Innovation Week (i-Week), a Way to Link Students, Industry, Government and Universities; the case of *Emergency First Response* at the Tecnológico de Monterrey

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Thematic line: Educational Innovation Management

Summary

The Innovation Week (i-Week) at Tecnológico de Monterrey represents an important step toward the development of an innovation learning strategy that creates an even stronger ties between students and industry professionals, government officials, health care specialists, culture developers, social workers and others, in order to propose procedures and become active in the process of transforming ideas to solutions in their communities, both nationally and internationally. In Monterrey campus, a total of more than 13,000 students participated in this i-Week (in Spanish: *Semana-i*) [21, 22] that took place from September 21 to 25 at different places in Mexico and abroad. This paper discussed the experience of the capstone project called Emergency First Response (EFR) [5, 6] that was developed in collaboration with six main groups from the State of Nuevo León in México: 1. EITI (School of Engineering and Information Technologies at TEC), 2. EGADE (Graduate School of Management and Business Administration at TEC), 3. Social Development Coordination group at San Pedro County (SEDESOL), 4. Public Health Department at the State of Nuevo León (SSNL), 5. National Center for Accident Prevention in México (CENAPRA) [18], and 6. Ternium Maintenance Department in Monterrey (TERNIUM). The EFR project had 182 participating students and they were attended by 15 professors from Computer science (CS), Information Technologies (IT) and Electrical Engineering (ECE) Departments. The participant students and faculty were prepared as first respondents in event to medical emergencies or accidents and they develop applications for the national and worldwide network of first respondents.

Abstract

The i-Week at the Tecnológico de Monterrey (TEC) provided a fertile challenge to link students of many undergraduate programs with practical real world activities in which they could make proposals to enhance social, health care and industrial productivity in their communities. The i-Week integrates academic departments, faculty and institutions in multidisciplinary projects, providing a very relevant project administration case. The *Emergency First Response* (EFR) project at TEC during the i-Week, included three different schools: Engineering and Information Technologies (EITI), Science and Engineering School (ECI) and Graduate School of Business Administration (EGADE). Fifteen professors from Computer Science (CS), Electrical Engineering (ECE) and Information Systems (IS) participated. From Nuevo León State government participated: The Social Development and the Public Health Department. Twelve collaborators from the Nuevo León government participated in the project. From Industry, two Chief Maintenance Engineers provided an overview to the Industrial Contingency Security at Ternium Enterprise, Monterrey. The EFR project generated thirty different student proposals. Also, all participating individuals received the First Respondent certification from CENAPRA (National Center for Accident Prevention, México). The EFR project allowed students and faculty to interact with government and industry to propose innovative solutions in accident prevention and first aid awareness.

Keywords

Higher education, multidisciplinary learning, university-industry-government interaction, first respondent certification

Theoretical Background

The percentage of death as a consequence of quick treatment of heart attacks surpasses 50%, and it is independent upon age [18,19]. The main surviving factor is the immediate attention that the victim could receive by applying artificial ventilation and cardio-pulmonary reanimation (CPR) in the scene. The main objective of the EFR project is to provide undergraduate students and faculty a liaison with health care administration groups, both in government and industry to develop projects for training and certifying First Respondents. Very few documented initiatives exist for creating a community conscience of first responders [3], even though the evidence has shown that when an emergency or disaster strikes, victims and volunteers act as the truly first responders. For example, disasters such as: the earthquake that struck Mexico City in 1995 or the tornados in central Florida in 1988. In both cases ad-hoc citizen's groups self-organized to rescue other people from rumble, and created disaster relief centers among other emergency response activities.

The EFR Project

The EFR project fosters the student and faculty participation [13, 11, 9, 14] with the government public health administration in serving as a First Respondents and to promote training and collaboration using information technologies to disseminate health care in emergency contingencies. The training consists of a First Respondent workshop that provides competences in first aid response, basic medical attention and evaluation of emergency contingencies to provide assistance to individuals who have suffered accidents or sudden illness while the paramedics arrives to the scene. The participating students were sophomores, juniors and seniors from most of the undergraduate programs in engineering, business and social sciences. Faculty form Computer Science (CS), Electrical and Computer Engineering (ECE) and from Information Systems (IS) participated in the project as coaches and instructors during the i-Week.

The basic conceptual contents of the first respondent workshop were:
1. Accident scene´s evaluation
2. Victims evaluation
3. Choking maneuver
4. Cardio-Pulmonary Reanimation (CPR).
5. Wounds, burns, fractures and convulsions.
6. Bandages and victim dragging.
7. Main illness characteristics, risk symptoms and preventing measures.

