also an evaluation of the methodology. So, this work presents the results of this first experience of Community Summaê in EMC/UFG and how its general impression is very successful due to the good engagement of the students and professors and the strengthening of the Active Methodologies in the local academic community, including cultural presentations by members of the Engineering school. The success was so huge that the results show that 88,8% of the students think that this methodology should be applied again. All the professors involved took advantage of this experience and only one professor among those who composed the assessment board still did not know Community Summaê. Indeed, all the professors who were present said that they would apply Summaê in their classes and courses.

Keywords: Active Methodologies, Problem-based Learning, Project Led Education, Community Summaê, Telecommunications.

Distance Learning Course on Intellectual Property

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Abstract

The increasing diffusion of the media and the search for alternative methods for obtaining continuous and specialized education make distance learning an important strategy in the ongoing training of professionals. The technology market offers a number of platforms, or Virtual Learning Environments (VLE), or Learning Management Systems (LMS) that can support collaborative educational activities. The implementation of Distance Learning (DL) in the Escola de Engenharia Elétrica, Mecânica e de Computação (EMC) occurred through the use of the Moodle platform provided by the Centro Integrado de Aprendizagem em Rede (Ciar) of the Universidade Federal de Goiás (UFG), which has, as a principle, the articulation between teaching and research in formal and non-formal learning processes in teaching and extension projects. The objective is to make the Ciar a space for the construction and realization of projects that seek the establishment of learning networks, mediated by practices that incorporate the technology of information networks, communication and education and teacher training. Thus, these requirements favor the implementation of the DL at the EMC/UFG. Therefore, it was proposed in the first half of 2015 the Intellectual Property Training Course, which aimed to use the technologies offered by Moodle for training students from the EMC/UFG and others interested in Industrial Property. Several technologies and activities were used during the course such as the use of discussion forums, the application of questionnaires from audios, videos and readings, the use of chat, the preparation/publication of conceptual maps among others. At the end of the course, it met the expectations of 87.5% of the students, all of them recommended the course to others. In addition, a low rejection of DL was observed. So, since the introduction of DL undergraduate courses in the 2016 selection process and the arrival at Moodle Ipê, the use of DL by EMC/UFG professors is expected to intensify. Consequently, the tools available in Moodle Ipê can be very useful in implementing the new resolution of the national curriculum guidelines for the Engineering course in Brazil.

Keywords: Distance Learning, Intellectual Property, E-learning Tools, Virtual Learning Environment, Moodle Ipê.

Historical Pathways of The Teaching of Engineering in Brazil

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Abstract

The new challenges faced by Engineering in the 21st century require a closer look at Engineer Education. The economic and social development of a country is based on human capital, responsible for making a difference in productivity and competitiveness among nations. Therefore, training and qualifying human resources continually is a must. As Engineering occupies an important position in the generation of knowledge, technologies and innovations, the quality of Engineering undergraduate courses offered in Brazil must be continuously improved in order to increase productivity and stimulate the possibilities of economic growth. The present paper aims to analyze how the teaching of Engineering has developed in Brazil from a historical point of view by analyzing the National Curriculum Guidelines (Diretrizes Nacionais Curriculares – DCNs), and by considering the profession and its military origins. Due to the complexity of Engineer training, the main elements to be considered in this analysis are the human factor and the revision of the DCNs. To our understanding, those challenges are not related to traditional content subjects taught only in Engineering courses, but also in Biology, Medicine, Psychology, Sociology, Economics courses, among others. This paper also discusses different DCNs for Engineering, placing special emphasis on its latest version approved in July 2018, and comparing it with a new proposal sent to the National Education Board (Conselho Nacional de Educação – CNE) in April 2019. Our findings reveal that the current curriculum for Engineering undergraduate courses no longer meets career expectations of new Engineers. The Engineering curriculum can no longer be viewed as a set of specific content subjects, it must also cover areas related to people, their needs, expectations and behaviors.

Keywords: Engineering, Engineering Education, History of Engineering, National Curriculum Guidelines, DCN.

RAP:

Annual Permitted Revenue

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Abstract

The motivation for the elaboration of the article was given through the Administration discipline given in the first semester of 2019 in the School of Electrical, Mechanical and Computing Engineering, whose objective is to develop a board game with free study theme. For this, our object of study was in our area of formation where we address the main problems that can occur in generation and transmission. Thinking about it, we developed the RAP (Annual Permitted Revenue) game, which according to ANEEL (a Brazilian abbreviation/acronym for National Electric Energy Agency) the acronym RAP is the remuneration that the transmitters receive for the provision of the public service of transmission to the users. For the transmitters that were tendered, RAP is obtained as a result of the transmission auction itself and is paid to the transmitters from the commercial start-up of their facilities, with review every four to five years, under the terms of the concession agreements. As the aim of gamification is to encourage learning through games, we model the real structures in the players. The basic electricity transmission network (voltages above 230 kV) is managed by ONS (National System Operator). Each player represents an energy transmitting company, except one player representing the interests of the ONS. In the course of the game occurrences will occur and the transmitting companies will have to solve the problems (multiple choice questions, true or false and still discursive), if the player's response is wrong, this will be penalized. As in Brazil, the National Interconnected System is interconnected radially, so the board is also radial. In the development of the game, bibliographical research was carried out to identify the main causes and consequences of faults in the transmission lines, substation and generation, the practical knowledge of the group members was also taken into account (one of the authors works in the local power generation and streaming). The methodology used returned to the authors relevant questions in the gameplay of the work developed, being the following: The evaluation revealed that 100% considered the game with total systemic vision (need, utility and others); 50% with total practicality (ease to understand and decide the purchase); 50% with total clarity of the project and innovation; 50% with total harmony between the elements (social, cultural, environmental, etc.); 100% with total presentation of the intrinsic theoretical foundations; 75% with total unprecedented theme. The evaluation of the users was considered positive, and the game could then be implemented in the training processes of new employees in the transmitting companies.

