



# An evaluation case for a research seminar

## *Un caso de evaluación para un seminario de investigación*

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**Recibido:** 12 de Febrero del 2020    **Aceptado:** 07 de Agosto del 2020    **Publicado:** 10 de Agosto del 2020

**Abstract.** - *The research seminar is a staple in many colleges and typically serves as a link between the researchers' work and the student body. However, more than an outreach activity, we believe that it is an excellent means of motivation, and an effort is rarely made to quantify the success of the program in terms of acceptance within the student body. In the following article we will present the results of a 4-year survey in a multidisciplinary engineering / design / architecture school for a state public university in Mexico. The survey was designed with the intention of quantifying the success of the activity in capturing the attention and interest of the students.*

**Keywords:** Education; scientific research.

**Resumen.** - El seminario de investigación es un elemento básico en muchas escuelas de educación superior y normalmente sirve como enlace entre el trabajo de los investigadores y el cuerpo estudiantil. Sin embargo, más que una actividad de divulgación, creemos que es un excelente medio de motivación, y rara vez se hace un esfuerzo por cuantificar el éxito del programa en lo que se refiere a la aceptación dentro del alumnado. En el siguiente artículo presentaremos los resultados de una encuesta de 4 años en una escuela multidisciplinaria de ingeniería / diseño / arquitectura para una universidad pública estatal en México. La encuesta fue diseñada con la intención de cuantificar el éxito de la actividad en captar la atención e interés de los estudiantes.

**Palabras clave:** Educación; investigación científica.



## 1. Introduction

As our society demands professionals with engineering skills, is important to identify that the attrition rate in engineering schools is significant. Research in this area has presented analysis [1-16], evaluation tools [2-10], and methodologies to [4-6, 12-20] help to understand and mitigate this problem.

The attrition rate can be attributed to diverse factors like, social (ethnicity, sexual orientation and/or identity) [1, 8, 11, 22-23, 25, 27], economic [1, 14 23, 26], personal (lack of belonging, health) [1, 6-8, 11] institutional (poor teaching and advising) [1, 4-5, 11, 13-14, 18-19, 22-24, 26], academic [1-4, 10-11, 13-15, 18, 23, 26-28] and/or, motivational [1-2, 10-11, 19-21. 24]. It is sometimes easier for the facilitators to simplify the problem as a lethargic phase that the student will push through, and if not, then his interest or abilities lie somewhere else. However, in some cases, we can help the student to push through their lethargic phase and turn them instead in a highly-trained professional.

Let us consider a random student, which finds some subjects appealing, and have an excellent performance in it, while disliking, or finding other courses not interesting, meaning, that he does not believe it has any real-world use for it, or find it very difficult, due to gaps in the knowledge required to understand such subjects. This last one is the case for some students when dealing with mathematics and physics [2-4, 6, 17, 26, 28]. Such courses are often the reason for students falling behind and/or dropping out.

The previous case tends to be significant for public universities, where a public entity (maybe the state and/or country) absorbs by far the cost of educating each student, i.e., each student has a cost per semester attributed to it, and so, if a student does not finish his/her studies and earns a degree these resources are effectively wasted.

Is the duty of the school to try to maximize the number of students that earn their degree while maintaining an academic standard?

Many academic programs exist to help students, tutoring hours are available, remedial courses are given, and group collaboration between students is encouraged.

However, as important as these efforts are, the activities that motivate the student, are paramount, and is or our firm believe that the academic and the motivational are intricately linked. A motivated student will surpass any hurdle presented.

Many higher learning schools have a periodic seminar where the students are presented with talks that range from research activities, scientific dissemination, or academic talks. In some schools attending to them is optional, while in other schools is mandatory and can be part of their curriculum.

No evaluation of such activities was found in the literature and we believe that the students enjoy such activities and can have a high motivational impact, and which serves to keep them informed of research scholarships, social service programs, professional bonding opportunities, and/or postgraduate choices.



The results presented in this paper were obtained from polling the audience in such seminars from 2012 to 2016, the specifics are presented in the subsequent sections

### 1. Methodology

The results presented here were collected in the Campus "Valle de las Palmas" of "Baja California State University" (Universidad Autónoma de Baja California - UABC) in particular for the multidisciplinary school FCITEC (Facultad de Ciencias de Ingeniería y Tecnología – School of Engineering and Technology Sciences).

FCITEC offers majors in Bioengineering, Aerospace, Civil, Electric, Electronic, Industrial, Mechanics, Mechatronics and Renewable energy engineering, also Industrial and Graphic Design, and Architecture.

