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Feasibility survey of water purification facility: Project – based learning

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Abstract

Background: A survey was done about the feasibility of installing a water purification facility inside of the Universidad Tecnológica Emiliano Zapata del Estado de Morelos. The main was applied project – based learning to integrate different knowledge areas to meet the approach: project management, market research, basic statistics and the industrial process. Working under this scenario student was able to develop new professional skills, developing a project with sustainable focus, since the ecological, social and economic impact around the region where the campus is located was taken into account. Project management was based on best practices described at Project Management Body of Knowledge. The installation of water purification facility would be profitable and the university community is willing to consume the water purified at their own university. Something that was not considered at the beginning of the project was the role of drinking water supplier that university can be taken, because the production capacity of the plant type selected exceeds domestic consumption. Students working under this scenario are able to learn autonomous behavior, since the face real issues and assume role of a businessman, making decisions, looking for their own information sources, developing professional competencies and in this case sustainability commitment.

Project management; sustainability; professional competencies; purified water

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Introduction

Water is a worldwide issue, humans beings needs water to live, and we needed it for many things. According to available data [1], 97 % of the all water is saltwater, 2 % is ice and it is conserved at glaciers and just 1 % remains for human consumption, for this consciousness about water conservation is really important. It is also common knowledge that water from rivers or springs contaminated in different ways, including the lack of which is a resource that besides the lack of people is running for caring this essential resource for life on the Earth. Therefore the treatment and responsible use of water is a topic related with social and sustainability aspects. The Universidad Tecnológica Emiliano Zapata del Estado de Morelos (UTEZ) [2] committed with its environment and taking care of it, started with its institutional program of sustainable campus in 2011. One of the three work axes of this program is the use treatment and responsible use of water, which implies:

- Treatment of wastewater to use in irrigation.
- To avoid or eliminate and reduce water leaks inside of the campus.
- Diffusion of information about the caring of water and the responsibility of each one has about it.
- The useless waste of water during the filling of elevated tanks or cisterns. This can be reduced applying the technology, by the installation of automatics control systems.

During the development of the project, one new one showed up: the installation of a purifier water plant. This could have an immediately sustainable impact in the region and with the internal and external community of the university. UTEZ is located at 18°51'2"N, 99°12'3"W [3], and it is really warm most of the year. UTEZ has in average a temperature of 30 degrees along the year [4]. Therefore water consumption is high, mainly by students because classrooms have no air conditioning. These two conditions: water caring and warm weather; hold the development of a feasibility survey about to install a purifier water plant inside of the university campus.

Water is a vital resource for humans, in Mexico it is common knowledge that the days when the water was taken directly from the tap are long gone, as most people consume bottled water, according to the survey conducted into the campus. It is also common knowledge that water from rivers or springs contaminated by different reasons, including the lack of which is a resource that besides the lack of people is running for caring this essential resource for life on the Earth.

The idea of installing a purifying plant in college with the idea of purifying water provided by the municipality and be the main, if not the only, supplier of bottled water on campus was raised. The objective of this work is to perform a feasibility study in relation to the cost and return on investment for installing a purifying plant in which it UTEZ provide bottled water into the campus and neighboring institutions UTEZ.

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This is a new service that the university offers its students and the general public, the cost will be lower than current providers and quality shall be certified by the relevant agencies. Another inherent benefit to project is the image of the UTEZ to the general public, since the internal and external community will recognize that the UTEZ has social commitment, serving the needs of the community with quality and commitment to the environment the region where it is located.

Frame of reference

To apply marketing techniques reviewed in the classroom, project learning technique was used, which involves the student in a more profound way, making it co-responsible for their learning process. The student conducts the administration of a project that has application in the physical world, beyond being just an academic exercise. Project-based learning is well documented in the literature [5 – 8]. According to the PMBOK [9] projects can be divided into five phases: initiation, planning, executing, monitoring and controlling, closing. This methodology was used in project management. The project is implemented in four months, at the end of which is due on feasibility study to install a water purification plant in the university campus. By objective was divided into three main: domestic market analysis regarding water consumption, investigation and analysis of the different providers of purification plants, general conditions for installation. In this way the student during the project integrates the knowledge acquired in the classroom to real-world situations, to develop skills needed in the profession, Figure 1.