Keywords: Administration, Energy, Gamification, Generation, Transmission.

A Cross-disciplinary Active Teaching Method Application: An Undergraduate Education Case Study

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Abstract

Active teaching methods have been widely and hermetically adopted in contemporary higher education, from undergraduate Science, Technology, Engineering, and Mathematics (STEM) courses to humanities like History, Political Sciences, Medicine, and Psychology, but very few cross-disciplinary uses have been reported. In this work, we describe the successful application of a single collaborative active teaching method in several extension projects of the Electrical Engineering and Geography Department of PUC-Campinas, carried-on in the period from 2016 to 2018. In the first case, the purpose of the projects is to promote the social and digital inclusion of visually impaired adults and children with cerebral palsy, through the appropriation of low-cost Electrical Engineering solutions. In one project this was achieved by developing a device that helps to evaluate the degree of visual impairment and permits the application of methods and processes for visual rehabilitation. The target audience in the Electrical Engineering projects is the health professionals, occupational therapists, physiotherapists, and social workers, of two partner institutions associated with the project. The Geography Department project example, on the other hand, focused on space organizations, turns its attention to a group of artists working on the outskirts of the city of Campinas. The project's partner group works on the preservation of afro-descendent culture since 1975. In this case, the social recognition of its group nature, organized into territories, is fundamental to guarantee the right to land tenure and promotion of citizenship. The goal of this work is to demonstrate how the participation of undergraduate students in two highly different extension projects, using the same active teaching method, can better prepare them for their personal and professional life. This is verified by applying a thirteen rating scale questions survey to all participating students at project's end. The active teaching method for all projects is based on coplanning, cospecification, codesign, codevelopment and covalidation of systems, process, and methods. The practice employs conversation rounds with the target audience, guided by a virtuous cyclic process which includes steps like information capture, validation, guidance, and feedback. These rounds are essential for common problem understanding and solution construction, all performed through dialogues and discussions with the target audience. The method also includes the construction of pedagogical materials like booklets, maps, audio material, and guidance manuals. During the extension project participation, the students had the opportunity to experience situations and challenge not present in regular course classes, like interaction with professionals of different areas of expertise and people with different cognitive capabilities. Analysis of the survey answers indicates that 100% of the undergraduate students agree that participating in the project was important or very important in communication development, problem identification, and proactivity skills. The results indicate that the application of the same active teaching method into two diverse extension projects can contribute to better undergraduate education.

Keywords: Active Methodology, Cross-disciplinary, Undergraduate Education, University Extension, STEM.

The Empowerment of Students Resulting from the Extension Projects Actions:

Students Empowerment through Target Populations Fostering

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Abstract

This article refers to the contribution in the empowerment of Electrical Engineering undergraduate students as a result of participation in social interventions and actions of two different Extension Projects. Project A fosters environmental sustainability, by way of involving actions with construction workers and project B, which is focused on the promotion of visual rehabilitation of the visually impaired through the construction of cognition development tools. This article emphasizes that the actions of extension projects in promoting the empowerment of the target populations likewise promotes the same on project's participating Electrical Engineering undergraduate students, therefore, evidencing an important side of the Extension Programs. The methodology of the work includes socio-educational workshops with the incentive to dialogue and exchange of ideas between the University crew and the project's target population. In general, extension interventions boost self-awareness that facilitates choices and actions in the community (collective and critical awareness) by adding value to individual actions. These actions improve the individual and the community as a whole, in a process of overcoming challenges of social transformation. Empowerment favors the dignity and freedom of citizenship, by enabling better choices and facilitating future personal developments. The methodology also includes systematic workshops with the target populations and orientation meetings with the students. The empowerment of the students has its origin in the actions of the Extension that begins with participation in socio-educational workshops and meeting preparation under the professor guidance. The target population profile study and consequent deepening of the problem understanding encourage the students to be resourcefulness and to pursue dialogues in the workshops or in the conversation rounds. The freshman students, usually shy and with a classroom-centered model thinking, faces a different reality beyond the classroom and needs to assume a protagonist role to accomplish the objectives of the work. The results of the participation in extension projects show that students grow a critical view of social issues and in academic maturity. The project's participating undergraduate students begin to envisage alternatives and improvements to social fairness aimed to promote the autonomy of the target populations. This is accomplished through the elaboration of cultural materials and technical papers for future conference presentations. In short, the students increase their ability to interact in different realities and begin to eagerly participate in the academic community. The Extension Projects are carried out with the support of the Pró-Reitoria de Extensão e Assuntos Comunitários da PUC-Campinas partnering with

organized social groups or communities of the city of Campinas-SP, Brazil.

