DATA ANALYSIS APPLIED TO THE EVALUATION OF A TECHNOLOGICAL NATURE TEACHING MODEL AS A REGIONAL DEVELOPMENT TOOL

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Abstract: This paper presents the creation and development of technological schools directly linked to the business community and to higher public education. Establishing themselves as a key interface between the two sectors they make a significant contribution by having a greater competitive edge when faced with increasing competition in the traditional markets.

The development of new business strategies supported by references of excellence, quality and competitiveness also provides a good link between the establishment of partnerships aiming at the qualification of education boards at a medium level between the technological school and higher education with a technological foundation.

We present a case study as an example depicting the success of Escola Tecnológica de Vale de Cambra.

Keywords: Business, competitive responses, data-analysis, development, education, learning, technology

CASE STUDY

Ten years have now passed since the Technological School of Vale de Cambra (ETVC) opened its doors and it is time to make a balance assessment and look to the future regarding the influence on the business community of the deployment of this type of education in a geographical area of heavy industry.

Founded in January 1995, FORESP - Association for Training and technological expertise, was the result of joint efforts of ACIC - Commercial and Industrial Association of Vale de Cambra, the Town Hall of Vale de Cambra, INETI - National Institute of Engineering and Industrial Technology, IAPMEI - Institute of Support to Small and Medium Business and Investment and also the Polytechnic Institute of Porto, gave substance to the Technological school of Vale de Cambra. Later, 6 of the most important companies of the region joined thus totaling 11 entities as founding members. [1]

Taking one of the main criticisms directed at the school – that being its inability to supply necessary skills for the work force, the creation of FORESP / ETVC took on the primary objective of resolving the deficiencies identified at the level of middle management of skilled personnel to meet the clear needs of the metal and metal mechanic industries, by far the sector with the greatest weighting in the economic structure of the region concerned.

As well as the first objective mentioned above, a second proposal and one of no less importance saw the establishment of protocols between ETVC and the Polytechnic Institute of Porto (IPP) with the view of possible further integration of the students in the Institute of Engineering of Porto (ISEP ). So that they, the students, may continue their studies while working. In this respect, it is the responsibility of IPP to provide scientific and educational supervision as well as to supply the majority of teachers from ISEP to teach the courses, with the remaining educators being locally recruited from among senior management of companies in the region.

Overview of the Regional Framework

Though originally located in Vale de Cambra, where professional activity began in April 1998, ETVC later started a process of geographical diversification, and now has a satellite school in Arouca. Its influence is making itself known throughout the sub-region of Entre-Douro-and-Vouga, (EDV) (an area with approximately 860m2 and around 300 thousand inhabitants, but which covers other neighbouring areas such as Sao João da Madeira, Santa Maria da Feira, Oliveira de Azeméis, Sever do Vouga, Oliveira
de Frades, Ovar, Castelo de Paiva, Estarreja and Albergaria) due to the fact that ETVC has received students that have residence and/or a professional address in these regions.

![Fig. 1. Localization of ETVC](image)

It is important to indicate that there are students from other areas, but in a more residual way, and that 5 areas from those mentioned above are the most represented, these being: Arouca, Oliveira de Azeméis, S. João da Madeira, Sta. Maria da Feira and Vale de Cambra.

This representation refers to either the origin of students or to the official address of the companies that welcome the students.

**Suitability of education provision**

The provision of training in ETVC has essentially covered the courses of technological specialization, in which we have seen approximately 1000 registered enrollments so far, around a total of 850 students. The current education provision concerning the courses of technological specialization (CET) at level IV contains the following areas:

- Applications of information technology management;
- Industrial Organization and Management;
- Management of Mechanical Production;
- Automation, Robotics and Industrial control;
- Industrial Maintenance.

In addition to these learning activities some initiatives were implemented to allow greater development between partners of the School, namely the students and companies, and of which the project HPCN (in partnership with ADRIMAG), the Program for Coordination and Business Participation (PAPE) and the implementation of an evaluation System of the School (SAFE) stand out.

