

UFSC COMPETE: CREATING SYNERGY BETWEEN DIFFERENT STUDENT COMPETITIONS TEAMS

Rodrigo de Souza Vieira
Universidade Federal de Santa Catarina
rodrigo.vieira@ufsc.br

Abstract

In this paper the outreach program UFSC Compete is presented. This program is divided into competing teams involving students from several courses at the University, and its goal is to create and defend a product in a competition against other national and international universities. The history of each competition and our teams are shown. The results of this action, inside and outside competitions are listed, demonstrating their importance for the academic and personal formation of its stakeholders. At the end some future actions are described to improve in the future the results of this Program.

Keywords: Student competitions. Engineering competitions. Training engineers.

UFSC COMPETE: COMO CRIAR SINERGIA ENTRE DIFERENTES EQUIPES DE COMPETIÇÕES ESTUDANTIS

Resumo

Apresentamos neste trabalho o programa de extensão UFSC Compete, que se divide em equipes de competição que envolvem alunos de vários cursos da Universidade, cujo objetivo é criar um produto e defendê-lo em uma competição entre outras universidades nacionais e internacionais. Aqui são mostrados o histórico de cada competição e de nossas equipes. São elencados os resultados até então obtidos por esta ação, nas competições e principalmente fora delas, demonstrando sua importância tanto para a formação acadêmica como para a formação pessoal dos seus envolvidos. No final são traçadas novas ações a serem tomadas no sentido de melhorar ainda mais os resultados do programa.

Palavras-chave: Competições estudantis. Competições de engenharia. Formação de engenheiros.

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Resumen

Este trabajo presenta el programa de extensión UFSC Compete, que se divide en equipos de competición que envuelven alumnos de varios cursos de la Universidad Federal de Santa Catarina con el objetivo de crear un producto y defenderlo en una competición entre otras universidades nacionales e internacionales. Aquí son relatados el histórico de cada competición y de nuestros equipos. Son relacionados los resultados obtenidos por esta acción, en las competiciones, principalmente fuera de ellas, demostrando su importancia tanto para la formación académica cuanto para la formación personal de los involucrados. Al final son delineadas nuevas acciones que serán consideradas con el objetivo de mejorar los resultados del programa de extensión UFSC Compete.

Palabras-clave: Competiciones estudiantiles. Competiciones de ingenierías. Formación de ingenieros.



INTRODUCTION

The competition has always been present on human beings lives. We are always motivated to overpass limits and break new records. The sport in general is a healthy way of competition, where merit is always present focused on the ability to win responsibly, ethically and legally. Different competitions that we have today in our world always aim at comparing results, choosing the fittest, the fastest, and most capable.

This ideal of competition was eventually introduced to the engineering schools in 1973, through the Recreational-Ecological-Vehicle (REV), designed by Dr. William R. Shapton professor at the University of Cincinnati at that time. It was a competition whose goal was to design and manufacture an amphibian all-terrain vehicle (ATV), for two occupants. In the first year the vehicles of all six teams, were taken from the market, adapted by the students. In the following year, 8 universities participated, developing their own projects (STEPHENS & SHAPTON, 1977). From this seminal competition, the Mini Baja East was created in 1976, organized by the Society of Automotive Engineers - SAE, which later became Baja SAE. On the first edition, there were 10 teams in the competition.

Besides a strong cooperation between the university and industry in the North American country, the competition has grown, allowing the establishment of others, such as Formula SAE in 1981 (6 teams) (COMPETITION, 2016), SAE Aero Design in 1986 (14 teams) SAE Clean Snowmobile in 2000 (7 teams), SAE Supermilage in 1980, and Shell Eco Marathon, which appeared in 1939 as a competition between company employees and then became a competition between universities.

Over time these competitions extended and crossed the boundaries of the former countries coming to another places, including Brazil. Here, the Baja SAE Brazil emerged in 1994 as a national event, and in 1997 with regional events, such as the Baja SAE Brazil-South. The Formula SAE Brazil came in 2004 for internal combustion engine vehicles only, expanding to the electric vehicles in 2012. Aero Design was created as competition in Brazil in 1999 and currently has three different categories with over 100 teams participating each year. Solar Brazil Challenge came in 2009, as the Polo Nautico of Federal University of Rio de Janeiro initiative. (UFSC COMPETE, 2015)

Gradually several Brazilian universities from every part of the country, were engaged in these activities in order to promote a broader and better training for their students. Thus, the national competitions listed above have become part of the agenda of several engineering

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schools, including the Federal University of Santa Catarina which is located in the South of Brazil, Florianópolis.

