

Playing with Mathematics in Peru through Internet: A Case Study of www.20enmate.com

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ABSTRACT

www.20enmate.com is an interactive website designed in 2003 to improve mathematical skills among Peruvian primary and secondary school students. The site seeks to strengthen the children's sense of motivation and self-sufficiency through an innovative didactic methodology that stresses the idea that learning and practicing mathematics can be both fun and rewarding. www.20enmate.com has achieved outstanding qualitative and quantitative indicators for the first three years, a result of its creative design and well-coordinated network of students, teachers, schools, parents, local Internet booths, the private sector and the general community. The design and implementation of this website is an initiative of Grupo APOYO and its social responsibility program.

Keywords: mathematics, e-learning, sustainability, Mathematics for Everyone, interactive website, educational network, social responsibility.

1. INTRODUCTION

According to the UNESCO^[1], Peru occupies the last place in school mathematics in Latin America. In order to revert this situation, Grupo APOYO has oriented its social responsibility program towards the betterment of mathematical education in private and public schools in Peru through a series of interrelated initiatives such as research on mathematics learning processes, editing of new textbooks based on modern learning methodologies, studies on psychological and cognitive development, updating of teacher's teaching techniques through workshops and videos, establishing liaisons between the school system and private companies to provide poorer students with didactic materials, creating book-loan programs to ensure the sustainability of these efforts, etc.

These initiatives, channeled through Instituto APOYO (Grupo APOYO's non-profit branch) are part of an integrated program called *Matemáticas Para Todos* ("Mathematics for Everyone"),

[1] Ministerio de Educación del Perú, *Boletín de la Unidad de Medición de la Calidad* N° 9. Lima, 2001.

whose goal is to generate a structural improvement in mathematics education in Peruvian schools.

Matemáticas Para Todos was born in 2002 as a response to the low quality and outdated methodology of mathematics pedagogy in Peru. Instituto APOYO developed a series of textbooks based on a new approach to learning processes, borrowed from Germany and adapted to local experiences, to renovate the quality and underlying philosophy of mathematics learning. These new textbooks were distributed nation-wide through school networks such as "Fe y Alegría" (which encompasses approximately 100 public schools) with the support of different private sector companies. Since February 2003, more than 90,000 books have been distributed in twenty one provinces. The natural limits of printed media, the slow process of closing fund-raising activities and the objective of reaching more students, however, prompted in April 2003 the creation of an alternative, more massive medium: www.20enmate.com, an interactive website that expands on the *Matemáticas Para Todos* project.

The primary objective of www.20enmate.com is to improve, via Internet, the mathematical skills among Peruvian primary and secondary school students. To achieve this primary objective, it is imperative to change the students general perception of mathematics, from a difficult and boring science to an easy and entertaining one.

In its first 3 years, more than 80,000 children nationwide have registered and visited the site regularly. The site has received recognition through a series of awards, including: In 2003 the Entrepreneurial Creativity Award for the "Communications" category and the IT Users Award for the "Websites" category. In 2004 the IT Users Awards for the "Educational Software" and "Courier Software" categories, the Crystal Obelisk Award for the "Best Social Initiative with a budget under US\$ 100,000 for a private enterprise" category, the PC WORLD Award for "Best Technological Initiative with Social Responsibility" category and the "Best Peruvian Website" Award in the "Education and Science" category.

The following case study is partitioned as follows: first, a brief description of the www.20enmate.com website is provided;

second, the development and coordination of the network that ensures the project's sustainability is described. Third, some of the project's updated results are presented. Finally, as a conclusion, some of the project's main lessons are discussed.

2. THE WEBSITE

www.20enmate.com is a free-access interactive website designed for primary and secondary school students, teachers, and parents. Interactivity stands as the key factor of this initiative, as it is what differentiates it from TV, radio or written media. As a learning process that directly involves the student, constantly demanding and reacting to his or her response, this medium is far more effective than other processes in which the student remains a passive listener or viewer. www.20enmate.com has several features that allow the student to test his or her own knowledge and performance, submit specific queries on subjects which he or she does not understand, practice through games and contests, and learn statistical data on economics, population, sports or music, thus illustrating some of the practical applications of what is being learned.

www.20enmate.com targets students from fifth grade in primary schools to fifth grade in secondary school, (ages 9 to 16), mostly in public schools. In the first year of the pilot project, however, the focus was on students of only first and second grade of secondary schools.

The design of the page and the navigation scheme were created taking into consideration the capabilities and limitations of such an audience. Indirectly, however, the website also caters to teachers, and parents, both essential participants of the student's learning experience.

The website has the following sections:

Registration

Like many other web-based services, www.20enmate.com features a registration database for students to ensure traceability and build up on previous sessions. This database also generates a community of users that can be timely notified whenever a new feature or contest is launched. It's not mandatory to be registered to have access to the following sections: Playing with Mathematics, The World in Numbers, Teachers and Parents. However, it's only upon registration that users receive unlimited access to the rest of the sections of the Web page.

