PBL in Technological Fairs: the Fetin Experience

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Abstract

In engineering courses, technological and scientific fairs offer an invaluable opportunity for students to test and expand their knowledge, investigate new concepts and technologies and work as a team. In this activity, the students are invited to seek for real life problems and to propose innovative solutions for them. Working in groups, they have to find a solution and implement it to create a final product. The present work describes the evolution of Fetin, a technological fair sponsored by Inatel, over the years, critically analysing all its aspects, both technical and formative, under the PBL paradigm, with the intent to contribute to this working area as much as a case study as another way to look at PBL.

Keywords: technological fairs; project based learning.

1. Introduction

Engineers are supposed to be problem solvers. This is an old quotation that holds true even today. However, the tremendous evolution experienced by technology in recent years has made the problems more and more complex. Therefore, the figure of a genius scientist that can solve all the problems is giving place to teams of engineers that work collaboratively to get the work done faster. In this scenario both technical and process skills are important.

Technological fairs appear as an enriching experience both for students and professors in this new scenario, because they provide an opportunity to go beyond the classroom. In general to have their projects working, they have to deal with issues that will be addressed only later in their courses. This is a singular situation that cannot be imagined in a regular class. The interesting point is that the students in general do not complain about it: they just think of them as another difficulty that they have to deal with.

Fetin is a technological fair promoted by Inatel (Instituto Nacional de Telecomunicações). In this activity, the students are invited to look for real life problems and to propose innovative solutions for them. Working in groups, they have to find a solution and to implement it to create the final product. Marketing issues are also encouraged, and this aspect has led to the creation of several successful companies by the students.

This feature introduces a new aspect to the traditional PBL, namely the choice of the problem to be solved by the students and not by the facilitator. In general, this is a challenging point, because students in general tend to be very ambitious in their goals (a good thing) but don't care too much about feasibility. The role of the facilitator in this scenario is to help them "to get their feet back on the ground".

The main goals of this work are to provide an overview of Fetin and make some consideration of the impact of this activity in students' life during and after their period in college. Also, some impacts of this activity in Santa Rita do Sapucaí are presented and discussed.

2. Brief history

Fetin's first edition occurred in 1982, under the initiative of a group of students, with 12 projects presented in a corridor. It has evolved over the years, and today it is a huge event that attracts thousands of visitors each year.

The motivation for creating such an activity was to allow the students to put their knowledge in practice. Most of the projects were simple, but the expositors were very excited to show their projects for the professors and colleagues. It is interesting to note that this is still one of the strongest reasons for which students participate in the fair.

In the first editions, the only instruction for the students was: "think about something interesting, build a prototype and show us the result". As expected, the result of this approach was that only a few, more interested students were engaged, and the variance in quality was very high, with a few good projects and a greater number of low quality or naïve approach ones. Figure 1 a) illustrates this first edition.

To encourage more students to participate, in the beginning of the 90s, some professors decided to give bonus in grades of their disciplines. This initiative was successful and from this point, the number of participants greatly increased, as can be seen in the contrast of Figures 1 b) and 1 c). This was an important lesson for the organizers: the opportunity to show their own ideas is not sufficient for the students; they want more.

2003 was an important milestone in the history of Fetin. For the first time, besides de technical plan, the students were asked to provide a business plan. This initiative greatly reduced the number of naïve projects, as the students realized that some ideas would not lead to interesting products, in a market viewpoint. Also, the presentation of projects became more "professional", with stands for each project and more care about the aesthetics (Figure 1 d)).

a) 1982

b) 1989

c) 1998

d) 2003

Figure 1: Evolution of Fetin over the years: pictures from a) 1982, b) 1989, c) 1998 and d) 2003 editions (images kindly provided by the Centro de Memória do Inatel)

In the first years after this change, however, this preoccupation with aesthetics became so intense that most students spent more time and energy thinking about it than solving the technical problems of their projects. The result was some low strength projects with beautiful presentation. To deal with this problem, the organization implemented some intermediary stages where the participants should deliver parts of the final project. It has led to improvements in the final quality of the final prototypes.

The lessons learned during more than 30 years showed that care must be taken in the way we encourage our students. Balance between technical, market, social and other aspects must be achieved, and it’s not a trivial task.

In the next section, the current adopted methodology is presented.