THE UFSC TEAMS

Looking for different ways to give to the students a complete learning within universities, the Competition Teams have been growing year after year in Brazil. These projects aim to put students on a collaborative work environment, where participants should learn about project management and work group, following rules proposed by the competitions in which they participate helping the university to be in the market.

The competition teams of UFSC campus Florianopolis are based on the Department of Mechanical Engineering, which consists mostly of undergraduate participants. They are: Ampera Racing (Team Formula Electric), Baja UFSC (Mini Baja Team), Céu Azul (Team AeroDesign) E³ (Team Energy Efficiency), Formula UFSC (Team Formula Combustion) and Vento Sul (Team Solar Boats).

From the historical point of view, the first team created at the Federal University of Santa Catarina was the Baja UFSC. This project is an outreach activity that allows students to obtain, expand and apply knowledge from different areas, such as administrative and technical, through a multidisciplinary design, increasing the student's education. The students must design and build a reliable off-road prototype, high performance, low cost, and large-scale production feasibility. These points are evaluated by referees that are selected from automotive industries of the country, which also represent the first contact of students with engineers that already work on the same area that they are looking for. The national Baja SAE competition nowadays is one of the most competitive students event of the country, with great visibility for both participating: students, and for the universities they represent. Beyond 22 editions held, the competition has projects and teams on higher and higher levels.

Team UFSC Baja SAE participates each year in the Regional Competition (South Region), and National (Baja SAE Brazil). The Regional Competition takes place at Gravataí (RS-Brazil), with 25 teams from the South universities. The National one happens at São José dos Campos (SP-Brazil), with 74 teams from universities across the country. Representing UFSC since 1997, the team has great performance on national Baja SAE scenario. UFSC has been seven times the winner of the South Region and getting good placements in the National one. UFSC team has

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already qualified for the World Competition twice (2009 and 2013) and got the eighth place in the last competition held last March of this year.

The team Céu Azul Aeronaves was the second team of UFSC. The team competes in the SAE Brazil AeroDesign Competition, held annually in DCTA (Department of Aeronautics Science and Technology), in São José dos Campos-SP. Since 1999, the first competition in Brazil, UFSC is represented. The competition's main objectives are to encourage and provide opportunities for students to obtain, to deepen and to apply knowledge, focusing on the aviation environment through a multidisciplinary project. Every year the competition has grown and in 2015 edition, 95 teams (maximum of competition) of universities across the country, and 3 abroad were registered. The competition is divided into three categories: Micro, Regular and Advanced. At Regular class UFSC team ranked 6th and 7th places in 2006 and 2004, respectively. In the Micro class, which participated in 2015, Céu Azul team took the 2nd place on the first participation, 3rd place in 2014 and it was the champion in 2012. The victory gave the opportunity to the team to participate in the world competition, in Texas in 2013, where it won the 3rd place and the trophy of the best structural efficiency. In the Brazilian competition history received honorable mentions, such as: best structural efficiency, greater precision on empty weight estimation and best technological innovation. Since 2015, the team migrated from Micro to Advanced Class, creating new challenges for their students.

E3 – UFSC efficiency energy team participates regularly in the national competition: Marathon of Efficiency, at Interlagos kart track, Sao Paulo. The team also competes on Shell Eco-marathon Americas, but not regularly. This event takes place in the United States and brings together teams from more than five countries of the Americas, including the United States and Canada. Both competitions encourage teams to develop prototypes in order to get vehicles that cross long distance with the least energy amount. For the students, they apply the knowledge acquired in the classroom, and develop multidisciplinary skills and working group to achieve that. The team at UFSC was established in 2009, and since then participates in the national competition every year, and went to Shell Eco-marathon Americas in 2012, 2013 and 2014. In 2012 the team took the second place in the national competition in "prototype gasoline" category and in 2013 in the same category, reached the 5th place in Shell Eco-marathon, obtaining the mark of 418 km per liter, which is the best brand of a Brazilian team until today. The team currently has a prototype in two gasoline and ethanol categories, but they have plans to build a new vehicle, powered by electricity.

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The Vento Sul Team is a multidisciplinary group of undergraduates and graduate students of Federal University of Santa Catarina in order to develop vehicles with photovoltaic solar energy powertrain. The team is focused on developing small boats, moved by solar energy, and it is a national reference nowadays. The team which has won for 6 consecutive years the Brazilian competition boats powered photovoltaic solar energy, called: Solar Challenge Brazil. They also participated three times of Dutch Solar Challenge, an international competition in the Netherlands, and it was considered the best non-European team in 2010, the lightest boat in 2012 and 7th overall placed in 2012 and 2014.