**Business community**

To assess the adequacy of education provision of ETVC and the needs of businesses from surrounding municipalities, a study was conducted [1] which revealed the existence of a community of 9280 companies registered in the 11 areas above. This high initial number was reduced, in two phases, so that in the first phase only those that pertained to the 5 most represented areas where stratified. The table of fig. 2 corresponds to their geographical distribution.

<table>
<thead>
<tr>
<th>Council</th>
<th>Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arouca</td>
<td>345</td>
</tr>
<tr>
<td>Oliveira de Azeméis</td>
<td>1609</td>
</tr>
<tr>
<td>S. João da Madeira</td>
<td>1162</td>
</tr>
<tr>
<td>Sta. Maria da Feira</td>
<td>2880</td>
</tr>
<tr>
<td>Vale de Cambra</td>
<td>580</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6576</strong></td>
</tr>
</tbody>
</table>

**Fig. 2.** Number of companies per area.

However, the predominance of micro enterprises, most of which have a labour force at or below 5, and not all of which interact with ETVC, led us to work only with companies which have 50 or more employees, stratified in 3 categories. Even like this, the study still focused on a total of 308 companies. The graph of fig. 3 is representative of the distribution of classes (between 50 and 100 employees, between 100 and 250 employees and over 250 employees) per company and per area.
The analysis of data collected concluded that the comparative percentage of companies per area with average schooling of employees that allowed them to enroll in courses of technological specialization was similar in 3 of the areas, highlighting S. J. Madeira positively and Arouca negatively as can be corroborated by reading figure 4.

**Characterization of the population**

The statistical data to consider in this type of study from a management perspective should initially be those that allow the classification of students as a whole. However, from the point of view of society in general and of the individual student we may jump to the conclusions about the image of the institution that may not be favourable and there will be disparity either amongst the students (working students or not) or in the levels of the current courses.

Thus, at the early stage we initially look at the population as a whole in order and then we establish populations with individualistic features, and study them separately.

**SUCESS EVALUATION**

The evaluation of educational quality of a technological nature has been a constant concern in ETVC since its formation. As such, it presents some main data and findings from a study that was carried out in order to deepen the knowledge of the student population, considering factors, as seemingly disparate, but at the same time so significant, such as the entry classifications or geographical origin.

One objective was the development of a measuring methodology that would define a conceptual framework where basic concepts were discussed, together with methods of analysis, in order to carry out a structured assessment with clearly defined objectives.
Fig. 6. A chart representing the distribution of student ages.

The analysis of the chart in fig.6 shows that though the number of students below the age of 20 is significant, the class that is the most representative is the [20,25], and that 75% of students are, upon enrollment, aged over 20. This fact is highly significant and, combined with the reading of the chart in fig.7, speaks volumes of this type of education that aims to attract most students from industry. These people were early school leavers who, according to the student themselves, had thought that their study days were behind them.

Fig. 7. Distinction between working students and regular students.

Characterizing the geographical origin of students, as shown in the pie chart below, illustrates that 6 groups were considered, five of which were the most significant areas. The sixth group represents those students who originated from an area not belonging to one of the five previously mentioned.

Fig. 8. Distribution of students according to their geographical origin.

It is clear to see that the area which provides more students is Vale de Cambra, where the main school ETVC is located. Unsurprisingly there is also a significant influx of students from Arouca (20%). What is significant is the percentage of students from Oliveira de Azeméis (18%), which speaks well of the amount of influence that ETVC exerts. To support this fact, the 10% of students from other origins are spread over 8 different areas.

Failure analysis

The analysis of data collected shows that there is a significant number of dropouts (table in fig.8) and that an analysis of these drop outs—the students that give up, those that annul enrollment, those that transfer to another course and those that transfer to higher education needed to be carried out.

Fig. 9. Distribution of student drop-out motives.

For the collection of such data a sample of 585 students was considered, of whom 226 were already qualified.