The workshop includes practical exercises with mannequins provided by the Public Health administration. Particularly the CPR training is exercised and verified in great detail to have the trainees developing skills and competences for CENAPRA certification.

The capstone activity consisted upon the use of the acquired knowledge to design and implement a tool to support education and training about first respondent skills and participation in the community. Teams of 5 to 6 students develop the procedure, specifications and necessary information to create the tool or app product. Some of the specifications released to reach a reasonable proposal for a practical tool are:
1. The tool must be proposed to an educational institution, service provider business, company or even the health care state administration.
2. The main idea is to advance in creativity and innovation for integrating the knowledge acquired to propose a very useful informative, servicing, campaigning, interactive tool or app that could educate, train or make more skillful a specified population sector pertaining the First Respondent in medical emergency situations.
3. The tool for emergency response should be selected to support users, workers in the prevention and servicing a medical emergency at their facilities.
4. The presentation could include a video or an application and all the team members must be available for the questions and answer plenary session.

The evaluation rubric for the product includes the following: The designed tool fulfills the goal of informing and educating about medical emergencies, the selected institution and organization exists and they are willing to use the application, and the selected project is practical, easy to use and innovative.

The competence development and desired outcomes for the students include:

a. Citizenship participation.
b. Communication abilities with Industrial and Government representatives.
c. Use of information technology (IT) tools and basic programming skills to perform Apps for mobile devices.
d. Certification from CENAPRA.

In terms of citizenship the student demonstrate participation while attends, actively participates and accomplishes the assigned activities by the state public health assistants. Also the students need to attend the plenary sessions (by SSPNL) and proposal presentations (where the proposals will be evaluated) to have full credit. About the communication skills the excellent elaboration of documentation for the app and the presentation of the proposal would provide a full credit to the students. The CENAPRA includes:

a. An observation by instructors of a practice realization of the drills required: accident scene evaluation, shocking maneuver, CPR procedure and good development of bandages and dragging.
b. A successful passing of the certification exam (80% minimum grade).

The final evaluation consisted of: 50% student assistance, 20% CENAPRA´s certification, 20% capstone activity, and 10% oral presentation.

EFR Implementation

Students from all majors interacted with faculty from ECE department, CS Department, IS Department, and external organizations. The external institutions are: SEDESOL, SSNL, and TERNIUM. The interaction among all the participating departments was very fluid and continuous meetings and feedback were performed, before, during and after the i-Week [22].

CENAPRA certified 182 participating students and 15 professors, once they presented and passed the comprehensive theoretical exam. As mentioned before students from all majors participated and they provided a very rich atmosphere for multi-disciplinary interactions among different disciplines.

Faculty-Student interaction was very good particularly at the consulting level where professor discussed the applications and the ideas with excellent maturity from the students. The interaction with external persons was extraordinary and the clerks and representatives from SEDESOL and SSNL were very surprised by the projects and ideas generated.

Table I illustrates a summary of the schedule of EFR at Tecnológico de Monterrey during the i-Week in the fall semester of 2015. The schedule included a one-day plenary seminar where most of the theory was dictated. Days 2 and 3 included practice and drill exercises for the most important maneuvers (Choking and CPR), bandages and victim dragging. One day was also dedicated to a plenary session for an industry representative that gave a lecture about Industrial Security and medical assistance. Day 4 included a review of the theoretical concepts in preparation for the certification exam. Day 5 included project presentations and evaluation.

The diversity in the student's disciplines resulted in innovation projects with a rich variety of both multidisciplinary innovation ideas and product prototypes. A total of 182 students, enrolled in the first respondent project, elaborated 30 innovative project proposals. Different media products were the outcomes of the innovation projects. The media products were: mobile applications, posters, workshops, banners at metro station, etc. An important characteristic of all the projects is their link with an institution or organization as client. The students contacted government dependencies, social groups, business and industrial associations. The interaction with these institutions was a key opportunity to justify the novelty of the proposed innovations. Two government organizations such as SEDESOL and SSPNL were very enthusiastic about the proposals [18,19].

Table I. EFR Schedule during the i-Week at TEC [5, 6].

