A Strategy for Faculty Enhancement Related to
Scientific Publications

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Abstract

This paper reports on an initiative to strengthen the research activities of engineering faculty at the University of Puerto Rico at Mayaguez. As a specific objective the project attempts to improve the number and quality of publications in peer-reviewed journals by young members of the faculty. A diagnosis carried out shows that young researchers are not trained to be independent researchers during their Ph.D. studies in the United States, and that important decisions are made by their advisors, so that they are not even aware of the existence of various problems. The activities implemented by the first author under this initiative include a workshop for a small number of participants. The theme of the workshop is the publication process and the topics are grouped in three main parts: the manuscript, the evaluation of a manuscript, and conflicts in the publication process. The publication process is here seen as a way to enter into a more profound set of problems frequently found in young researchers which may cause difficulties in their activities and production. Thus, the workshop also introduces the participants to problems related to the history of science, philosophy and methodology of research, ethical dilemmas that arise in research, and aspects of sociology of the publication process. During the workshop the participants also work on a manuscript reporting a research already carried out by them. The initiative has been running for three years, and an initial assessment shows a clear increase in the motivation of the participants towards research activities and an increase in the publication of papers.

1. Introduction

The Engineering School of the University of Puerto at Mayagüez (UPR-M) has been concerned for some time about increasing the publication of research papers by the faculty. A significant increase in journal papers has been achieved in recent years, as shown by information obtained from the Science Citation Index, but the university administration expects to improve the present situation [9].

Almost all assistant professors in the Engineering School at UPR-M obtained a Ph.D. in the US, so that they have already carried out research leading to an original contribution to their field. However, this is not reflected in the number of publications that they produce during their tenure-track period. Let us consider how a young researcher in engineering is trained. In a typical situation, the graduate student studies with a well established professor in the US. The topic of the research is defined by the advisor, together with the hypothesis, and many other aspects of the research. This means that the graduate student performs the activities of a research which was planned and designed by someone else. When the research yields a new contribution, the advisor writes a paper (co-authored with the student), sends it to a journal, and discusses with the reviewers. The graduate student is not trained to become an independent researcher at the completion of the studies, because he/she has been considered more like a research assistant. The young person joins the university but the results of research and the communications of findings take a very long time.

The needs detected by the authors in this area are not just problems of technical writing, but include different aspects of the research process. How can this situation be modified?

This paper reports on an initiative oriented to modify the situation depicted above. The strategy followed is to focus on the process of publication as a way to access to other problems and thus try to make explicit to the young professor what elements would help in his/her research and communication of results.

The goals established by the university administration were to motivate a change in the attitude of the faculty towards research activities and communication of results, so as to promote a situation of self-confidence and self-motivation. More specific objectives were established for this project, including

- To stimulate the development of a critical point of-view in the research work.
- To develop the ability to write a paper with high chances of being accepted.
- To visualize and solve conflicts associated to the publication process.
- To train in the review of scientific and technical papers.

2. Methodology

Traditional approaches in this field consist in providing training in technical writing (see, for example, Brusaw *et al*.[3] , Day [6]). The emphasis is placed on writing aspects, but other perhaps more important areas are left out of the discussion.

In this project we attempt to include topics related to the research process itself, including the presentation of the main concepts, the evaluation of a manuscript, the conflicts that arise, the discussions, the value of argumentation, etc. Thus, it is necessary to go into the work of the researcher and his/her relation with the environment.

The approach followed is centered on a workshop and backed by several additional activities described in Section 4. The initial activity with the young faculty is a workshop on the process of publication in engineering, which is taught by the first author. There are only six participants in each version of the workshop, which lasts for 25 hours of direct contact plus several hours of individual work done outside the classroom. The participants are first interviewed and fill a questionnaire which is used as a diagnosis of the situation.

The name of the workshop has involved over time. In 1997 it was called "Peer-Review Workshop" and the present it is called "Workshop on the Process of Publication in Engineering". The workshop is framed on a wider activity called "Initiative to Strengthen the Publications in Engineering Faculty" which is directed by the Dean of Engineering.

3. Contents of the workshop

The workshop has an open structure formed by units. During the first unit the activities are centered on reading, analysis of texts, and writing using papers by other authors as basic elements. Arguments and discussions are built using such texts. As the workshop progresses, each participant uses his/her own manuscript.