Self-Evaluation

This section allows the users to constantly test themselves in the diverse topics of their academic program, and have a clear notion of the subjects they have mastered and those they should further reinforce. As mentioned, all registered users have access to a personal database that keeps records of their performance in previous tests so they can have an accurate idea of their improvements and weaker areas. Together with the test results, the website points out the specific pages in the *Matemáticas Para Todos* textbooks where more exercises can be found. This allows the users to realize the topics in which they are actually

lacking skills, prepare them for school exams and this way obtain higher grades.

Queries to Dr. Mate

This feature functions as a question drop-off box where students can freely place any query or doubt on any of the academic subjects, as well as on the use of the website. The answers are sent to the student in no longer than three days. Additionally, this section contains a list of the most frequently asked questions, as well as the corresponding tips and suggestions for each case.

Playing with Mathematics

This section reinforces mathematical knowledge and mind quickness through a variety of problem-solving games. It's not mandatory to be registered to play, but only registered users are recognized in a ranking and the users with the highest scores are awarded with a series of prizes accordingly. Some of the diverse educational games presented are: "The King of Multiplications", "Mathematical Football", "Mathematical Volleyball", "Mathematical Memory", "The Game of Clouds" and "Mathematical Genius".

The world in numbers

This section contains various statistical data sets which help the student complement and apply his or her understanding of different areas of mathematics, such as demographics, economics, music, sports or geography. This way, this section teaches the user the importance of mathematics in the real world.

Contests

This is a special and very popular section that periodically organizes on-line mathematics contests nationwide. Attractive prizes are offered to stimulate a healthy and tough competition.

Teachers

This section provides teachers with pedagogic lectures and recommendations on specific chapters of the *Matemáticas para Todos* textbooks. The purpose of this section is to train the teachers in the new methodology and familiarize them with the characteristics and uses of the website. Like students, teachers can leave questions for Dr. Mate and receive recommendations according to the *Matemáticas Para Todos* textbooks.

Parents

This section provides information to parents on the mathematical preparation of their children and on how to better support them in their learning processes. Like students and teachers, parents can also send questions for Dr. Mate to receive feedback.

The initial development of www.20enmate.com had two main phases: research and development.

Research

In order to develop a basic conceptual draft of the product, the research process was initially focused on searching in the web for mathematics education sites. Once this research was finished, a concept draft which including a series of tentative

sections was tested with several focus groups and structured in depth-interviews with different groups of children (ages 12 and 13) from both private and public schools from the Lima area. This allowed the team to gather information on the children's general Internet navigation styles as well as their impressions of the initial concept draft. The results of these focus groups provided key information that shaped the features and characteristics of the final product, and shed light on the network strategy required for its successful implementation and sustainability in time.

Development.

Once the concept test was finalized, an interdisciplinary team of programmers, graphic designers, system analysts, project coordinators, education specialists and teachers were organized to develop the pilot product. When the development process was finalized, another series of pilot test were conducted using additional focus groups and structured interviews.

Up to now, the design and programming of www.20enmate.com has used the following technological resources:

For the data base

Microsoft SQL Server 2000

For programming

- 1) Visual Interdev 6.0 (selected for its advantages in platform shows and in XML components).
- 2) Macromedia Dreamweaver MX, which allows a better coordination between design, ASP and XML.
- 3) Visual Basic 6.0, for the design of the different components.
- 4) Macromedia Flash MX and Action Script for the development of Animations.

For design

- 1) Adobe Photoshop 7.0, for the generation of art in the site.
- 2) Macromedia Freehand 11 for the management of vectorized images.
- 3) Macromedia Flash MX and Adobe ImageReady 7.0 for the development of flash files and animated gifs.
- 4) Macromedia Dreamweaver MX for the implementation of the pages.

3. NETWORK DEVELOPMENT

The efforts invested in developing such a website would have been futile if they hadn't combined an integral communications and relational strategy, capable of building a strong and efficient network of actively involved and committed participants. In this sense, the on-going process of coordinating the participation of schools, teachers, principals, Internet booth owners, volunteers, the general community, the private sector and Grupo APOYO, is essential for the sustainability of www.20enmate.com. The partnership with *Banco de Crédito del Perú*, the project's main corporate sponsor, was a central instrument for the communications and diffusion operations.

Specifically, the design and development of this network involved the following activities:

National On-line Mathematics Contest

launched for the first time on September 2003. It's a biannual 30-day-event that, up to now, has been the only contest of its kind. Its main purpose is to give additional incentives to students to practice mathematics. The contests winners are awarded with a variety of prizes, that go from a small backpack to bicycles. The contests are always accompanied with various press conferences involving different media and key executives from both Grupo APOYO and *Banco de Crédito*.