3. Methodology

The main educational goals of this activity is to promote an integrated, transversal view of technical content and to develop process skills such as group work, communication and project management, among others.

The whole process is based on the PMI methodology (PMI, 2012). Under this perspective, a project is defined as "a temporary group activity designed to produce a unique product, service or result." Also, project management is defined as "the application of knowledge, skills and techniques to execute projects effectively and efficiently.

To accomplish these goals, five processes are identified in all projects:

- Initiating
- Planning
- Executing
- Monitoring and Controlling
- Closing

For each one of these points the PMI methodology assigns a set of tasks. Obviously, a student project is much simpler than a real business project, and therefore all the steps were simplified to be adjusted to the complexity level of their needs.

Since the knowledge level of the students greatly differs as they advance through the course, 5 different levels were created, one for each year of the course. Students of different years are allowed to participate in the same group, but the level in which a group belongs is the one of the most advanced student.

3.1 Agenda

With these points in mind, a set of tasks is assigned to each group, beginning before the conception of the project and ending with the presentation of the final solution at Fetin. The entire process starts in the beginning of the academic year (March in Brazil) and ends in October. Each stage is eliminatory, that is, if a group does not deliver the scheduled task on time, it is eliminated. The agenda is outlined below:

- **Opening keynote (March)**: presentation of the rules and steps and a motivational keynote given by an expert. This keynote is focused on innovation and creativity, solutions for the new problems and related subjects.
- **Subscriptions (March)**: students are invited to form groups of 4 members. At this stage, it is not necessary to present an idea for the project. The main goal is to promote the initial interaction among the members of the group.
- **PMI keynote (April)**: students are presented to the PMI methodology through a brief keynote given by a professional in this area.
- **First group meeting (April)**: in this first meeting with the organization, the group must present the idea of the project and make a critical analysis by filling in a form based on PMI. The information that must be provided include the idea of the project, its scope, assumptions, scenario analysis (SWOT analysis), competitive differential, risk analysis and the project's analytical structure.
- **First meeting with advisors (April)**: for each group an advisor is assigned. The advisors are professors of the course and their role in this first meeting is to critically discuss the form that the students have filled in. This is a critical stage, and the advisors must be aware of feasibility of the idea, as the students in general do not deeply think about this particular issue. Questions like necessary technical knowledge, electronic component availability and others should be addressed in this meeting.
- **Presentation of project idea (April)**: after critically analyzing their projects, the groups must present them to the organization. Those that are considered inappropriate or too simple are eliminated.
- **Project development (May-September)**: during this period, the groups must develop the first prototype. They also must regularly talk with their advisors to report the evolution of the project and to discuss the problems and get feedback.
- **First prototype presentation (September)**: about one month before the fair, the prototype must be working. This presentation was not required in the past editions, and as a result, many groups dropped just hours before the beginning of the fair, causing lots of trouble for the organization. With this early presentation, the problem was greatly minimized.
- **Project refinement (September-October)**: in this stage, with the prototype already working, the groups focus on refinement and presentation of their projects.
- **Fetin (October)**: during the Fetin's week, the students have to prepare their stands, and finally present their projects in the fair, that lasts 3 days.

3.2 Project documentation

Until 2011, projects documentations were formatted like real engineering projects, with specifications, calculations and all the parts that comprise such kind of document.

This is a good approach, as the students have the opportunity to have a real project documentation experience. However, they have (or will have) several opportunities to practice this form of documentation several times during the course.

Another form of communication that the students will need in their professional career is the persuasive essay, in which they should convince investors or their managers that their ideas are worth considering for investment or development. This requires a different approach, with a particular language style and even a different graphical presentation. It is particularly challenging for engineering students, as in general they prefer to write equations rather than producing texts.

With this idea in mind, we created a magazine for the projects presented at Fetin. Each project was given a 2 pages space to deliver its message, and the format was left relatively free to explore creativity. As a suggestion, it was suggested that the text would have the following sections:

- **Introduction**: description of the problem, the solution and the market.
- **The project**: description of the project and implementation details.
- **Operation**: details on how the prototype works.
- **Curiosities**: some funny or interesting story about the project. It could be the narration of how the group arrived to the idea or some interesting information related to it.
- **Biography**: all the authors are invited to write a short biography of themselves and to include a photo.
- **Bibliography**: as in all technical texts, the consulted bibliography should be provided.