The contents of the units have been grouped in three parts: the first part deals with the publication itself, its importance, historical evolution, structure, and contents. The second part focuses on the critique and evaluation of the manuscript by peers. The third part is about the conflicts that occur during the process of evaluation (peer-review), and the consequences that this may have in a young researcher.

Each unit is centered using an organizing question. The questions chosen for discussion and reflection are:

- What are the main features of scientific and technical research in Engineering? [8, 14]
- Why is communication so important in Science and Engineering? [4]
- What forms of scientific communication existed in the past? [21]
- What forms exist today?
- What forms will exist in a near future? [21]
- What is the internal structure of a paper? [3, 6]
- How do different persons write?
- What criteria are employed to evaluate a manuscript? [5, 15, 26]
- Are there techniques to evaluate a manuscripts? [16]
- How are reviews done in practice? [5, 15, 16, 26]
- What differences are found between the evaluations of papers and books?
- How to handle a positive evaluation?
- How to handle a negative evaluation?
- What ethical problems may arise in the publication process? [17, 18, 19]
- Is peer-review an objective and trustable process? [11, 12, 13]
- How can one prove that a piece of knowledge is true? [2, 7, 8, 14]

- What social impacts can publications have?

The literature employed for the units are listed in the bibliography. Each unit focuses on one question. Following a presentation by the author, the group discusses the topic and then proceed to work on a specially designed activity. For example, for one unit we have developed "the game of the journal", in which three fictitious journals are established and the participants play the role of editors, reviewers, and authors, in order to get acquainted with the different perspectives of the stakeholders. This also serves to train the participants in the process of evaluation of a manuscript, to establish criteria about acceptance, to identify original aspects in a manuscript, and to show differences in criteria and conflicts between the participants.

4. Other activities within the initiative

The workshop is supplemented by additional activities, as illustrated in the figure.

- Expert-novice tutorials consist in a personalized strategy which centers on the specific case of a young researcher. Although it is a very expensive in terms of the human resources required, it is highly effective. The expert needs to get involved into the research of the novice, so as to help in the identification of opportunities of publication, originality of the contributions, etc.
- An internal peer review system is established with the participants of the workshop. This provides a friendly review with a constructive approach before a manuscript is sent to a more demanding and competitive review.
- A distance-learning approach is now in the process of implementation, based on the experience of several editions of the workshop. At present the material is in written form [10], but it can be transformed into an interactive resource (either CD-Rom or Internet).
- Additional help in terms of technical writing is also offered to the young researchers by means of seminars to facilitate writing, technical style, influences, and limitations of models.
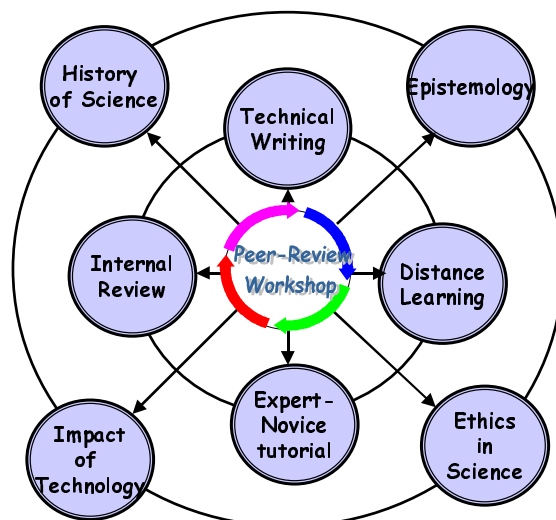
The activities in the second circle have not been implement yet. They are oriented to provide a deeper understanding of different aspects of science.

5. The philosophy of this initiative

As mentioned in the introduction, a paper is here seen as a concrete object which emerges out of a research. From this object it may be possible to reconstruct the complete process of research. Any stage which is not successful in the research process will be negatively reflected in the manuscript produced. For example, a weakness in the formulation of good motivating questions at the beginning of the research will affect the quality of the research done. But the methodology, the research activities, and the process of assessment are not the only aspects reflected in a scientific paper. There are also contributions from other fields, such as the construction of knowledge in the engineering discipline in which the research is carried out; links between the research and ethical issues; philosophy and history of science; the relations between science, technology and society, and several others. For example, a researcher may know about the recent state of the art in the topic of the research, but he/she also needs to understand the historical evolution of the discipline. A similar situation arises with respect to the insertion of a research line within a certain paradigm (as meant by Kuhn [14]) and the consequences that this may have for the evaluation of a manuscript.