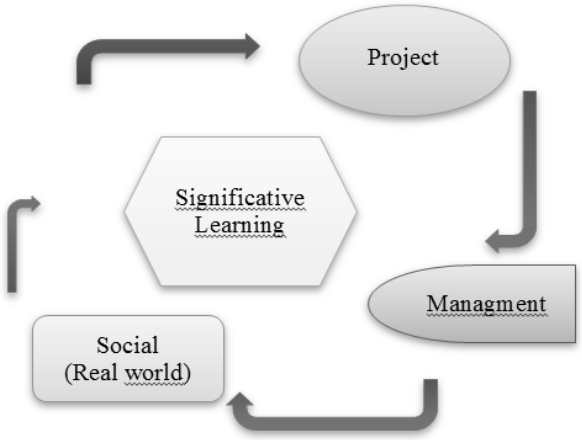

Figure 1 Different factors are involved in the significant learning process

Methodology

For project management the PMI best practices were followed [9]. According with PMI, there are five project phases, Figure 2.

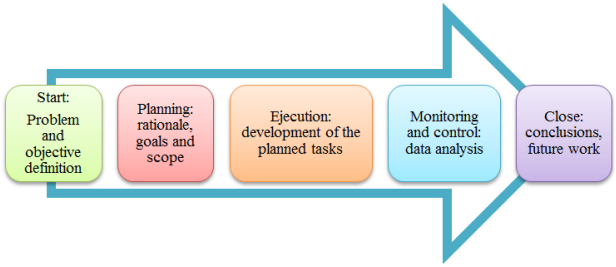

Figure 2 Project management phases

In the classroom the basic tools of market studies are taught, important and general aspects that make a study of this type, so that the student is able to identify characteristics that may be endemic of your project and adapt techniques project implementation. The market analysis is widely described in the literature so it is not considered necessary to deepen the description of the item [10 – 13].

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This research helps to create the strategic plan of the company, is preparing to launch a product or facilitate the development of products launched depending on the lifecycle [11]. It is most attached to the need for the project, and to position the product in the UTEZ community will be critical in the success of the final project. It is important to know the target market which will give the satisfactions to perform an accurate analysis of cost - benefit and estimate the recovery time of the investment.

It is very clear that the target market is fully identified [12,13]: the student population UTEZ therefore this target market analysis is performed to obtain information and establish confidence level on the introduction of the product.

The findings are used to make decisions that will solve specific marketing problems, therefore, market research is beneficial in various situations, but the decision that is made is not automatic. This decision can be based on:

- The cost - benefit.
- Resources available to conduct market research.
- Administration attitude towards implementation

In order to obtain the data for analysis using the technique of questionnaire or survey application [10], define the variable to monitor and questions should be properly structured. A survey was applied selecting a sample of 200students of both shifts, diversified in all areas.

The objective of this survey is to identify the preferences of the population sample, with respect to consumption of bottled water and identify the size and ideal for introducing this new product in the domestic market UTEZ price. The market study was also conducted to identify the best supplier of water purification plants. The strategy was searching online and visiting nearby locations within the community. For the project the student followed the best practices of the PMBOK (PMI), following the sequence described in Figure 2. The first points have already been discussed to this part of the rest will be described in the following section.

In the start-up phase, the important aspects of the project are detailed. The initial project meeting with the two advisors and the young researcher is performed. The projects requirements are underlined, besides of the objective, the stakeholders are listed, an all of this important things are put together on the project chapter (PMBoK), and it is signed. This is a very important document because, is going to be the guide for the successful development of the project, and every time researchers get lost, they can go back and review it the objective, the scope and so on, to get back the project in the right way.