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	Inauguration. Plenary session	Practice: Scene Evaluation. Classroom session	Theory: bandages, and wounds, fractures, victim dragging, convulsions. Classroom session	Industrial Security. Plenary session	Proposal presentations by teams in Classrooms
AM	Theory: Scene Evaluation. Plenary Session	Practice: Chocking Maneuvers and RCP. Classroom session	Practice: RCP In Classrooms	Review and Plenary Practice session.	Wining Proposal Presentations Plenary Session
PM	Theory: Chocking Maneuvers. Plenary Session	Team Formation	Collaborative team work	Collaborative team work	Certification Exam.
PM	Theory: CPR. Plenary Session	Collaborative team work	Collaborative team work	Collaborative team work	Closure, Plenary Session

The innovation projects focused on three specific groups: assisting, training and raising awareness around first respondents. In the awareness group, the common goal was to promote consciousness about the importance and need to have first respondents among us. Examples of innovative ideas in awareness were: the elaboration of media and the proposals of guidelines to organize promotional campaigns at universities and high schools; the media and guidelines to organize run and walk events; the proposal of a law to call for restaurants with first-respondent certified employees and to display posters with chocking maneuvers at the workplace; and the elaboration of media that takes advantage of the curiosity-shame nature of people to realize the need for first responders.

In the second group, the common project goal was to assist the first respondent on how to react under an emergency and how to reduce response time. Examples of innovative ideas involved the development of mobile apps with features such as: guiding the first respondent in real time with specific step-by-step instructions; incorporating voice commands for faster response; incorporating an option for direct emergency calls; rapid access to key maneuvering data, tracking the location of an accident; incorporating a database with the current location of first respondents; support for scene study to avoid risks; and tracking the path and arrival time of the ambulances.

The projects in the third group had the goal of educating/training first responders using different types of media. Several projects naturally combined the education and the awareness categories together. Educational projects covered common contingencies such as: cardiopulmonary resuscitation, burns, choking, convulsions, wounds, strokes, etc. The educational projects also considered instruction about maneuvers for different environments such as: home, social, club, gym, school, business and others. Examples of innovative ideas for first-respondent education were: the elaboration of first-respondent complementary materials with illustrations and concise instructions; elaboration first-respondent educational materials with specific emphasis on babies; a training program specific for rural areas and medically underserved communities; mobile phone content to reinforce the knowledge about the cardiopulmonary resuscitation procedures; an elective course about first respondents for high schools; tools for fast location of first-respondent training and educational materials; an instructional program that integrates books, videos, web sites and workshops; teaching awareness of ineffective traditional-medicine remedies and their medically accepted counterpart treatments; and interactive guides and video games to strengthen the knowledge about maneuvers like cardiopulmonary reanimation.

EFR Results

The Table II illustrates the student´s opinion with respect to: workshop content, instruction by SEDESOL and SSPNL, Consulting and instruction by TEC faculty, time allocation to different topics and supporting materials such as audiovisuals and tools. With regard to the overall opinions and recommendations of the activity by the students, they suggested some precise actions that could

improve, even more, the experience in terms of managerial, logistics, organization and structure. Some of the popular suggestions were:

1. Try to redistribute better the workshop theoretical content during the week. This is try to avoid having all the theory in one or two days only.
2. To have more practice sessions to do maneuvers and procedures.
3. To give more time in developing the App or application.

The students also provided their opinion with respect to recommending the activity for future semesters at Tecnológico de Monterrey. Table III shows opinions from 182 students that attended the workshop.

The figure 2 shows the results from the exam required to receive the certification from CENAPRA. From the figure 2 the minimum-approving grade was 15/20 (or 75/100) and therefore all the 182 students were certified as first respondents with an amazing 93% of the 182 students obtaining a percentage grade of 90% or more.

Table II. How did students like the fundamental elements of the EFR.

How did students like?	% of students saying: EXCELLENT	% of students saying: VERY GOOD
Workshop content	59	33
Instruction by SEDESOL/SSPNL	61	28
Consulting/instruction by TEC faculty	73	22
Time allocation	39	33
Supporting materials	62	37

Table III. Student Expectations and Recommendation to others.