The following two approaches are employed in this work:

a) A systemic approach.
The advantage of using the publication as a "process" (as opposed to working with a paper as a "thing") is that one can now identify situations, problems, and conflicts involving the authors, editors, reviewers, and the scientific community. Such situations contain aspects which may be ethical, philosophical, historical, cultural, besides the contents of the specific discipline to which the manuscript refers. The process of publication is here thought as a system. Familiarity with such a system may help the young researcher to break some barriers which would otherwise appear to be insurmountable.

b) A constructivist approach
The project has been framed within what is known as a constructivist approach (see Ashman & Conway [1], Duschl & Hamilton [7], Piaget [20], and Vygotski [22]). The main assumptions of the constructivist approach [23, 24] are: (i) Knowledge is a construction of the person; (ii) This construction is an active process; (iii) This activity of the person occurs in a context of cooperation with others; (iv) This activity is influenced by the historical and cultural environment in which the person learns.

Furthermore, the concept of "zone of close development", due to Vygotski [22], is also central in this approach. A group of participants working together with different levels of experience will take the novice to a higher level than what would be reached by the person alone.

6. Diagnosis at the beginning of the workshop

At the initiation of the workshop the participants are interviewed and complete a questionnaire regarding their needs and expectations associated with the workshop.

The deficiencies and fears identified can be grouped as fear to make a mistake in public; to produce something which is not up to the state of the art in the field; and to write.

The expectations identified are: to break the ice and start a new stage regarding publications; to identify the weaknesses and to correct them; to improve their approach towards the research; to plan the research in such a way that writing a paper would be easier at the end; to improve on how to focus on something all the time so as to obtain useful results; to make a gradual progress regarding publications.

Other topics identified as deficiencies include how to write something which will be of interest to an audience; to limit the scope of a paper; to feel comfortable about writing a paper; to learn if there are formats which have proved to be successful; to write something that is coincident with what he/she wants to communicate.

The reasons why the young researcher wants to publish include to gain recognition in the field; to progress in the academic career; to establish relations with others in the field; to obtain founding for further research; to spend more time doing research.

7. Evaluation of the workshop by the participants

The workshop is evaluated using an instrument with some multiple-choice questions and some open questions. Some important aspects reflected by the evaluations are:

- 36% of the participants said that they were not familiar with the material discussed, 55% were moderately familiar, 9% were familiar, and 0% were very familiar.
- 73% responded that the work done would be of top help to increase their productivity in terms of research paper, 27% it would be of a great help; for 0% it would be of intermediate or no help.
- The motivation to get involved in activities associated with publications was increased in 90% of the participants; and remained the same in 10% of the cases.
- The benefits from the participation in the workshop were identified as "outstanding" in 55% of the cases; "high" in 45%; and "intermediate" or "low" in 0% of the cases.
- 100% of the participants considered that this kind of workshop should be offered on a regular basis to all professors.
- 100% stated that would recommended this activity to his/her colleagues.
- At the end of the workshop, 40% considered that were "very close" to completing the paper in which they worked ; 30% were "close"; 30% were about half way; and 0% responded that that were "far".

8. Conclusions

The main conclusions obtained from this experience can be summarized as follows:

- The workshop has been a motivating activity to help the participants work toward writing journal papers.
- The participants were satisfied with the type of training received and would recommended the activity to others. This is expected to have a multiplying effect in the faculty.
- Part of the effectiveness of this proposal is because it is offered by engineers for engineers. This is a way to help the young professors to discuss their problems with someone who shares their background. Most engineers do not trust help offered to them by professionals from the social sciences.
- An effort needs to be made by the participants to incorporate philosophical and epistemological dimensions as part of a mental structure which is used to deal with technological problems.
- The development of general techniques to analyze situations was found very useful for the assessment of a manuscript.

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