In the planning phase all strategies are designed, and the schedule of each of them, actually of the all project development is planned. In this paper project, had to be developed in four months, so the schedule design activities for this period, and also there is planned reviews during the development of the project to review the status with the stakeholders, but also to be assure everything is going good.

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At this stage the appropriate instrument for data collection was chosen, what in this job the questionnaire was selected. Selection of the questions to get the really important data in a fast way is made. In this survey the authors chose the sample size to perform the questionnaires into the campus. Basics statistics to analyse data were done using a spread sheet. Questionnaires were applied to two hundred students from different shifts and careers.

During the implementation phase, all scheduled activities are done, for example the market survey and the analysis of different suppliers of water purification plants, with the purpose to get the analysis of cost benefit to install it inside of the UTEZ campus.

The monitoring and control phase is to take care that the project is executed in a timely manner, and in case of some setbacks appear react promptly or even are able to predict the occurrence of unanticipated events.

In closing the review of compliance with the purpose and planned actions is made. The project is finished with the feasibility survey. Therefore the proposal to install the purifier water plant inside of the campus is presented to the university authorities to make an educated decision.

Working under this scenario student gains skills in different areas of knowledge strengthen the knowledge acquired in the classroom and acquire training as a researcher. In addition it gains autonomy in managing their own learning recognizing the environment in which it operates, and evaluating their strengths and their weaknesses.

This kind of autonomous behaviour gives to the student also competences in relation to seek their own sources of information to discriminate in terms of quality of the same, whether printed or electronic. This scenario give to the student an integral education, providing meaningful learning, and that the institution earns in the sense that they have the data to make an educated decision and have the social, economic and environmental benefit.

Results

The survey starts getting the information about how many litters by week of drinking water the university is buying, and the cost for buying them, Table I. University is paying about 6896 usd for drinking water concept by year. And the consumption of drinking water by year is 1600 litters approximately. At the moment that this survey was done, there were 2500 people at university, including administrative people and students. Once this important data is known, the next step is research about purified water plants providers. All of these data are about drinking water that university; data from student's community are not included. Authors considered a very good estimation about ROI (Return Of Investment) could be done with these data.

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Drinking water by week		
Place	Liters	Cost
Building three	300	23.91
Building two	240	20.44
Building one	200	18.01
Talleres	240	14.17
Building four	60	5.31
Library	40	4.13
Principal building	140	14.46
CEVISET	220	22.73
CECADEC	160	9.45

Table 1 Liters by week of drinking water and their cost

The research was done going to visit directly the providers at their plants or calling them by phone or by e-mail. Based on this research "Purisystem" was the optimum option for university, Table II, since according with data, university does not need a huge production level. However data shows something really interesting, university could by the drinking water provider for other institutions in the neighbourhood. It means purified water at campus could be consumed by the internal market and also there is an opportunity for external market.

Drinking water by week		
Place	litters	Cost
Building three	300	23.91
Building two	240	20.44
Building one	200	18.01
Workshops	240	14.17
Building four	60	5.31
Library	40	4.13
Principal building	140	14.46
CEVISET	220	22.73
CECADEC	160	9.45

Table 2 Comparison of different providers of drinking water plants

This two starting steps, shows that installing a purifier water plant in the campus looks like a good business opportunity, besides another value added points, like social and ecological University image. More deep analysis must to be done to take into account another kind of issues, the adaptation of current facilities, the health permissions to operate, bottles and jug containers, stickers basic supplies for plant operation, people to operate it, and so on. All of these data needs to be put together to have a good estimation for the ROI, however the feasibility looks so far so good. Student has made a real marketing survey and also a research about choosing the provider. Students get competences about autonomous performance and skills to select their own information sources, negotiation getting the right data and social commitment.