The school opened its doors in august 2009 to the student population of about 600 and 20 full-time academics (FAs), by the summer of 2014 the population had grown up to around 3,500 students and 70 full-time academics plus many partial time lecturers. The rapid increase in the student and faculty bodies made it necessary to establish periodic seminar. By faculty request, a seminar program was established in March 2012 (with around 2,000 students and 50 FAs). The purpose of this activity was to create a periodic forum where the teaching staff could present to the school community their research projects, results, and student collaborations.

In addition, we were trying to foment a program where the student would be able to build the competencies necessary for interactive listening, questioning in a

respectful manner, and the ability to reflect on the connection between the theoretical and practical knowledge presented in the talks.

Due to the geographic location of the university (i.e. travel time), it was necessary to schedule the seminar during the school hours, and so only those students without any activities at that time or those were the teachers permitted the group to assist the seminar, had the opportunity to attend the talks. This greatly impeded us to reach a wider audience. Since 2012 until April of 2016, the seminar has hosted 59 talks and around 4,646 attendees. The topics presented were varied and of interest to the student body.

During the last 41 talks, the total audience was of 3,017 students and 200 teachers/administrative personnel. The students in the audience were surveyed, and the results will be presented in the next section.

As the section deals with statistical results, it is necessary to determine if the number of answered surveys satisfies the minimum statistical sample. To determine this, we use the following equation

$$n = \frac{N\sigma^2Z^2}{(N-1)e^2 - \sigma^2Z^2} \quad (1)$$

Where,  $n$  is minimum statistical sample,  $N$  number of total population (here 3,500), the standard deviation value of the population,  $\sigma$ , is not known so is common use to utilize 0.5 in such cases, for the trust value,  $Z$ , we use the 95% i.e.  $Z = 1.96$  (the usual value) and for the error range,  $e$ , we assigned the middle value for an unknown population, i.e.,  $e = 0.04$  (4%) [29, 30].



To validate our statistical results, we will utilize Cronbach’s alpha [31-35] as given by

$$\alpha = \frac{k}{k-1} \left[ 1 - \frac{\sum_{i=1}^k \sigma_i^2}{\sigma_t^2} \right] \quad (2)$$

where  $k$  is the number of scale items, in this case, the total number of talks where the question was asked in the survey,  $\sigma_i^2$  refers to the variance associated with the answers for each date, and  $\sigma_t^2$  is the variance related to total for each answer.

The values of alpha commonly assigned to evaluate the consistency are shown in table 1.

**Table 1.** Interpretation of the Cronbach’s alpha values in terms of the consistency.

Cronbach’s alpha	Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

A full deduction and discussion about Cronbach’s alpha can be found in the cited references.

## 2. Results and Discussions

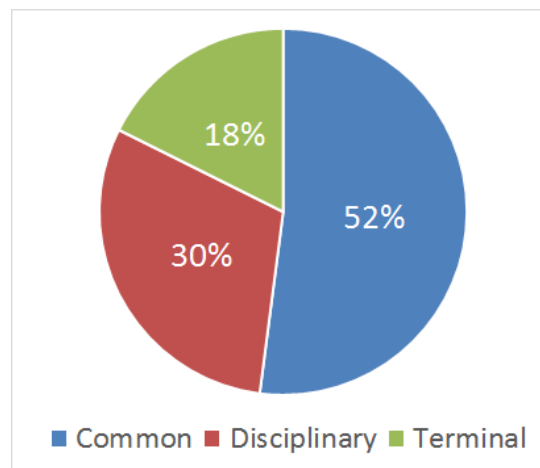
The data shown in this section are the results of surveying the audience in the last 41 talks, in total, we have around of 2,700 surveys, the final tally differs from the final attendance because some participants did not answer or fully answer the survey.

By using equation (1), we determined that the minimum statistic sample for a population of 3,500 students is around 494, far below the number (2,000) of surveys at our disposal; this allows extrapolating the data found here to the full student body.

The results will be presented in four subsections 3.1) Audience, 3.2) Knowledge and attendance, 3.3) Quality, 3.4) Research projects.

### 2.1 Audience

The semesters are academically split into three stages: common, 1st to 3rd semester, where the common courses are taken, and the student chooses their major. Disciplinary, 4th through 6th semester, and the terminal stage is 7th, and beyond, this is where final specialization is chosen.



**Figure 1:** Assistance by academic stage.

Out of the 3,017 student attendees who answered this question, 1,400 were from the basic stage, 816 from the disciplinary stage, and 574 terminal stage, with 227 not registering their semester.



The results are in complete agreement with the number of students in each stage in the school and are encouraging as we can inform the newest students about scientific research activities in the school.