The Formula UFSC team competes in the national Formula SAE Competition, held annually in ECPA (Automobile Sport Club of Piracicaba). In Brazil, the competition is on 13th edition, and it is a qualifying stage to participate in Europe and the United States competitions, which are the world's largest competitions of automotive engineering students. Referred to as the cradle of good engineers, the competition provides great learning, challenging students to apply classroom content in order to get the best design result. It also prepares the students for a very competitive market, given them the opportunity to get in touch with well-known companies to build the project. The team Formula UFSC had begun in 2010, getting results increasingly significant and it is a nationally acknowledged team. Currently the team has one of the most powerful project around the world, and was the pioneer applying technologies such as the use of wings and turbocharger in its vehicles.

The Ampera Racing has the main activity as the proposal to design, build and test a mono-place electric vehicle of high performance aimed at Formula SAE Electric competition. In this sense, it enables the staff members to get knowledge and experiences acquired beyond the competitions. As a design result, they must reach a vehicle that has applicability in the market, can be efficient and show good performance as well. Divided into technical and management areas, the team provides to participants contact with real engineering problems, management and teamwork. They must apply the theoretical knowledge acquired in the classroom and complementing the research and outreach activities of the University. The team has got the 3rd place in the very first participation, in 2014, establishing itself as the main staff category in the South.

UFSC COMPETE IN EDUCATION

Even as an outreach activity, the participation of a student in one of UFSC teams is a great complementary activity in his formation. We can reach these conclusions through the objectives achieved on each team listed before. From the student side he can:

1. Develop innovative engineering solutions to their prototypes due to limitations and rules imposed by the regulations: The specific regulations for each competition restrict the possible solutions to be found by the teams, enhancing the creativity of each one involved in the project.

2. Provide teamwork and create management and organization knowledge: This is something fundamental in engineering courses, during the education little emphasis is given on this direction. Thus, students can practice management concepts in a practical problem even at the University.

3. Promote the technical exchange and knowledge between the teams: this point is really important, because the student can create and increase his network, putting him in touch with other students from different universities, and with engineers already working in the area.

4. Develop leadership and planning skills: Each team has a captain and managers in several areas, which develops leadership and planning activities, goals and actions established.

5. Develop the ability to sell ideas and projects: Students must submit their projects and to convince the referees that they have the best competition project. This is not a classroom subject and becomes an important point. On the teams, the students must develop responsibilities regarding to project that they are supposed to do.

6. Encourage the ethical and professional behavior: it is a competition and therefore must be won respecting the rules and opponents during the tests. This helps to form excellent professionals, therefore can make a better society, with the strengthening of essential principles to become good citizens.

7. Participation in national and international competitions representing the University: At this point two results must be considered. The first is the sense of "body" of the student with UFSC; he feels motivated to be there defending his University. Also he feels responsible to have a coherent behavior, because he carries the name of the University on.

8. Theoretical knowledge Extension related to their training: UFSC Compete activities are complementary to those developed inside the classrooms. This means that all knowledge, worked

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inside the classroom, and on practical applications in the teams, is just one thing. As results, we can get students more prepared for engineering practical life.

9. Intensify relationship between university and student communities: Although the team's goal is to participate in the competition, all actively participate in the SEPEX, showing the community the developments made in the University. In addition, some teams take part in school visits leading to academic future skills worked at UFSC.

10. Improvement of existing technologies: Teams must always be ahead of the others to ensure a good result, and thus, new technologies and innovative solutions are generated in our laboratories.

11. Development of interdisciplinary in the University: Despite that most students participating in UFSC Competition came from engineering courses, some teams has on their staff some students from other departments, such as psychology, management and design. This action promotes closer relationships among students of different courses, creating a good environment between them.

12. Improve his Personal and professional skills: it is undeniable that the student who participates in UFSC Competition activities becomes a different pupil. The sense of responsibility, due to constraints of time and resources for carrying out the projects is already an important fact in personal formation by itself. Furthermore, the development of engineering practical solutions gives to students a different formation.

Besides all this advantages, from the University side, there are also great achievements:

1. Academic production: students are encouraged by the advisers of the projects to generate technical/scientific articles. This is the entrance room for students to participate on national and international fairs and congresses.

2. Increasing of University visibility: good results are the key point for showing the University competences. This becomes an important marketing tool, demonstrating their skills and capabilities.

3. Relationship Consolidation between university and student communities: as has been mentioned before, the teams work connecting students and putting them into the academic community, through a stimulating action.

4. Encouraging the entry of high school students to the University: visiting local schools and show their projects causes a great admiration in future academics. Realizing what they can do at University, an immediate empathy between the institution and future students are created.

5. University integration: Currently the competition team projects in other campus of UFSC have been developed. In Joinville there are teams in all competitions mentioned here also with promising results. Today there are actions to integrate all the teams and there is already a lot of cooperation between them, in the sense of project development.