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Students have opened the panorama about all of these no planned things in the project start and that has to be done for a complete survey.

The next project step was, perform the internal market survey, for this case data source was the questionnaires applied to some selected sample from the total UTEZ universe. The sample size was selected according with the researcher criteria [14]. Questionaries' were answered by students, staff and some external service providers to have a heterogeneous sample and data from different possible customers. According with data coming from the questionnaires most of the people surveyed get their drinking water from Jug water source, this one is the 25 litters bottle i.e. familiar size. Also it means most of the people use one container more than once and just wash and refill it.

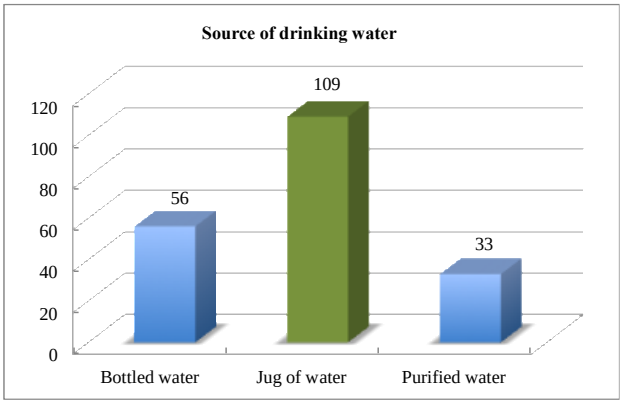

Figure 3 Jug water is the preferred drinking water source.

Another important data is the preference of people about the size of the bottle, in this case surveyed people prefer one litter size more than another one, Figure 4.

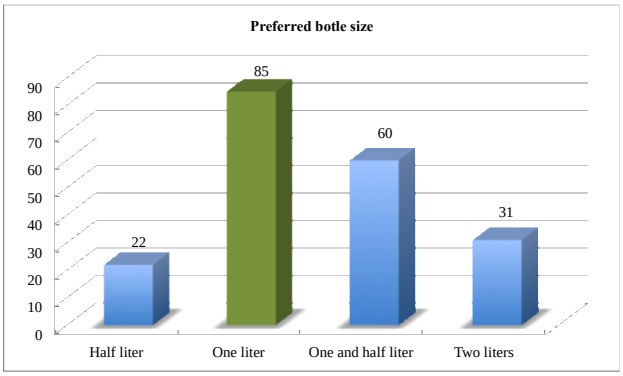

Figure 4 Surveyed people prefer one litter presentation.

Maybe this size is preferred due to could be easier to carry on with you, and the refill containers are in this presentation. It is also important to know if the people care about the brand of the bottle water, because is common knowledge that some products are consumed by fashion, by imitation or just because the advertising. The data shows that for approximately 71 % of university community does not care about the brand of bottled water, Figure 5.

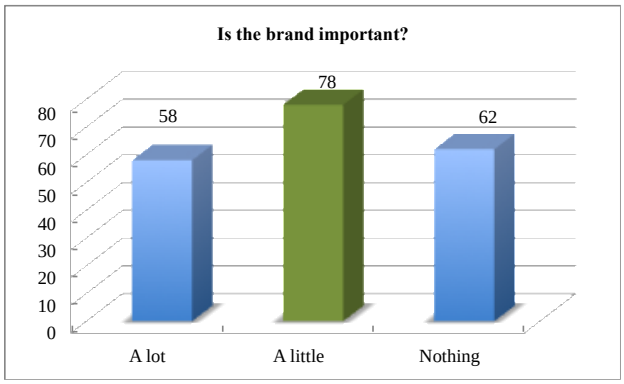

Figure 5 The brand of the bottled water has no value added for most of the people.

For the cost-benefit analysis is important to know how much is people are willing to pay for the purified bottled water manufactured at university campus. The most common price for one litter size of bottled water is $0.74 usd, Figure 6.