Keywords: Extension Projects, Student Empowerment, Sustainability, Workshops, Populations Fostering.

Power Electronics Education:

A Contemporary Teaching Approach

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Abstract

Currently, there is a growing demand for methodologies that best qualify Engineering students at Universities. These methodologies require a substantial change in Engineering Teaching programs improving or even changing the traditional ways of imparting knowledge to students. In Power Electronics Study the factors that make learning difficult for Electrical Engineering students, in order for them to achieve full understanding of the subjects addressed in a first discipline in this area, are the academic maturity required coupled with their multidisciplinary nature. The problem is aggravated in practical activities, which demand the availability of a laboratory infrastructure with specific characteristics not always available. An alternative for the study of Power Electronics, with a more contemporary focus, is to introduce, through a new Instructional Design (ID) Project, not only the incorporation of more Hands-On activities that approach truly meaningful (authentic) contents, but also, new methodologies and technologies to support educational objectives that make full use of Digital Information and Communication Technologies (DICTs). This work proposes to develop and carry out a methodological design of a blended teaching for a power-electronics-based practical training program (PEBPTP) for students of the Electrical Engineering Course of the Federal University of Maranhão in Brazil. The proposed program is mainly based on the use of a digital controller (unified) based on FPGA, developed and realized specifically for control and power inverters study. From controller's VHDL Code already realized, a Reuse Logic Block is generated (Intellectual Property Core (IP Core)), for use within the LabVIEW FPGA Hardware Description Environment (HDL). A Graphical Interface (GUI), more intuitive, and developed from the LabVIEW environment, will support the realization of the PEBPTP, for parameterizing the Controller, and show relevant figures of merit of the performance of the converter being study. The active methodologies, converging with the diverse possibilities of resources of the DICTs, implanted in the classroom, with the adequate contextualization of the specific resources of each area, contribute increasingly to the student being protagonist of their own knowledge construction. Finally is proposed, and in full adherence to a novel trend, that both the PEBPTP and the unified controller previously developed in FPGA are embedded in what is being named Lab-on-a-Chip (LoC). This embedded structure will allow access to the laboratory hands-on program via a web service that uses a fully programmable logic device (PLD) that incorporates an integrated structure known as System-on-a-Chip (SoC). The above proposals and experiences involve the mastery not only of curricular and technological knowledge, inherent to the training of an Engineer, but of mainly, the pedagogical technological knowledges and correct use of DICTs. At this point, in particular, is founded our contribution within the context of Engineering Teaching, to advance in the improvement or perhaps in the modification of the "classroom" of Engineering courses, which today go beyond the physical space of the University.

Keywords: Active Methodologies, Blended Teaching, DICTs, Instructional Design, PEBPTP.

Engineering and Technology Congress:

Contribution to The Engineer's Technical and Professional Development

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Abstract

CET - Engineering and Technology Congress is the largest student congress of Engineering in the state of Goiás. Four editions have been done, with an average audience of 1400 participants from 13 Engineering courses. The CET 2017 was guided by the theme "Efficiency and the Search for Improvement" with the attendance of 1050 students. It is the result of the dedication of the Polytechnic Association at UFG, which planned and developed the entire event with the support of several sponsors and the Federal University of Goiás, as well as the initiatives that make up the University. The organizing committee was composed of 25 students from the Polytechnic Association and 50 volunteers, the schedule for planning and execution was three months. Its purpose is to promote the debate of new techniques and technologies, putting the academics in contact with the vanguard of the segment, and show the Engineering force in the development of new technologies, as well as in the growth of the whole society; In addition to seeking integration and stimulating the competitive spirit among teams across the country through the competitions that were held at the event. The event featured lectures, presentation of scientific articles and competitions. A total of 32 lectures were held, with topics specific to each of the 13 Engineering courses involved in the event and also topics that covered the largest possible number of courses. The contents of the lectures presented with information about the world market in terms of Engineering, economics, among other topics and presentations of technologies and trends of great impact in Brazil and in the world with the biggest names in each segment. The competitions were filled with challenges designed to promote participant interaction and Engineering practice. Challenges include Kart competitions, which aim to stimulate the scientific essence of students and encourage them in the development of new technologies for the automotive area, in addition to awakening their competitive spirit. The Robotics competition was held with the purpose of promoting the research and development of applications in Robotics in the state of Goiás; The Net Promoter Score (NPS) methodology was used to evaluate the impact caused to the students, and through the data collected at the end of the event, it can be concluded that the objectives were satisfactorily achieved. The overall grade of the event was 8.1 points, and UFG students made up about 61.2% of the total participants, the rest of the students were integrated from other Universities. About 96.1% of the students would recommend the event to someone

else, and would return in the next edition. The three courses with the largest number of participants were: Civil Engineering (32.5%), Electrical Engineering (19.7%) and Mechanical Engineering (14.5%). The organizing committee learned and developed many skills, like leadership, critical thinking, vision, communication, teamwork, financial management, time management and people management.