The advisors have also an important role in this activity by revising the text and correcting the mistakes. This magazine is distributed to other universities and secondary schools, and therefore serves also as a marketing tool for Inatel. Then, it is extremely important that all the articles are correctly written. The cover of the first issue of the magazine is shown below.

Figure 2: front cover of the first edition of Revista Fetin (Fetin, 2012)

3.3 Infrastructure and investment

The defrayal of such an event is not cheap. Means must be provided for marketing (both internal and external), rental of stands, electrical and communication (Internet) support, among others. Also, components and laboratories must be provided for the students to develop their projects. In our institution, a special lab was created for this purpose (Figure 3).

An additional budget must be provided for awards. In our model, the first 3 places in each category receive some kind of prize.

The organizing committee must have time to dedicate to this activity, and this also represents an investment for the university. It is estimated that the total cost of Fetin is about US$ 100,000.00 for each edition.

Figure 3: students working in their projects in the lab (images kindly provided by the Centro de Memória do Inatel)

3.4 Satellite events

Together with the projects exhibition, there are some satellite events. They serve as additional attractions for the visitors and also to fill in the spaces when the number of projects is low. Some of them are:

- **Campus tour**: many secondary schools visit Inatel during Fetin. We use this opportunity to show our labs and other places and talk about our courses. Tutorials about education are provided for the teachers (Figure 4 a) and play activities involving projects are also provided for the students (Figure 4 b).
- **Keynotes**: about several technological issues such as programming languages, the future of Internet, management techniques, and so on (Figure 4 c).
- **Recruitment**: some companies use the fair to recruit employees among the students.
- **Video game tournaments**: it is a very attractive for the younger people (Figure 4d).

a)

b)

c)

d)

Figure 4: teachers participating in a PBL workshop a); secondary students engaging in a mousetrap car competition b); a technological keynote inside Fetin c); and a video game tournament d). (images kindly provided by the Centro de Memória do Inatel)

From these experiences, we noted that it is important to keep a balance between the main fair activity and the satellite events. Although these extra activities help to attract more visitors, care must be taken to maintain the focus in the main goal of the fair, which is to present the projects. In this sense, the video game tournament was discontinued because, in our vision, it is not aligned with this main objective.

4. Social impacts

Santa Rita do Sapucai is a little town situated in the southeast of the State of Minas Gerais. The city is known as the "Electronic Valley", since it has plenty of electronic industries. Many of these industries were born as projects inside Fetin.

The city also has both a technical school (ETE - Escola Técnica de Eletrônica Francisco Moreira da Costa) and a college (Inatel - Instituto Nacional de Telecomunicações) which hold courses in electronic knowledge. It also has another college - FAI, which has majors in Administration and Informatics.

These two features together contributed to the establishment of several other technology-based industries in the region.

5. Conclusion

In this work, an experience on project based learning in a technological fair scenario was presented. With more than 30 years of existence, this experience is mature but still continues to improve, in order to enhance both technical and process skills of the students involved in it.

In a certain way, we can say that this activity goes beyond the traditional PBL when allows the students to choose the problem to be solved, instead of receiving it from the facilitator. This is a challenging aspect that must be carefully addressed by the facilitators: students tend to be or very ambitious in their ideas (which lead to projects that in many cases cannot be implemented), or too naïve in their approaches (leading to poor projects).

To guarantee a massive participation, it is important to recognize that prizes are attractive only for the best students. For all the others, it is necessary to create an alternative way. In our institution, bonus in grades showed to be very effective.

This activity should be viewed as a class: maybe the most interesting and motivating class in the course, and all the people involved in it, especially students and professors, must be really engaged for it to be successful.

Another lesson learned is that satellite events help to attract visitors, but they must be planned in a way that contributes to the main event, and not to move the focus to another point.

Finally, Fetin has and is collaborating for the social transformation of our region, from an agriculture based economy to a high technology industry one.

References

Campos, L. C., Dirani, E. A. T & Manrique, A. L. (orgs.)(2011). Educação em engenharia - novas abordagens. São Paulo: Editora PUC-SP.

Rajala, S. A. Beyond 2020: Preparing Engineers for the Future (2013). Proceedings of the IEEE, Vol. 100, May 13th, 1373-1383.

PMI (2012). A Guide to the Project Management Body of Knowledge, 5th Ed.

Fetin (2012). Revista Fetin, 1 (1).