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All data analysed so far, shows that installation of a purifier water plant inside of the campus, because university is paying almost the same money by year for drinking water than the cost of the plant, and internal market is able to accept the own university purified water brand. There is a goal market identified and that's is going to accept the product and the necessary investment is almost equal to the actual annual payment for drinking water.

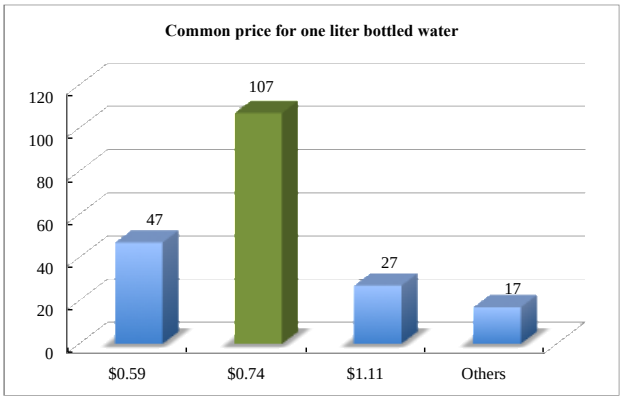

Figure 6 The price of the bottle can be lower than the most common current price.

Conclusions

Project – based learning is a scenario that lets integrate different skills, due to student needs to apply knowledge learned from the classroom and needs to develop autonomous competencies. Project management applied in the development of this kind of projects let, and in some way dare the student to figure out the way to get enough information to make decisions and propose possible solutions. Make students more able to prevent some issues during the development of a project and react in a rapid way if some emerge.

Purifier water plant installation is a feasible and profitable project.

This kind of project are the ones that start just like a simple idea and give as a work product the born of a new micro enterprise with high confidence of success.

In this type of feasibility studies should include analysis of the environmental impact, since in sustainability issues should be directed not only at work but a feasibility study to consider the ecological impact. In this work it was excluded, not from lack of courage or an underground act, but not to be one of the academic strengths of UTEZ. The environmental impact caused by the installation and commissioning of water purification plant is scheduled within the project management, but as a future work. For this purpose the integration of a multidisciplinary team, where knowledge is supplemented in the social area, business development and marketing, environmental, health and project management is recommended.

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References

Comisión Nacional del Agua, CONAGUA, www.conagua.gob.mx. Retrieved at May 2015.

Universidad Tecnológica Emiliano Zapata del Estado de Morelos (UTEZ). www.utez.edu.mx.

ISSN-On line: 2414-8830

Instituto Nacional de Estadística y Geografía (INEGI). www.inegi.com.mx. Retrieved at April 2015.

Google maps. https://maps.google.com.mx. Retrieved at May 2015.

Blank, W., Harwell, S., 1997. Promising practices for connecting high school to the real world. Official of Vocational and Adult Education (ED). University of South Florida, Tampa.

Dickinson, K. 1998. Providing educational services in the summer Youth Employment and training program. Social Policy Research Associates. U.S. Department of Labor, Washington, D.C.

Harwell, S. 1997. Project Based Learning: Promises practices for connecting high school to the real world. ERIC Document. Tampa, Florida.

Challenge 200 Multimedia Project. Retrieved at june 2013. http://pblmm.k12.ca.us/PBLGuide/WhyPBL.html.

PMI, 2000. A Guide to the Project Management Body of Knowledge. Project Management Institute. Newtown Sqaure, Pennsylvania, USA.

Naresh K.M., 2004. Investigación de Mercados: un enfoque aplicado. Pearson. México.

Pope, J., 2002. Investigación de Mercados: guía maestra para el profesional. Bogotá. Norma.

Pujals, J., 2001 Investigación de mercados. Cataluña:Materials. España.

Navidi, W., 2010. Statistics for Engineers and Scientists. McGraw – Hill Higher Education; Third Edition.

ISSN-On line: 2414-8830