Besides the success achieved at UFSC, there are other schools/universities that have used these programs under an active learning process, where the student interacts direct to the knowledge. There are some examples abroad, such as the Universities of Robert Morris (SIRINTERLIKCI, KERZMANN 2011), Toronto (JONES, 2015), Coventry (BOOTH, WHITE, 2008), Monterey (RIVERA-SOLORIO, GARCÍA-CUELLAR, FLOWERS, 2013) and the Technological Institute of Israel (DOPPELT, 2003), and in Brazil, such as the State University of São Paulo (FERREIRA CAPORALLI and SON, 2011) and the Federal University of Campina Grande (ARAÚJO et al, 2006)

FINAL CONSIDERATIONS

As demonstrated throughout this paper, it is undeniable that the competition team activities bring several benefits to the entire academic community. Such as training, formation and integration of students, it can be easily identified as a good complementary activity on engineering courses. In this way, administrators and teachers that are direct involved to competition teams must provide full institutional support, to strengthen the bond of the student with the institution.

The teams of UFSC Competition rely on partner companies and supporters of projects that help part of their actions. This is also so much important for the students' formation. This develops responsibility sense, in practical way, as they develop a new leadership skill.

However, the concept behind UFSC Competition is much broader than a number of student's groups working alone on different projects. UFSC Competition program aims in the near future to bring together all the teams in the same place, catalyzing synergistic processes of developing projects and solutions. Several teams have processes and similar activities that can be developed in parallel among them, speeding up the searching for solutions, burning stages, increasing productivity and generating new technologies faster. Repetitive tasks may be shared or banned, according to the most direct contact between students.

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The process started almost 20 years ago, and today it has generated a number of autonomous work teams, each one under a particular management structure. The next step now is to unify these skills, creating an innovative space, aiming to increase the project skills.

We can conclude that the involvement of a university into projects similar to these ones here is a good way to achieve an image of excellence. It goes on to become a reference in the formation of well-prepared professionals for practical life. It is a common sense in engineering education that there is a mismatch between the reality in schools and industries. The concept of engineering between these two worlds is different. Adopting practices such as shown here, forcing the student to face a real problem during their formation, minimize this problem. This is further reinforced by the fact that it is a competition, i.e., doing well is not enough; we should do better than the others to win.

REFERENCES

ARAÚJO, T., PEREIRA, V. G., VALE, L. G. M, SOUSA NETO, J.M.R., LIMA, A.M.N, MARIBONDO, J. F. **Projeto Mini Baja como Estudo de Caso para Instrumentação Eletrônica**. Congresso Brasileiro de Educação em Engenharia - Cobenge, 2006, Passo Fundo.

BOOTH, J.G., WHITE. P.(2008) **Innovative Curriculum Development within the Motorsport B.Eng course at Coventry University**. Engineering Education 2008 International Conference on innovation, good practice and research in engineering education, Loughborough, Inglaterra, 2008

COMPETITION HISTORY. Disponível em < <http://www.sae.org/students/> > Acesso em: 28 junho. 2016.

CRAWLEY, E. F., MALMQVIST, J. , ÖSTLUND, J. S., BRODEUR, D. R. **Rethinking Engineering Education: The CDIO Approach**, Springer. 2007.

DOPPELT, Y., **Implementation and Assessment of ProjectBased Learning in a Flexible Environment**, Int. J. Tech. Des. Educ., 12, 2003

FERREIRA, E.G., CAPORALLI FILHO, A. **Influências do projeto baja sae no ensino da engenharia e no desenvolvimento do aluno**. Acessado em 28 de junho de 2016, disponível em <http://acervodigital.unesp.br/handle/unesp/164303?locale=pt_BR>, 2011

JONES, M. L. W. **Engaging Complexity And Contradiction: Understanding Formula Sae Through Cultural-Historical Activity Theory** in Proceedings of the 11th International CDIO Conference, Chengdu University of Information Technology Chengdu, Sichuan, P.R. China, 2015.

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RIVERA-SOLORIO, C., GARCÍA-CUÉLLAR, A. J. e FLORES, A. **Design and Construction of a Boat Powered by Solar Energy with the Aid of Computational Tools.** International Journal of Engineering Education Vol. 29, No. 2, pp. 380–387, 2013

SIRINTERLIKCI, A., KERZMANN. T.L. **Active Learning through SAE Baja Competition.** 2011 ASEE Annual Conference, Vancouver, BC, 2011

STEPHENS, J. and SHAPTON, W., **Mini-Baja 1977 - An Overview,** SAE Technical Paper 780241, 1978.

UFSC COMPETE: Relatório de atividades 2015.