Keywords: Congress, Education, Engineering, Extracurricular, Technology.

Engineering Market and Academia:

An Analysis of Extracurricular Activities

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Abstract

The Market Week is a technical event aiming to strengthen ties between academia and industry, and to prepare the students of the Engineering Schools of the Federal University of Goiás (EE-UFG) to meet the real needs of the job market, and thus better prepare future Engineers. This is achieved through Lectures, Workshops, Challenges, Recruitment Fairs and Technical Visits, where it is taught soft skills, techniques and tools consistent with the Engineering areas of the market itself. In three editions, the event was attended by more than 50 companies and professionals and more than 400 participants of Engineering courses. The Market Week is an event created and organized by the Polytechnic Association, whose mission is to inspire and empower students, bringing them closer to the market and contributing to the training of pragmatic and excellent Engineers. In its third edition, the event had the participation of 19 students in the organizing committee, and 14 volunteers, lasting five days. Three months were spent in planning and execution. The overall score of the event was 8.6, remaining very close to the previous edition. The organization of the event was evaluated at 7.2 points. The infrastructure grade was 8.2 points, and the team's performance was assessed at 8.9 points. About 94.7% of the participants would indicate the event to friends, indicating an increase of 1.7%, compared with the previous edition. It was verified that 50.9% of the participants had not had previous contact with professionals of companies of the Engineering area, neither through internship nor the Market Week. Participants reported having known better the importance of skills such as communication, leadership, trust, and problem solving. The methodology used to collect data was the Net Promoter Score (NPS). The analysis of the data shows that the students were positively influenced in their development, through the stimulation and incentive to learn the soft skills and tools required by the job market.

Keywords: Engineering, Extracurricular, Industry, Market, Soft Skills.

Design of a Low-cost Weather Station for Use in Sensor Network Systems for Agriculture and Engineering Education:

A Case Study

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Abstract

In agriculture, knowledge about meteorological and climatic variables is essential for taking action in various activities, and may be the difference between their success and their failure. However, often due to cost, the density of weather stations is low in several regions, causing great uncertainty in the models of climate estimates. The need for an affordable solution to this problem led to the construction of a low-cost weather station that would meet the metrological demands for climate-quality monitoring in plantations, and could be easily extended to Engineering education for its statistical techniques for sensors calibration, microcontroller programming and hardware design. Thus, for the development of the project, a survey was made of the sensors and transducers most used in climate variable measurement systems in an activity of planting (anemometer, thermometer, rain gauge, hygrometer, radiometer, gas sensor) and metrological tests in order to obtain their error curves if the accuracy and precision information was not provided by the manufacturer; an electronic circuit was designed to integrate them; a software was programmed for data capture and embedded in an Arduino Pro Mini; and another one for the sending of data, through a NodeMCU. It is important to note that the sensor network system has been calibrated and its characteristics used in the construction of the station fulfill the metrological requirements for the measurement of climatic variables. Thus, it is possible to construct a low-cost calibrated weather station with good metrological characteristics, whose unities are the same as used by INMET - Instituto Nacional de Meteorologia, and which can be used in the study of Metrology discipline, since it contains a good range of sensors for a practice of theoretical activities, such as the use of statistical techniques such as the Chauvenet criterion, complemented by the study of Student's "t" Distribution; and also direct tests, as well as the implementation outside the classroom, enabling more accurate readings of the environment and creating the basis for several future researches that depend on environmental variables, such as estimation of evapotranspiration rate, soil irrigation design, water balance of the region, among others. Indoors, the students were able to verify the valid range of the sensors values using 29 degrees of freedom and 95% measurement certainty criterion. Besides that, the

implementation of the imbedded codes and computer networks establishment allowed them a multidisciplinary integration of skills. We would like to thank CEFET-MG, FAPEMIG and PET/SESu/FNDE for their support in this project.

Keywords: Agriculture, Engineering Education, Metrology, Sensor Network System, Weather Station.

