



# EDITORIAL

## The reality of Engineering Research Methodology

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Editor

In Perú, there are many experts on Scientific Research Methodology, however, a few of them are Engineer. Furthermore, most of the books of research methodology (for example [1], [2]) are focused to social science and contain insignificant quantity or nothing of engineering problems, thus, the methodology concepts are only in theory level in Engineering. As consequence, the engineering students have difficulties to elaborate a research project because the miss of handbooks and guides in a suitable methodology for Engineering. The problems to apply an Engineering Research Methodology are many. These problems and the criterions to consider to face them are shown as follows.

The first problem is the confusion in applying the measurement instruments, for example, if the energy efficiency is evaluated in a mechatronics system, the instruments cannot be questionnaires or interviews, they have to be instruments that measure the input energy and the usable work produced by the system; these instruments are not designed or validated, as it is made with questionnaires or interviews, because the factories supply them ready to use in the laboratories, although, they have to be selected.

The second problem is the confusion in the data analysis. In this stage, generally, the objective is to know the correlation between variables and if it is positive or negative; however, in engineering, the existence of positive or negative correlation is known in most of the problems because the knowledge of physics and chemistry sustain this, thus, the research have to be oriented to obtain the mathematic model based in physics and chemistry to describe the phenomenon. For example, obtain the relation between the air flow in a solar collector and the quantity of absorbed energy by the air; it is known for transfer heat theory that more convection heat transfer is obtained when the air flow increase, but, the mathematical model has to be identified (define structure and calculate parameters) to describe the behavior of the solar collector respect to the variables in study.

The third problem is a different treatment to take the samples. For example, when the resistance of a new composite material wants to be known, specimens of the material have to be subjected to tension, flexion and compression testing. In this case the samples are the specimens and the population are every composite material with structure between the characteristics of the new composite material. Therefore, the population is infinite. This is untypical in examples of research methodology books.

The fourth problem is that normally the engineers create its problem solutions in the field of Engineering, therefore, the engineering students tends to do that. However, most of the books of research methodology do not clarify in what stage of the investigation methodology the solution is created. A research method is used in Engineering called the Technology Research [3] - [5] or Technology Development but this theme is taken just a little in the books. Many of



the thesis and research made a design of a prototype, software, structure, and others for a particular case [6] – [9]. These thesis and research are Technology Developments that follow a Design Methodology, for example: a necessity is identified that will be the problem, a research of the current solutions of related problems is performed, solutions are proposed, the best solution is selected using calculus to evaluate them, the solution is implemented in simulation or in a prototype, and finally, the solution is evaluated.

It is important to take into account these criteria at the moment to apply a Research Methodology for Engineering, thus avoid complications and in the worst case restart the research.

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