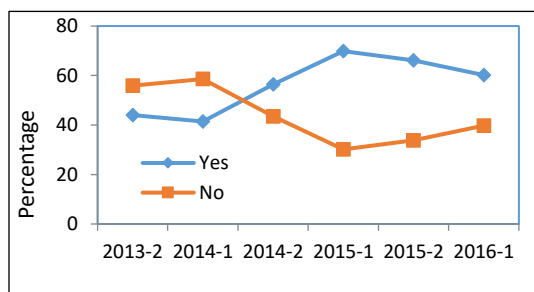
By applying equation (2) to the values used to generate figure 1, we found  $\alpha_1 = 0.9008$  which according to table 1 have an excellent internal consistency

### 2.2 Knowledge and attendance

Figure 2 shows the percentage of attendees who had prior knowledge of the seminar.

We will discuss Cronbach's alpha values for each figure at the end of the section, as the analysis is quite similar for figures 2 and 3.

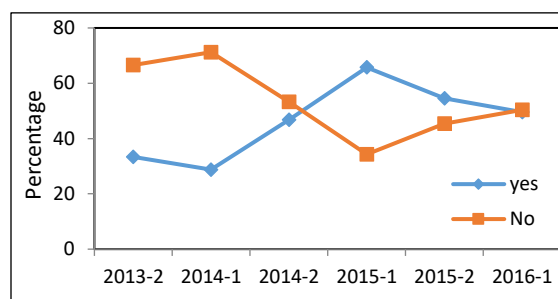
We note that from 2013-2 to 2015-1 the percentage with prior knowledge has continuously grown, and by 2016-1 60.2% of the attendees had prior knowledge of the activity. We consider this extremely important, as per year almost 900 students are freshmen and need to be informed of the different activities available.



**Figure 2.** Percentage and number of attendees who had prior knowledge of the seminar.

In figure 3, we present the percentage of the audience that had attended the seminar previously. We can see that by the end of 2016-1, 60.2% of the attendees had knowledge of the activity, this means that

almost two-thirds of the total population find the seminar interesting enough to participate more than one time.



**Figure 3.** The audience was asked if they had attended before to a talk of this seminar.

The organizing committee must make a greater effort to generate more interest. So, a basic question that must be asked is, how did the students find out about the talk? In figure 4 we present such findings.

We found after analyzing the surveys that most of the students (73%) knew about the talk because of their teachers while 14% because of the notifications posted through the school (around 100 such notifications are posted each talk) while 8% found out by our Facebook page and repost of the information, while 3% by word of mouth.

At this time, is clear that the main way that students can participate in the event is by leave of the teacher from his class, but as we see 25% of the student participated out of their free will, this is very encouraging. We believe that by using electronic publicity, like social networks, we can reach an even broader number of students, in this we propose the addition of students as their input would be of great value in managing the information in social media; we recommend the use of focus groups.

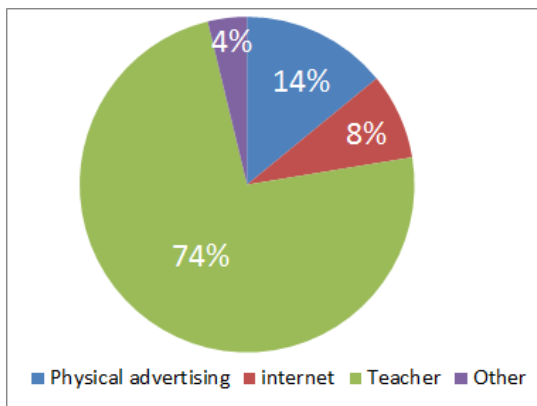


Figure 4. Ways the audience learned of a talk.

The values for the Cronbach’s alpha for each figure are  $\alpha_2 = 0.6091$ ,  $\alpha_3 = 0.2833$ , for figures 2 and 3, respectively, both number significantly low, as presents in table 1, in particular for  $\alpha_3$ , we believe that this due series of factors. First, the literature [31-35] is clear that the Cronbach’s alpha methodology is not particularly good at assessing a small number of questions (2 possible answers: yes or no) for a set of items (in our case, talks). Second, the information presented here is skewed, as we were only asking for “knowledge and attendance” of those already participating in it. A more consistent result should include responses for a random group of students. Nevertheless, we include these results because it shows some interesting information and allows discussion and the methodology and can be of some help for future works. Cronbach’s alpha for the data presented in figure 4 is  $\alpha_2 = 0.9815$ , which shows excellent internal consistency.

### 2.3 Quality

We quantify the quality of the talks presented by asking the student to rate, the speaker (figure 5), and subject matter (figure 6) using a 5 point Linkert scale,

where 5 is the best review and 1 the worst. The Cronbach’s alpha for both sets of data is 0.9806 and 0.9831, respectably.