Agile Methods to Enhance Iterations in Designing Solutions for Active Ageing

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Abstract

Agile methods to foster rapid creative iterations were introduced in the squad “Studio Silver” at the Industrial Design department of the Eindhoven University of Technology. These methods are used in order to build understanding of the needs and social interaction of healthy and active ageing and design interventions for new behavioral patterns and increase quality of life. To nurture Agile iterations, we integrated a working approach for the students, consisting of trial-reflection-iteration and feedback loops. Throughout the implementation of the squad (i.e. a studio approach of approximately 30 students for collaborative communities in which students work in design and research projects), students present their progress in terms of short write-up of the design proposals, presentations, and prototypes several times in a period of 16 weeks. Formative feedback serves as feed-forward method to stimulate new actions in the design allowing spacing effect in rapid prototyping and supporting long-term learning. We conducted a study in semester 2, 2019, to investigate the effects of feedback and reflection on students’ deliverables. Two interim feedback moments were introduced. The first one took place in week 4 for students to present design/research proposal to demonstrate why there is a design/research challenge, how they plan to tackle it, what they expect to achieve and what they have already achieved. In week 8, students submitted a reflection that summarized the feedback, which they have received in the rubrics regarding the integration of competence areas, design research process, and demonstrators, and presented their reflection on their understanding of the feedback received. In addition, students’ perceptions on coaches’ feedback style was collected to learn whether coaches’ attitudes stimulate reflections and iterations. Results of interim feedback moments from the selected deliverables of 10 students indicated that most of the students made improvements in their design and research processes showing that this Agile method on feedback-reflection loop stimulates iterations. Regarding students’ perceptions on feedback and coaching style, this helps students reflect, understand better and adjust the design scope/research challenge of the project.

Keywords: Design-based Learning, Engineering Education, Feedback and Assessment, Interdisciplinary Education, Reflection-in-Action.

Identification of Teaching Competencies for The Use of Problem Based Learning (PBL) to The Discipline of The Civil Engineering Course

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Abstract

Considering the discussion about teaching competencies required for teaching in Engineering, this research contextualizes the fact that the professional who teaches in Engineering courses has an essentially technical background and, in general, because of this, finds difficulties in transmitting knowledge in a didactic way. However, their training and performance facilitate their adaptation to the use of technological tools aimed at undergraduate education. The aim of this research was to identify teaching competencies to be used to facilitate the use of the Problem Based Learning (PBL) method in undergraduate teaching in Civil Engineering at a public University in the city of Marabá, Pará. The study followed the strategy to apply the PBL method in two disciplines and then to consider the perceptions of the students and one of the professors of the undergraduate course in Civil Engineering at the Institution of Higher Education in relation to the method. For this, the structured questionnaire based on the teaching competencies for the higher level level presented by Zalbaza (2017) was applied. Thus, from the use of BPA in teaching undergraduate Engineering was made a survey of teaching skills that would need to be developed by the teaching staff of the institution of higher education. These competencies were presented in two ways: the competencies to be developed by the professor directly participant of the research and the other teachers of the institution of higher education. The data were treated and measured according to the average of the students' responses, comparing with the teacher's response, in order to identify which competencies should be potentiated. From the results and contributions of this study, it was identified that among the ten competencies addressed in the questionnaire the competencies "Management of new technologies", "Identification with the institution and teamwork" would be the competencies that would need to be potentiated by the professor directly participant of the research and "Tutoring and student support" are the skills that would need to be potentiated by other teachers to ensure the use of PBL in Engineering Engineering.

Keywords: PBL Education, Engineering, Civil Engineering, Education, Vocational Training.

Reliable and Low-cost Alternatives for Virtual Instrumentation:

Development of Virtual Instruments to Be Applied on Engineering Education

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Abstract

Virtual instrumentation is a concept directly connected to the virtualization of systems, equipment, controllers, and processes, using, basically, a data acquisition board and a software that processes, treats, and presents the information to the final user. Consequently, due to both simplicity and efficiency, it has been acquiring space for various purposes. This work proposes the development of low-cost and satisfactory metrological characteristics virtual instruments to be used in teaching and researching in Engineering. Thus, two prototypes were built: an ammeter and a voltmeter, both virtual and suitable to measure continuous values. MyOpenLab[®] is a free development software that presents a wide variety of tools and an uncomplicated application. Therefore, both MyOpenLab[®] and the signal acquisition board, Arduino[®] Uno, were selected considering their effectiveness and low-cost. For the development of the ammeter, it was also necessary to use a DC sensor and the ACS712 was chosen. In view of the fact that it is an experimental research, it was necessary to collect the data for validation and calibration of the virtual instruments. Initially, in order to verify the precision of the instruments, various measurements of current and voltage were made, by one of the authors, on three different days and times. The intent was to observe if they were able to repeat the results under different climatic conditions. In order to verify the accuracy of the instruments, the average of each value measured was compared with the measured by an Agilent U1242B multimeter, used as reference in the calibration by comparison process. The results obtained with the calibration were satisfactory for both virtual instruments, since they presented a low systematic error. Therefore, it was concluded with this research that it is possible

to create quality virtual instruments, which can be used to supplement the demand of students and professors of institutions that do not have many lab resources. The authors would like to thank CNPq, PET/MEC/SESu and CEFET-MG for their support on this project.

Keywords: Accuracy, Calibration, MyOpenLab®, Virtual Instruments, Precision.

