WORKING WITH YOUNG PEOPLE AT THE UNIVERSITY OF PORTO

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Abstract: This paper describes several initiatives conducted at the University of Porto in Portugal and separately within its Faculty of Engineering, whose common goal is to attract young people to higher education at a general level, and to science and technology in particular. The U. Porto Annual Exhibition is briefly mentioned; however the Junior University is described in some detail. The Engineering Open Days and the EMPE Portal for secondary level students are also presented.

Keywords: University of Porto, U. Porto Annual Exhibition, Junior University, Engineering Open Days, EMPE Portal.

1. Introduction
Many countries are actively seeking to attract more youngsters to professional careers in the fields of science and technology. Portugal is no exception to this trend. But as a complement to this particular emphasis in science and technology, a national effort is also being made to bring more young people to higher education (HE).

Portugal has reached a level of achievement in HE in line with that of other OECD countries:

- About 35% of 20-year-olds are enrolled in HE.
- The number of students in public HE institutions has risen from 277,000 to 288,000, new 1st year students from 84,000 to 115,000 and graduates from 51,000 to 66,000 per year, during the period 2005-2009.

Nevertheless, a mere 15% of the active population has HE qualifications (well below the 27% OECD average).

Among other policies, this has led to the signing in January 2010 of an important 4-year agreement, a "Contract of Confidence for HE", between the Minister of Science, Technology and HE among all 35 public HE institutions [1], involving an increase in their budget by 100 million Euros per year, seeking to accomplish their strategic goal of an additional 100,000 graduates by 2014.
After providing some background data about the city of Porto and its University (U. Porto), this paper first describes a number of very successful and original initiatives launched by U. Porto, targeting youngsters between the ages of 11 and 17 and their families:

- "Universidade Júnior" (Junior University).

The focus then shifts to activities promoted within the Faculty of Engineering aimed at motivating teenagers to pursue their studies in one of the ten engineering areas offered:

- Engineering Open Days.
- "Portal EMPE" (Exploration of Multidisciplinary Problems in Engineering Portal).

2. Porto and its University

According to the official figures for 2008 [2], the resident population in Portugal slightly exceeds 10.6 million inhabitants. Porto, with over 200,000 inhabitants (1.28 million in the metropolitan area), is the second most populated city in the country.

With roots dating back to 1762, U. Porto is currently the largest of the fifteen public universities in Portugal, with nearly 29,000 students (6,500 postgraduates), 2,300 teachers and researchers, and 1,700 technical and administrative staff comprising 14 faculties, one business school and 69 research units that spread across 3 campuses [3] throughout the city. Around 2,000 international students attend U. Porto each year.

The University offers over 600 training programs per year, from bachelors, masters and doctoral degrees to continuing professional education. U. Porto has 1,860 full-time equivalent lecturers and professors (73% holding a doctorate). It produces over 20% of the Portuguese papers indexed each year in the ISI Web of Science, constituting the largest education and research institution in the country.

3. U. Porto Annual Exhibition

"Mostra da U.Porto", the annual Science, Education and Innovation Event launched in 2003, is an opportunity for the academic community to exhibit the diversity of its areas in a large venue, using attractive scientific knowledge issues for interacting with the public in general (Figure 1).
Figure 1: Views of the 2010 edition of "Mostra da U. Porto"

During a Thursday to Sunday event in March, numerous secondary schools, along with their teachers and students, visit the show and interact directly with University collaborators. Many U. Porto teachers and researchers are present, as well as recent graduates and final year students who are particularly gifted in engaging the youngsters while providing feedback and attending to their questions. This event is also a favorite among families, U. Porto alumni and the public at large (Figure 2).

Figure 2: Activities and exhibits at "Mostra da U. Porto"

The number of visitors rose from 6,500 in 2003 to above 15,000 in 2010. The number of visiting schools expanded from 21 to 92 in this year's edition. In 2009 a conference cycle entitled "Science: What Else?" further complemented this event.

4. Universidade Júnior

After a process of internal discussion and diagnosis on how to motivate secondary school youngsters to continue their studies onto a higher education level [4], U. Porto organized the first edition of Universidade Junior (UJr), a pioneering project aimed at school pupils in the 11 to 17 age group [5] rapidly becoming a huge success. The first edition took place in July 2005.

UJr programs have several formats according to the pupils' ages [6]. The first part of UJr occurs during 4 weeks in July with:

- Summer Experiences (for 5th and 6th graders, i.e. 11-12 years old)
- Summer Workshops (for 13-14 years old)
- Summer Projects (for 15-17 years old)
- Language Schools (for 11 to 17 years old).