From the analysis of fig.9 we can conclude that only 17% of students dropped out for a good reason. What is important is the analysis of the 83% who gave up or simply cancelled their registration. There is a number of reasons in explanation of this including personal, professional, illness and non specified motives. In an attempt to find other motives for justifying the dropout rates we analyze (in fig 10) the frequency of student type drop-out.

Fig. 10. Distribution of student type dropout rates.

The highest percentages of students leaving school are the workers, which comes nothing as a surprise. However the high withdrawal among regular students represents an unexpected result, which should merit the attention of the school in respect to the selection process of candidates.

It should be noted that despite there being a slightly higher rate of worker student drop out, there is also a higher number of worker-students that complete the course or are in the final stages of completion.
This drop out study is complemented with the phase analysis where the same withdrawal is given. (table of fig.11).

<table>
<thead>
<tr>
<th>Abandonment phase</th>
<th>number of students</th>
<th>percentage of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>phase of the course</td>
<td>&lt; 5%</td>
<td>35</td>
</tr>
<tr>
<td>5% - 50%</td>
<td>92</td>
<td>64%</td>
</tr>
<tr>
<td>&gt; 50%</td>
<td>18</td>
<td>12%</td>
</tr>
</tbody>
</table>

Fig. 11. Dropout rates during course phases.

A higher percentage of students withdrawals are to be expected at the early stage of the course. However this has not happened, so it is necessary for the school to focus on the high percentage of dropouts among those who were integrated into the normal functioning of the course. The low percentage of dropouts from among students who completed at least half of the course says a lot for its success. This analysis of phase withdrawals must, however, be carried out in more detail so that it encompasses in the same group students who withdrew after 5% of course completion and students who left after completing half the course. The third group should consider students who withdrew shortly after the completion of half of the courses along with students who left in a final phase of the course.

Success Analisys

The analysis of success involves the determination of the rate of success, which is the ratio between the number of graduates and the total number of students.

Fig. 12. The yearly success rate.

It is necessary to point out that although this study relates to all the courses within the ETVC, it is important to distinguish between the courses of Level III and Level IV in that the first tend to disappear while the latter are the current main bet of ETVC. In fact, among the courses in Level IV, the course designers chose to distinguish the courses that have a greater number component of curriculum units in the area of mathematics, from those that do not have this component. This option is due to the fact that mathematics is, in Portugal, a reason for failure at school, and there are those who even cite it as a reason for leaving school. However, as we shall have occasion to appreciate, this theory will be completely denounced by the truth of the facts, at least in what concerns this case.

In the graph of fig.13 we can verify that the current option to invest efforts in the development of courses at Level IV is a sure bet as achieve higher rates of success are achieved.

When it comes to math, much of the propaganda has been demystified and therefore concentrating on a solid education of basic mathematics is absolutely essential to the education of a technological nature.

Fig. 13. Success rate for each course type.

An evaluation of success over time implies a comparative analysis of development of the final average grades of the students. This analysis is plotted in fig.14, where the average of the marks is presented over 9 years and as can be seen there is a trend around the 14 to 15 mark which leads to a classification of Good according to the standards of education in Portugal.

Fig. 14. Marks over a nine year period.

Once again we make the separation between the courses of Level III and Level IV,
and in the latter we distinguish between those which have a strong mathematical component and the ones that do not. By examining the graph of fig.15, we can conclude in a similar way as previously done in examining the graph of fig.13, particularly where the mathematics component is concerned.

**CONCLUSION**

The evaluation of various parameters of success points to highly satisfactory conclusions. We see that the number of students has grown over the last 10 years (fig.5). The most representative class (75%) are students between 20 and 25 years which speaks well of the aim of this type of education of attracting those people from the work force who had interrupted their studies (fig.6) According to a survey of graduate students, 65% claim to have enhanced their professional conditions in some way as a result of the completion of the course (fig.16) and 46% of student graduates continued onto higher education, all of them gaining places at the Institute of Engineering of Porto (fig.17).

**Fig. 15.** Marks for each type of course.

**Fig. 16.** Chart of Job improvement.

**Fig. 17.** students who continued their studies.

**References**