3D Virtual World Strengthening Theoretical Practical Relationships in the Educational Institutions:

Solution Based on 3D Virtual Worlds to Fill a Lack of Resources in Educational Institutions

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Abstract

The lack of infrastructure, and resources in schools and Universities around Brazil is a problem that directly affects the academic development of professionals. Most of the educational institutions did not follow the technological advances regarding the forms of education. This stagnation is caused by problems, such as the training absence of education professionals, insufficient investments in infrastructure, and few resources compared to the demands. The importance of conciliate practical content with theoretical is directly linked to students' learning, a fact that in some institutions is very difficult to happen due to the lack of laboratories or equipment that support the number of students. This work presents the assembly and, control of a liquid level plant, and posteriorly, the creation of the same model in a 3D virtual world. The intention is, when using a virtual plant, simultaneously trigger the real system, so that the data of the physical plant are sampled, and returned to the server, reflecting all the results of the actions occurred as faithfully as possible. Thus, it aims to provide high interactivity, so that users

have an immersive experience, and a dynamic learning, through the high degree of realism that the proposed system provides, which leads to an attractive learning process. The system is assembled using the OpenSim virtual world server, which has tools that allow a real-world approach, such as previously created objects, and date as well as time adjustment, capable of promoting characteristics that simulate the daily cycle, the interface device between virtual, and real world Raspberry Pi, and a power interface card. The tests were performed using the constants found in the controller tuning, and comparing the results of the real plant with the one modeled in the virtual world for different setpoints. Various possibilities of using 3D virtual worlds tools can be applied to provide high immersion and interactivity for teachers and students. The virtual model presented a satisfactory answer, once it traced the behavior of the model. The effectiveness of this model justifies its use to provide students with complete learning, reducing costs, and increasing the capability of institutions to propose the conciliation between theory, and practice content approached. We would like to thank FNDE, CEFET-MG, and PET/MEC/SESu for their support on this project.

Keywords: Teaching and Learning, Virtualization, Remote Lab, 3D Virtual World, Theoretical Practical Relationships.

Engineering since High School:

The Development of Skills Deemed Necessary to Higher Education and The Vocations Awakening in Students Arising from Brazilian Public Schools

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Abstract

In accordance with the Programme for International Student Assessment (PISA), the Brazilian Basic Education is lagged in comparison with the international context. Back in the 2015 PISA edition, Brazil was allocated between 59 to 66 rank position out of a 73 countries rank in mathematics, reading and science courses. These rates had no significant improvements in comparison with previous years. The average grade corresponding to sciences remained steady since 2006, and of reading, since 2000. Mathematics showed a considerable 21 points improvement since 2003, however it decreased 11 points between the years of 2012 and 2015, according to the Organization for Economic Cooperation and Development. In order to minimize the situation, the project “Electronic Instrumentation Project For High School Students of Public Schools, and its derivatives”, was submitted to the National Council of Scientific and Technological Development - CNPq, in public calls in the category of Institucional Program of Scientific Initiation Scholarships to High Schools (in Portuguese, PIBIC-EM). Furthermore, with funding from the Universidade Federal de Campina Grande, two editions of the Extension Scholarships Program (in

Portuguese, PROBEX), were entitled “Skills and Competences Development in the Technology Area for High School Students”. Both projects happened in the city of Campina Grande, state of Paraíba, Brazil, between the years 2016 and 2018, under the coordination of the students in Electrical Engineering Anyelle K. F. de Queiroz, Joyce V. Morais Rodrigues, Marya M. Vieira Formiga and Rayanna M. de O. Francklim, supervised by Jalberth Fernandes de Araújo and Raimundo Carlos S. Freire, professors in higher education. The projects had as its premises to awaken vocations in high school students from public schools for the great area of Engineering, by presenting applications such as: Energy Generation, Distribution and Transmission Systems; Microelectronics; Telecommunications; Automation and Control, Civil Construction; development of prototypes in the Biomedical area, among others. Aiming not only to alleviate possible struggles in the Exact Sciences, but also to work other crucial skills such as group dynamics, eloquence, and above all, motivate them to pursue their future careers in the great area of Engineering. The projects generated a number of positive impacts, among which: awards in a technological development contest, approval in exact courses: 70 percent of the students in the 3rd year of high school were approved in courses involving the area and 80 percent of high school students enrolled for the new edition of the project. Accordingly, we can consider the motivating and essential results for the students growth. The teaching done in a practical, playful and challenging way incites the debate, makes the knowledge instigating and, therefore, attractive.

Keywords: Basic Education, Electrical Engineering, Microelectronics, Vocations Awakening, PISA.