They run Monday to Friday, 09:00 to 18:00, with a one week duration (two in the case of language schools). The pupils have their meals at canteens like regular students. Each group has a maximum of 14 elements, with two junior tutors who are recent graduates or final year students, under the coordination of one member of the academic staff. A sample of the Summer Experience and Summer Workshops programs offered for July 2010 are shown in Tables 1 and 2.

**Table 1: Summer Experiences sample week program (one of five)**

<table>
<thead>
<tr>
<th>Summer Experience</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>FEUP</td>
<td>Planetarium</td>
<td>FEUP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>Sports</td>
<td>The colors of dreams</td>
<td>Bacteria killers</td>
<td>Adventure at the Botanical Gardens</td>
<td>Young minds in the world of professions</td>
</tr>
<tr>
<td>Lunch</td>
<td>Sport Faculty</td>
<td>Fine Arts Faculty</td>
<td>Science Faculty</td>
<td>Science Faculty</td>
<td>Psychology &amp; Educ. Sciences Faculty</td>
</tr>
<tr>
<td>Afternoon</td>
<td>Sports</td>
<td>The colors of dreams</td>
<td>Bacteria killers</td>
<td>Adventure at the Botanical Gardens</td>
<td>Young minds in the world of professions</td>
</tr>
</tbody>
</table>

**Table 2: Summer Workshops sample week program (one of six)**

<table>
<thead>
<tr>
<th>Summer Experience</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>FEUP</td>
<td>Planetarium</td>
<td>FEUP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>Let’s go on-line</td>
<td>Sound and its wonders</td>
<td>Discover fractals</td>
<td>From microalgae to biodiesel</td>
<td>Be a star</td>
</tr>
<tr>
<td>Lunch</td>
<td>Psychology &amp; Educ. Sciences Faculty</td>
<td>Fine Arts Faculty</td>
<td>Science Faculty</td>
<td>Science Faculty</td>
<td>Humanities Faculty</td>
</tr>
<tr>
<td>Afternoon</td>
<td>Let’s go on-line</td>
<td>Sound and its wonders</td>
<td>Discover fractals</td>
<td>From microalgae to biodiesel</td>
<td>Be a star</td>
</tr>
</tbody>
</table>

During the Summer Projects, each pupil is allocated a personal project for development during the week. They are expected to take home the final outcome. The topics available at FEUP for July 2010 include namely: Making a Multimedia CD; The Small Great World of Nanotechnology; Use the Earth and Preserve It; Let’s build a Sustainable Future; Let’s Try Chemical Engineering.
In 2010, the Language Schools will offer to foreigners German, Spanish, French, English, Italian, Latin, Russian and Portuguese.

The second part of UJr is comprised of one-week schools in September, where top students of the 10th and 11th grades are introduced to more advanced activities and research environments in the fields of Health Sciences, Humanities, Mathematics and Physics, under the supervision of junior researchers or PhD students.

The activities of UJr take place in many labs and research centres of all 14 Faculties of U. Porto and at the School of Music and Performing Arts of the Polytechnic Institute of Porto. A hands on, "learning by doing" approach is generally adopted, with fieldwork and thematic visits also included. Figure 3 displays examples of three different areas.

Figure 3: UJr activities in sport, mechanical engineering, biology and dental medicine.

The pupils come from as far away as the Algarve, in Southern Portugal (Figure 4). A lodging program is provided for such cases (covering 965 pupils in 2009, 554 of them girls). Over 30 City Councils offer transportation and scholarships.

The participation levels have consistently been above 4,000 (4,532 in 2009). For the 2010 edition, 80% of the places offered were taken up within the first 2 weeks of the application period, with the numbers now exceeding 5,000.
Figure 4: Nationwide origin of participants in UJr 2009 (the blue dots indicate existing protocols with 33 City Councils) [7]

Visits to the UJr portal (http://universidadejunior.up.pt) come from all over the world (Figure 5), totalling more than 90,000 for the period January-October 2009.

Figure 5: Countries (in green) from where the UJr portal was accessed in 2009 [7]
This novel approach, while relatively new in Europe, is the object of an international network of organizing institutions, the European Children’s University Network (EUCU.NET), with 127 programs already active in 23 European countries.

Table 3 reflects the period 2002-2009, showing the evolution of the 1st phase of admissions for 1st year students at U. Porto [8]. In 2009, and for the first time in Portugal, all the places offered at U. Porto were taken in this phase. It is fair to admit that such success may be due to the impact of UJr to some extent.