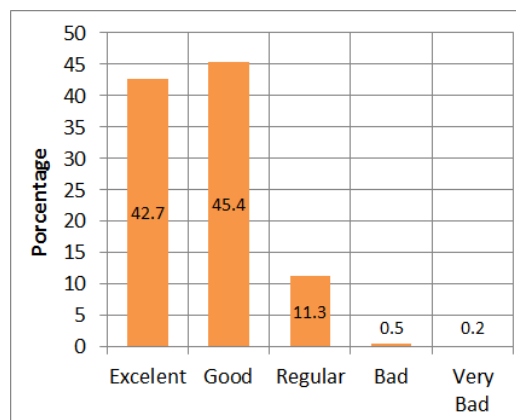


Figure 5. Audience grading of the 40 speakers in a 5-point scale.

Figures 5 and 6 show a very favorable reception from the student to the speakers and the subject matter of the talks. This shows the organizer that a careful selection of the speakers, topic, and importantly the level at which the information was presented, we try to keep the information at a level adequate for a third-semester engineering audience.

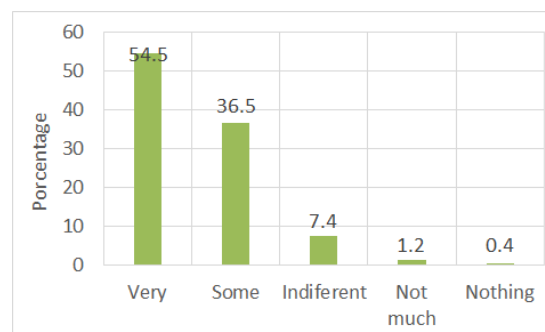


Figure 6. Audience grading the 40 talks in term of their appeal.

We believe that the social media can help to get additional comments about what types of talks the students would like to receive and would allow focusing the activity to the





liking of the students, so they can increase the total attendance

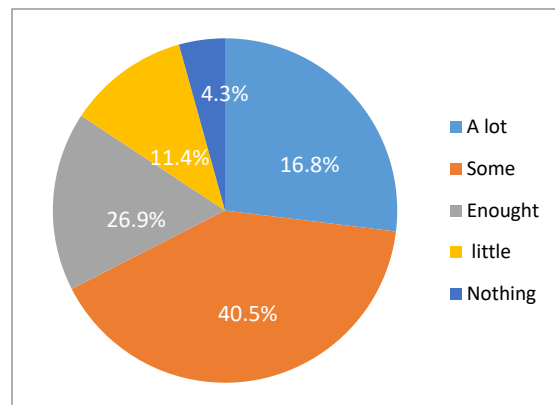
### 2.4 Research projects

We believe that scientific research and the dissemination of it can have a positive impact on the academic life of many students, but sometimes we forgot that some students may not have prior knowledge of the existence of research activities in our schools or that they can actually participate on it. As part of the purpose of the seminar, we are interested in informing the student body about those research opportunities, and the many options available to them, including research grants, thesis opportunities, internships in companies, summer schools, and many others.

We asked the attendees if they knew that there are research activities in FCITEC? and found out that the attendees have knowledge of the existence of research activities in our school, is very interesting that 78.2% of the students have this information, this number has changed very little over the semesters, so a lack of knowledge in this area, appears not to be a significant obstacle.

The students know that research is been done in their school, but we wonder if do they know that some of those projects have scholarships associated with them? We ask the polled students this and found that of the 2,773 polls, only 54.6% answered yes. This result is not entirely unexpected, as FCITEC is a new school, many of the activities do not have immediate recognition by the community. But we find it very encouraging that the percentage has been growing as the years go by meaning that the information has been reaching more and more students

and we believe that the seminar has been playing a big part.



**Figure 7.** Evaluation of the interest generated thru the talk to join a research project

Figure 7 shows the results as presented by the survey, again by assigning a numeric value of 5 to "A lot" and 1 to "nothing". The results tell us that 16.8% of all the students want to participate in research activities, this is very encouraging, and a way should be found to try to include them. This item is our survey and it was found out to have a Cronbach's alpha of 0.9815.

It is clear to the authors, that figure 7 is not enough to validate if the research seminar influenced the research activities, at the time of the study no information was available to us to explore this question.

### 3. Conclusions

We have shown statistical results from a survey applied to the attendees of the research and diffusion seminar at FCITEC, from august 2013 thru April 216, approximately 2,700 surveys were collected.



The results presented have shown that students have found talks interesting and because of them have considered joining (or joined) research activity, in the different modalities that UABC offers. The analysis also reveals that the main way the audience has found out about the talk calendar is by their teachers. Here we recommend using more and more the use of social media.

We showed that the seminar has had a positive effect, as the interest of students to join research projects has more than doubled in 2015 with respect to those reported in 2014.

### Acknowledgements

The authors of this paper would like to thank the many students that were graceful enough by answering our survey.

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