Worksheet for Calculations in Distribution of Electrical Power using Microsoft Excel®

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Abstract

The search for the continuous improvement of the quality of the service of electricity supply to the consumer is now a crucial factor for the survival of companies. One of the most important steps in this quest for quality is undoubtedly planning, an essential tool for the decision-making process. In the context of Electric Energy Distribution Systems, planning is a routine activity, since such systems require the continuous analysis of several indicators to solve everyday problems. The study of this important subject integrates the grid of Electrical Energy Distribution course, being crucial for the formation of the Electrotechnical Engineer. As the didactic examples used are usually very simple and do not allow the student to observe the particularities and details of the problems and in order to further improve the training of future Engineers, a spreadsheet was developed to support the Federal University of Campina Grande (UFCG). This work presents the current status of the development of the Worksheet for Calculations in Distribution of Electrical Power using Microsoft Excel®. It was developed in the Visual Basic for Applications (VBA) language of EXCEL® software and, in its current version, calculates the voltage drop, power losses, load flow and provides the voltage profile of the feeder. Such information is obtained after insertion of the power factor, primary feeder voltage, length of the stretches and the type of conductor used. The worksheet requires minimal information from the user and allows the generated data to be exported to a new worksheet, to print reports or to generate the voltage profile curve. The worksheet has already been applied by the students during exams of the discipline Electrical Energy Distribution. In addition to facilitating the examination, there was a significant improvement in learning and interest in issues related to the electric energy distribution area, since the use of this new tool has enabled the students to understand the entire process of calculating power flow, voltage drops, and losses over a power distribution system.

Keywords: Excel, Load Flow, Power Losses, Visual Basic for Applications, Voltage Drop.

Laboratory of Integrated Practice:

Training of Engineers for The 21st

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Abstract

Understanding our mission statement, which is, “Transform our Country through Education”, also considering the centrality of students in our educational institutions, we have been challenged to offer a competency-referenced curriculum that allows creating learner autonomy, increasing student’s rates and performance. Helping students to learn as well as supporting them to become protagonists of their Life and Career Projects have been one of the main goals of higher education institutions. Therefore, it certainly involves the development of socio-behavioural skills, considering the necessity of dealing with the demands of modern society. Educators around the world, performing both in and out of the classroom, believe that Project-Based Learning – PBL is a critical instructional approach that allows students to master and enhance skills and academic content knowledge, which are essential for improving success, for building personal purposes and attitudes to overcome life’s challenges in the contemporary world. The PBL approach provides the student with a deeper understanding of the studied content while putting theoretical concepts and strategies for problem-solving into reflexive practices. At the same time, it adopts the development of multidisciplinary capabilities related to communication, collaboration, leadership and management. PBL relevantly supports the development of reasoned critical thinking. In this framework, the main goal of the Laboratory of Integrated Practices – LIP as an innovative curricular unit that aim is to articulate core competencies for Engineering students in the two first years of its Bachelor program. In 2018, 2760 Brazilian students took part in this research. Student’s perceptions regarding non-conventional academic experiences and active learning methodologies are collected for evaluating the program. From the understanding and reflections that emerge from LIP’s practical and reflexive activities, students have prove to become able to conciliate new knowledge with previously known ideas. Notably, once LIP’s classes involve mentoring as a critical element for strengthening the training process, each lesson is opened by pre-activities or questions meant to engage students and to build interest while offering opportunities to share what they already know on the subject. This phase includes helping learners to make connections between the preexisting knowledge base and the insights

that will arise from assignments, lesson and unities. The 5Es Methodology is additionally contextualised, based on the constructivist learning theory, which suggests that knowledge and meaning are built from people's experiences. The following phases are therefore highlighted, considering a five-stage instructional model for inquiry-based learning: 1) students receive information prior to the lesson, engaging it and promoting connections between past and present learning experiences (Engage); 2) students deepen comprehension, through experiments and other interactions (Explore); 3) students attempt to explain what they have learned and experienced with mentoring interaction (Explain); 4) students deal with new situations in the sense of deepening skills (Elaborate); 5) students provide evidence of significant learning and comprehension (Evaluate). The results obtained from the participant's reports - students and teachers - allows verifying common perceptions regarding engagement, creativity, problem-solving, autonomy, critical thinking and argumentation. The academic gain that arises from social learning also strengthens formative and learning purposes to enhance the formative assessment.

Keywords: Formative Assessment of Learning, Reflexive Practices, Significant Learning, Training of Engineers, Laboratory of Integrated Practices.

Methodology to Apply Horizontality to The Engineering Curriculum

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Abstract

The Engineering curriculum in Brazil is based in a vertical grid, where the content is provided to students by structural axes that span the entire course. Thereby, it is possible that some students prioritizing advanced subjects over basic ones, from the initial semesters. The structural basis of any training must be provided in the initial phase so that the student can correlate the concepts to come between the different disciplines and axes that will have to face in order to reach his goal of being formed, in this case: Engineer. In order to adapt this situation, a curriculum with block enrollment was created at Unijui - Campus Santa Rosa - which integrates the basic knowledge of Engineering and for its functionality, implementation and execution individual pedagogical projects are being created for each semester as a way of interconnecting the disciplines, facilitating, to the involved entities, this lateral relation between the components of the semestrality and not only with respect to the vertically structured axis of which it is part. These semester pedagogical plans meet the need: the student perceives the relationship between the concepts he sees separately in the classroom; of the teacher, who has a tool that allows him to speak/expose/teach topics related to Engineering, even teaching another area related to training, such as Mathematics, Physics, General Mechanics, etc. It is worth mentioning that this pedagogical organization is foreseen in the PPC (Pedagogical Project of the Course) and is a main part of the Plan of Implementation of this PPC, which also provides: monitoring of failure, evasion and qualitative and quantitative evaluation factors. The training in 10 semesters, to which these Engineers are being submitted, must occur in 5 years, another factor observed for the pedagogical control of the semester plans of training of Engineers. With this, it is hoped to improve the scholastic performance of the students of Engineering, to reduce the evasion and to increase the generalist knowledge of the

Engineers that will be formed in this new proposal.