Promotion in schools

Initially an alliance was made with the *Fe y Alegría* school network. This alliance committed school teachers and principals to promote the use of the site and their student's participation in the contests. Through time, more public schools have adhered to this initiative, and up to now there are more than 3,000 schools nationwide that have at least one student registered in the website. It is important to point out that the active involvement of teachers in this process not only increases the number of new visitors to the site, but also forces them to familiarize themselves with the Internet as a new teaching media, thus increasing their professional skills.

Promotions in local Internet Booths

In Peru, 88% of Internet usage takes place at Internet booths. Among children between 12 and 16 years old, 97% use Internet booths. Most notoriously, in the lowest socioeconomic sector, this figure stands at 98%. In light of the importance of the network, the project demanded a specific strategy for Internet booths that would create a long-term relationship rather than one for a single promotional event. The concept of "booth partnership" was more suitable to this goal as it implied a relationship in time and a commitment to the project and its objectives. With this purpose, numerous booth owners signed a commitment act with www.20enmate.com, which accorded the use of promotion material in their business, and in exchange APOYO covered the costs of the discount hours given to students, provided materials and merchandising as incentives, etc. The involvement of Internet booth owners has been crucial as a direct source of guidance on the proper use of the website and a powerful contact for communicating future events.

Promotions and Publicity

Along with the previously described media and materials, www.20enmate.com uses banners in several educational websites and sends newsletters to its registered users to promote the page and upcoming contests. Publicity was conducted through the network of agencies of *Banco de Crédito del Perú* and the network of clients of Grupo APOYO.

Student Workshops

Employees from Grupo APOYO participate regularly in workshops targeted to students of the *Fe y Alegría* school network. The objective of these workshops is to enable students to use the site's sections, take advantage of its various services, and invite them to participate in the National On-line Mathematical Contest. The employees' active involvement constitutes a rich source of ideas for the improvement of the

website and the integral project. It also serves as a space to share in the sense of social responsibility and fulfillment in making a positive contribution to our country.

Teacher Workshops

A second type of workshop was developed for teachers in order to train them in the use of the new mathematical textbooks and the website. It is important to point out that many teachers were not familiar with the use of Internet, so that such workshops not only made them better program collaborators but, also, committed them to improve their pedagogical skills.

4. UPDATED RESULTS

The results from this initiative have been up to now overwhelmingly positive. During the first year, 11,232 students registered, solved a total of 14,537 exams and visited 740,168 pages. During the second year, the number of students registered increased up to 32,035, the number of exams solved were 61,880 and the number of pages visited was 2'149,479. For the third year, the number of students registered reached 82,992, the number of exams solved were 151,777 and the number of pages visited was 3'779,984.

In terms of qualitative achievements, www.20enmate.com has accomplished the following:

- 1) Through its system of self-evaluation, games, contests, and queries, the website has instilled a sense of autonomy and self-teaching which guarantees greater results in the long run.
- 2) The projects strengthens the student's sense of self-esteem and personal achievement, helping him or her establish personal goals, and maintain work discipline.
- 3) The project promotes the use of the Internet as a crucial work tool among students, teachers, and parents.
- 4) The project breaks the prejudice that mathematics is a boring subject, exclusive to those few gifted students.
- 5) As a powerful media, the website has also allowed more students throughout the country to learn a better mathematics curricula, promoting a more decentralized and uniform educational standard.
- 6) Develops a sense of fair competence and personal achievement through contests, prizes and gifts.
- 7) Promotes the interaction among students, between parents and children, and between teachers and students.
- 8) Indirectly, and through their children, this project promotes the use of the Internet among adults, which, until then, might have had no contact with this new media.
- 9) The project benefits Internet booth owners both financially and psychologically, as the promotional campaign not only increased the demand for their services, but also gave them the opportunity to collaborate in the betterment of their communities.
- 10) Helped teachers improve their teaching skills, learning the uses of new technologies and methodologies for mathematics education.
- 11) Provided volunteers and employees of Grupo APOYO with a deeper sense of contribution to the betterment of their society.

5. CONCLUSIONS

Perhaps the most important lesson learned from the www.20enmate.com experience is that the real challenge of applying the new information technologies to educational projects lies not in the design of the technologies themselves, but in the construction and perpetuation of the networks in which they operate. It is relatively easy to underestimate the organizational sophistication and the human-resource management skills required to properly administrate these complex and multi-disciplinary projects, especially one such as www.20enmate.com that aims at nothing less than a structural improvement of nation-wide mathematics education. After all, the agents involved are not only numerous—programming experts, education consultants, company directors, publicists, media, Internet booth owners, school principals, teachers, parents and children—but each one operates under different and often contrary incentives and constraints.

Finally, www.20enmate.com differs from most social responsibility projects in that it aims at a sustained and ever-growing impact on the general community, rather than focusing on a specific issue affecting the firm's immediate entourage. Only such out-reaching efforts can generate true change, the kind that translates into real competitiveness improvements and a more knowledgeable, integrated community.