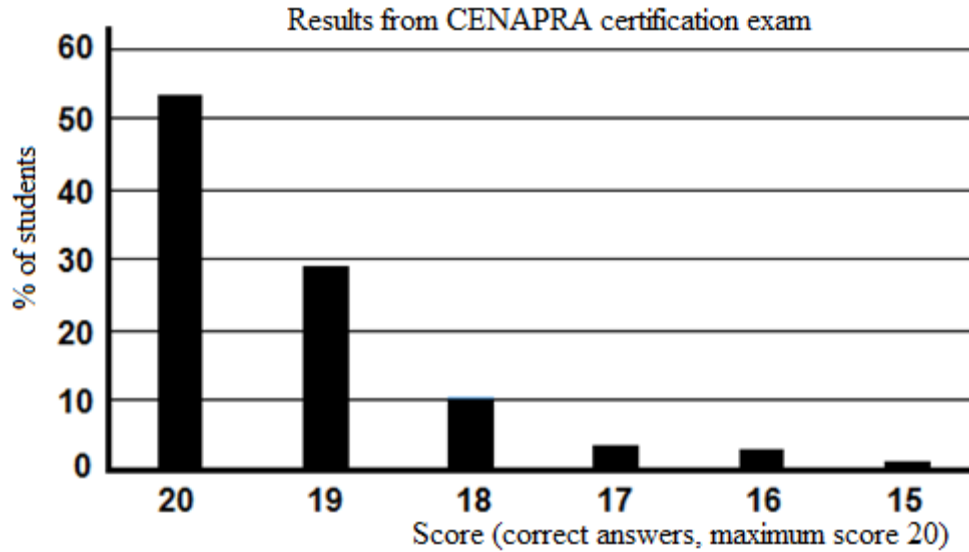| Were your expectations fulfilled?	Would you recommend the workshop?
YES	YES
88%	92%
Opinions of 182 students using an exit survey at the end of the workshop	

Figure 2. Results from the certification exam for 182 students.

When the students delivered their products, personnel from SSPNL and CENAPRA were part of the jury in the final oral presentations. The figure 3 illustrates the categories of the different product prototypes developed by the students during the EFR i-Week activity. SSNL and CENAPRA were very optimistic about the use of the generated products and applications. The multidisciplinary and collaborative [14, 7, 2, 4, 8] approach to the EFR project was so successful that the project will be offered again in 2016.

Finally, the TEC performed an institutional survey to a sample set of students participating in the i-Week [22]. From a sample of 3,966 students from Monterrey campus (C.MTY), and 1,365 from EITI, 64 students were interviewed about the EFR Experience. Figures 4 and 5 illustrate a summary of opinions from the interviewed students with respect to: their living experience and their satisfaction, respectively. Figure 5 shows that more than 50% of the students participating in the EFR activity had a Good to Excellent opinion about the "Living Experience". Figure 5 shows that about 75% of the students participating in the EFR activity had a satisfied to very satisfied opinion about the it. Finally, considering the overall opinion of the students participating in the EFR experience, figures 4 and 5 illustrate that the number of students with positive opinions are much higher than the percentage of students from the EITI and C.MTY (Monterrey campus). Also the figures show that the number of negative opinions of EFR students are much lower than the number of negative opinions from the EITI and C.MTY.
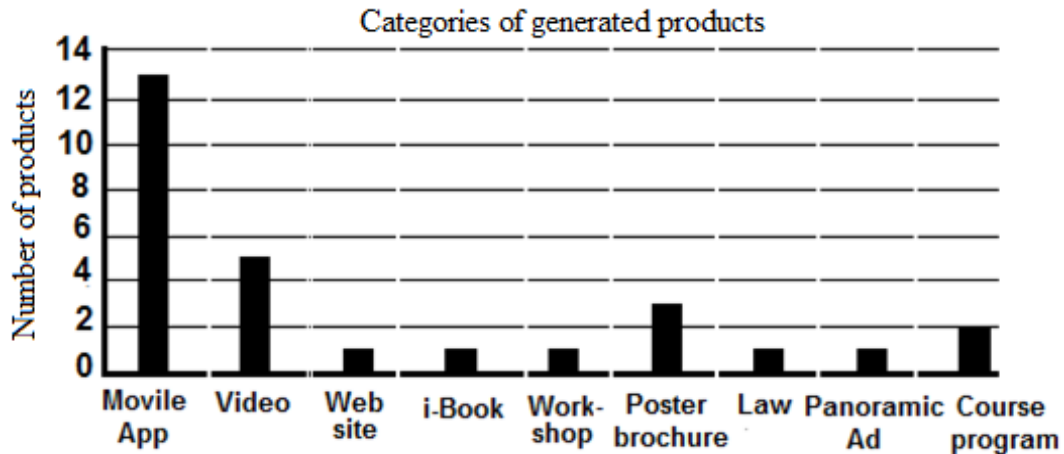
Figure 3. Categories of the product prototype generated during the EFR i-Week.

Conclusions

The EFR project developed for the i-Week at TEC delivered 196 more first respondent students to be prepared for providing medical attention to individuals having accidents or sudden health contingencies. This project was the initial seed that will exploit in higher and more profound benefits in the academic community because the student has the opportunity to interact not only with government officials servicing the population in public health issues, but also with industry personnel dedicated to provide health care safety in industry. The project focused in the following outcomes: citizenship participation, communication abilities using Information Technologies.