Keywords: Education, Curriculum, Engineering Education, Interdisciplinarity, Pedagogical Course Design.

The University Extension as A Tool Applied to The Incentive of Science in Fundamental and Average Education

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Abstract

Engineering teaching aims to apply the Exact Sciences in obtaining quality of life, infrastructure and technology for people. However, interest in science has been declining in the Schools. The students have been working with ready tools and their creativity for technological innovation has been gradually diminished. Applying the University Extension and inverted classroom concepts, according to Papert (2001), the Unijui Electrical Engineering Course, is creating projects in Elementary and Middle School to awaken students' interest in Exact Sciences, showing the challenges and possibilities existing in the area. This work seeks to show the link between elementary education, high school and undergraduate, in order to strengthen the Brazilian teaching of Engineering as a whole. The actions proposed in this report present Engineering in an attractive way to young students. In this context, Unijui's Energia Amiga and Física para Todos projects are working directly with children and young people, under the themes of energy conscious consumption, safety in electricity and robotics. The objective of this article is to present the extensionist actions and discuss the innovation points for the trajectory of the Engineer, which begins in the awakening of his vocation still in Basic Education in the area of Exact Sciences. As a secondary focus, it is hoped that women will also be able to attend higher education courses.

Keywords: Education, Engineering, Electrical Engineering, Exact Sciences, University Extension.

“Meninas que Engenham o Futuro” Extension Project:

An Action for Inclusion of Women in The Field of Engineering

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Abstract

The exact sciences and Engineering represent one of the means which still concentrate most of the vacancies for males. Against this background, the “Meninas que Engenham o Futuro” extension project of the Universidade Regional do Noroeste do Estado do Rio Grande do Sul, UNIJUÍ, in partnership with CNPq, MCTIC e MEC, has as its central theme the insertion of women in the field of Engineering. In addition to demonstrating to the students of basic education, their potential in the field of Exact Sciences and Engineering, which requires a multidisciplinary and sustainable thinking. The project will be worked with female students and teachers of Basic Education enrolled in participating public schools in the city of Ijuí and Santa Rosa, Rio Grande do Sul. In the organization and execution, the project has two teachers of Electrical Engineering, two teachers of Chemical Engineering and three undergraduate female students matriculated in Engineering courses. For the project, two themes were chosen to be studied with students: the concepts of energy efficiency and the concepts of rational use of water. From these studies, the students will be encouraged to develop projects for their schools, aiming at the practical application of the contents. Among the potential and opportunities that this project provides, we can mention the fight against waste, which results in cost savings to public coffers, that can be reversed

in other investments. In addition, the project will develop the relationship between University and social sector, based on a dialogue and exchange of knowledge. This alliance with society will contribute to overcoming inequality and social exclusion and to build a more just society, ethics and democratic. This ensures sustainable regional development, from the demonstration to the students and teachers, their potential in the Exact Sciences and Engineering, and with that, the transforming power of the society and community that they live.

Keywords: Chemical Engineering, Electrical Engineering, Energy Efficiency, Extension, Water.

“Energia Amiga” Extension Project

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Abstract

The “Energia Amiga” Extension Project of the Universidade Regional do Noroeste do Estado do Rio Grande do Sul, UNIJUÍ, has as its central theme the Electrical Energy, based on three lines of action: conscious consumption of Electrical Energy, safe use of electrical installations and technological residues. The projects aim the development and sustainability, making a commitment with the social responsibility and interaction with several areas and segments of society. The project is made by undergraduate students of Electrical Engineering together with undergraduate students in Literature and Design, with the guidance of teachers from the respective areas. The project started in 2018 in public schools of the city of Ijuí, Rio Grande do Sul, where was worked on the main concepts of day-to-day electricity, as well as conscious energy consumption and safety precautions about electricity risks. In 2019, the project will keep the work with public school students from the city Ijuí, and for the first time in Santa Rosa as well, the main focus of the project is in the technological residues area, developing two books about reverse logistic. The books are divide in two volumes, the first one is directed to the third year students and the second volume to the ninth grade students, the academics participating in the project will go to the schools to develop the activities (writing contest, full-size board game, classroom activities) with the students. In addition, to deepen the knowledge presented and to approach new contents, each student receives a book with texts, drawings and various activities, developed by the graduates participating in the project, by the teacher in charge, and carried out with sponsorship of companies and entities of the electric sector. The contents of the book are turned to reverse logistics, addressing its concept, history, development in Brazil, reverse logistic of lamps and batteries and electronic waste.

Keywords: Education, Electrical Engineering, Extension, Reverse Logistic, Energia Amiga.

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