Table 3: Statistics of the 1st phase of application to U. Porto for 1st year students

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Places (P)</td>
<td>3984</td>
<td>3768</td>
<td>3870</td>
<td>3933</td>
<td>3938</td>
<td>3968</td>
<td>4025</td>
<td>4050</td>
</tr>
<tr>
<td>Admitted (A)</td>
<td>3642</td>
<td>3447</td>
<td>3623</td>
<td>3618</td>
<td>3689</td>
<td>3947</td>
<td>4010</td>
<td>4052</td>
</tr>
<tr>
<td>A/P (%)</td>
<td>91.4</td>
<td>91.5</td>
<td>93.6</td>
<td>92.0</td>
<td>93.7</td>
<td>99.5</td>
<td>99.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Applications</td>
<td>19271</td>
<td>16368</td>
<td>17169</td>
<td>18405</td>
<td>18333</td>
<td>24242</td>
<td>25041</td>
<td>24904</td>
</tr>
</tbody>
</table>

5. Engineering Open Days

Dating back to 2001, The Faculty of Engineering of University of Porto (FEUP) has been offering on an annual basis a 3-day program of activities designed at disseminating its engineering areas of focus among students and teachers from the 9th to the 12th grade. During these Open Days, more than 3000 visitors are welcomed at the FEUP labs with services being provided by staff and junior researchers.

The combined effect of the Open Days and the UJr activities organized at FEUP may be considered very positive in terms of student recruitment, as shown by Table 4 that lists places, admissions and applications for the period 2002-2009 [8].

Table 4: Statistics of the 1st phase of application to FEUP for 1st year students

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Places (P)</td>
<td>745</td>
<td>745</td>
<td>770</td>
<td>770</td>
<td>795</td>
<td>810</td>
<td>830</td>
<td>840</td>
</tr>
<tr>
<td>Admitted (A)</td>
<td>712</td>
<td>673</td>
<td>752</td>
<td>746</td>
<td>723</td>
<td>811</td>
<td>830</td>
<td>840</td>
</tr>
<tr>
<td>A/P (%)</td>
<td>95.6</td>
<td>90.3</td>
<td>97.7</td>
<td>96.9</td>
<td>90.9</td>
<td>100.1</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Applications (Ap)</td>
<td>3068</td>
<td>2198</td>
<td>3222</td>
<td>3079</td>
<td>2858</td>
<td>5250</td>
<td>5832</td>
<td>5166</td>
</tr>
<tr>
<td>Ap/P</td>
<td>4.1</td>
<td>3.0</td>
<td>4.2</td>
<td>4.0</td>
<td>3.6</td>
<td>6.5</td>
<td>7.0</td>
<td>6.2</td>
</tr>
</tbody>
</table>

The figures of Table 5 show an increase in the proportion of girl candidates and girl admissions to FEUP, in addition that they are also becoming more competitive in this process.
Table 5: Statistics of female performance in the 1st phase of application of 1st year students to FEUP

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female Admissions</td>
<td>26.0</td>
<td>29.5</td>
<td>31.7</td>
</tr>
<tr>
<td>% Female Candidates</td>
<td>29.8</td>
<td>32.6</td>
<td>32.6</td>
</tr>
<tr>
<td>% F Adm./ % F. Candidates</td>
<td>0.87</td>
<td>0.90</td>
<td>0.97</td>
</tr>
</tbody>
</table>

6. The EMPE Portal
From April 2003 to April 2005, FEUP financed a Project entitled Exploration of Multidisciplinary Problems in Engineering (EMPE) [9] where the main objective consisted of promoting the involvement of teachers, researchers and students from several Departments of FEUP in the exploration of practical problems integrating specialized know-how from various scientific areas. One of the outcomes of this Project is the EMPE Portal (http://empe.fe.up.pt), an educational portal aimed at school pupils with the purpose of stimulating the curiosity and interest of potential future FEUP students for multidisciplinary engineering problems in which physics and mathematics can be seen in action [10].

The Portal uses Web2.0 tools for increased interactivity and to respond adequately to how young people today communicate, socialize, collaborate and construct their knowledge. Each user has its own profile and network of friends within the Portal. The contents are dynamic and may be created by the users. The user is integrated in a community where he participates and contributes. The Portal has invested in creating a social network to link a community of people (with varying age, culture and experience), all sharing a common interest in scientific and engineering topics, in an informal learning environment. The Portal has chat, post and personal blog creation facilities.

7. Final considerations
In Portugal, two-thirds of the pupils choose their future profession between the 7th and 9th grades. In a study conducted by IEEE/University of Central Florida, 50% of practicing engineers attribute their choice of profession to the direct encouragement gained by the involvement in science programs. According to official Portuguese sources, in 2003 there was a reduction in the demand for HE courses of 13.5% in Science and of 8.7% in Technology. Initiatives like those described in this paper are an invaluable and well aimed contribution to reverse this trend. The results look promising.

8. Acknowledgements
The contribution of Professor José Ferreira Gomes, the “father” of Ujr, is gratefully acknowledged. Dr. Paulo Gusmão, the current head of the Ujr team, has provided most valuable information.

References