The public health administrators evaluated procedure and presentations of applications developed by students. Also, using the evidence collected by health administrators, all the 182 participating students approved the certification exam to become first respondents in Mexico.

From the exit surveys, 88% of the students fulfill their expectations and 92% would recommend the workshop to future students at TEC. The replication of this project at TEC would help in the development of future technologies and mobile applications which can be developed by students working in all undergraduate majors at TEC.
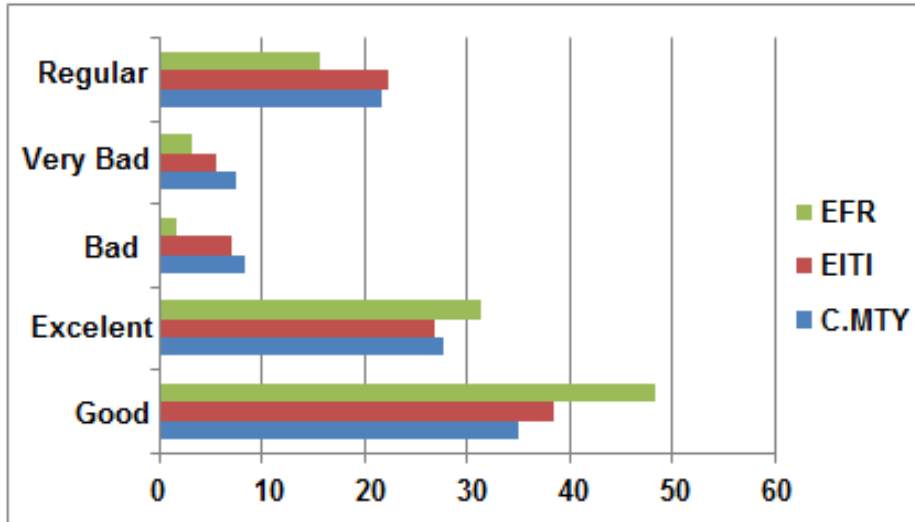
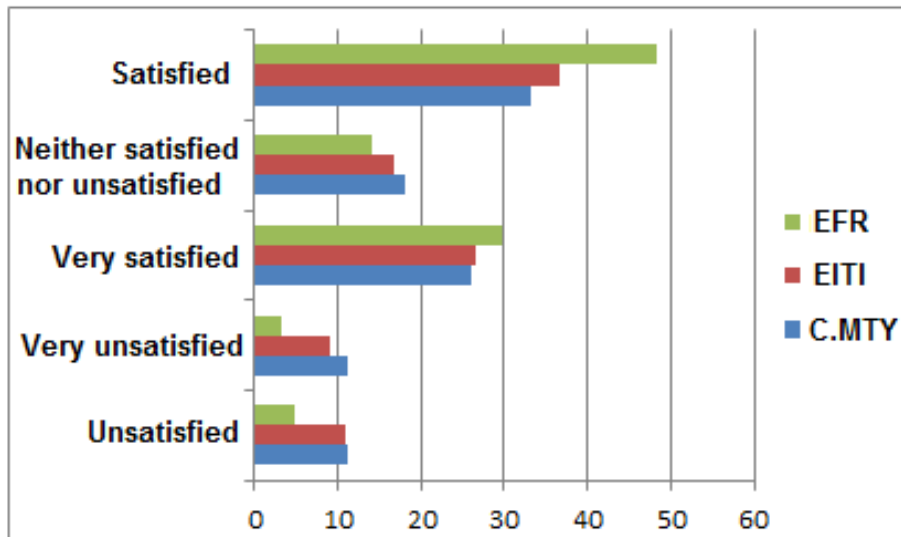**Figure 4.** Institutional survey to students [22]. Question: "How was the living experience at the i-Week?"

Figure 5. Institutional survey to students [22]. Question: "What was your satisfaction level at the i-Week?"

Appendix

Figures 6, 7, 8 and 9 show some representative photographs of the theoretical training and practical activities performed both, in plenary sessions and in classrooms to develop the necessary skills to become a first respondent during the EFR i-Week at the Tecnológico de Monterrey, September 21 to 25 of 2015.

Figure 6. EFR plenary session, September 21st, 2015.

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Figure 7. Photos of practice with manikis in the plenary session

Figure 8. Photos of CPR practice in the classroom, for child and adult

Figure 9. Photos of CPR and CPR ventilation practices in the classroom

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