

# Interdisciplinary Research Project Management

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**Abstract.** In this paper a general methodology to perform interdisciplinary research is proposed aiming to maximize the results from a University point of view, which includes the educational perspective. Project Management concepts and techniques serve as inspiration to the methodology, while problem-based learning supports the educational perspective. The methodology also highlights the matter of innovation, technology, economics and social development.

**Keywords:** innovation, interdisciplinary research, methodology, problem-based learning, project management.

## 1. Introduction

Is science becoming more interdisciplinary? According to Porter and Rafols [1], the answer is yes. If we consider that researchers and professors are increasingly demanded for productivity, then a strategy to maximize their research results is desirable. This paper attempts to provide that strategy for real problems in an interdisciplinary approach.

In an educational environment such as a University, at some point a research shall become part of learning activities. Because of the growth in the field of interdisciplinary research, a natural question arises: should interdisciplinary research begin in undergraduate years? In a correspondence to Nature [2], Tong states that:

*Making the transition to postgraduate research from undergraduate modules is not easy and is not necessarily successful at present. Earlier engagement with interdisciplinary research methodologies and results is likely to reveal fresh horizons to the next generation of scientist.*

An example of that trend is the University of California at Irvine Summer Undergraduate Research Experience program. Their findings offer evidence for the efficacy “for training undergraduate students in transdisciplinary concepts, methods, and skills that are needed for effective scientific collaboration” [3]. Another example is the didactic graduate course “Building interdisciplinary research models” offered by the Schools of Nursing and Public Health at the Columbia University, New York. They conclude [4]:

*What is needed now are specific tactics and action plans to prepare faculty for what is, for some of them at least, a new way of working and thinking.*

As far as the author knows, some strategies for interdisciplinary research have been proposed. However, their application is restricted to specific fields. In [5] de Vries et al. proposed a framework for using TRIZ in a co-disciplinary design environment of electromechanical products. For a clinical service organization, King et al. [6] proposed a framework of operating models for interdisciplinary research programs. In an agricultural research context, Nuijten in [7] proposed a combination of natural and social sciences research

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styles. Wild in [8] proposed a systematic framework for supporting cross-disciplinary efforts. Also, Wilson [9] exposed the interdisciplinary research and publication opportunities in information systems and healthcare.

Differently from the cited frameworks or research methods [5]-[9], this work proposes a general methodology for interdisciplinary research to increase productivity in a University context that may be combined to them, and it suggests a natural way to incorporate the interdisciplinary research in educational activities. Additionally, it shall facilitate the transition to postgraduate research from undergraduate modules when applied in both levels, as highlighted in [2]; it shall be useful for training undergraduate students in interdisciplinary methods, which is an objective in [3]; and it may help faculty for “a new way of working and thinking” to do interdisciplinary research, as a necessity concluded in [4].

The author organized this paper in accordance to the IMRAD structure: introduction, methods, results and discussion; which is adopted as part of the Uniform Requirements for Manuscripts Submitted to Biomedical Journals of the International Committee of Medical Journals Editors, 2008 update. The author believes that adopting this structure would help search engines in international databases to store and to retrieve information within research papers in order to facilitate meta-analyses and systematic reviews.

## 2. Methods

In order to elaborate a methodology to maximize results in an interdisciplinary research, an approach to innovation in interdisciplinary research and a schema for an interdisciplinary approach of a real problem are presented, which combined to Project Management concepts [10] and through a problem-based learning approach [11], [12] produce an Interdisciplinary Research Project Management strategy.

For an interdisciplinary research, the approach to innovation in this work must be considered in the context of a real problem. The proposed approach has three phases, which are represented in Figure 1. Given a real problem, in the first phase, two or more fields shall be considered to be applied in its solution. After choosing the fields to approach the problem, in phase two, the researcher or group of researchers shall try to elaborate a new fundamental or methodology based on their knowledge of the select fields. If somehow the combination of two or more concepts of different fields generates a new fundamental concept to the problem or a new methodology to approach it, then its application to the real problem is phase three, which is an innovation that may produce a new technology.

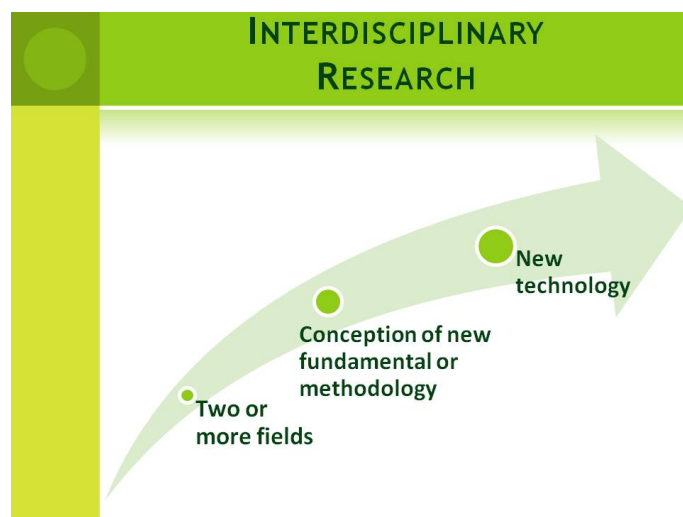


Fig. 1: Approach to innovation in interdisciplinary research.

Still in a real problem context, a new interdisciplinary approach to a real problem is interesting, even if it does not produce a new result because it shall be used as a study case for a problem-based learning approach in a classroom at the University level, as in Figure 2, and the classroom experience with the new approach shall be published. Nevertheless, also in Figure 2, the new interdisciplinary approach shall produce

publishable new concepts, and their application may induce the development of a new technology, that may be published too. Finally, the use of this new technology may promote economic or social development.

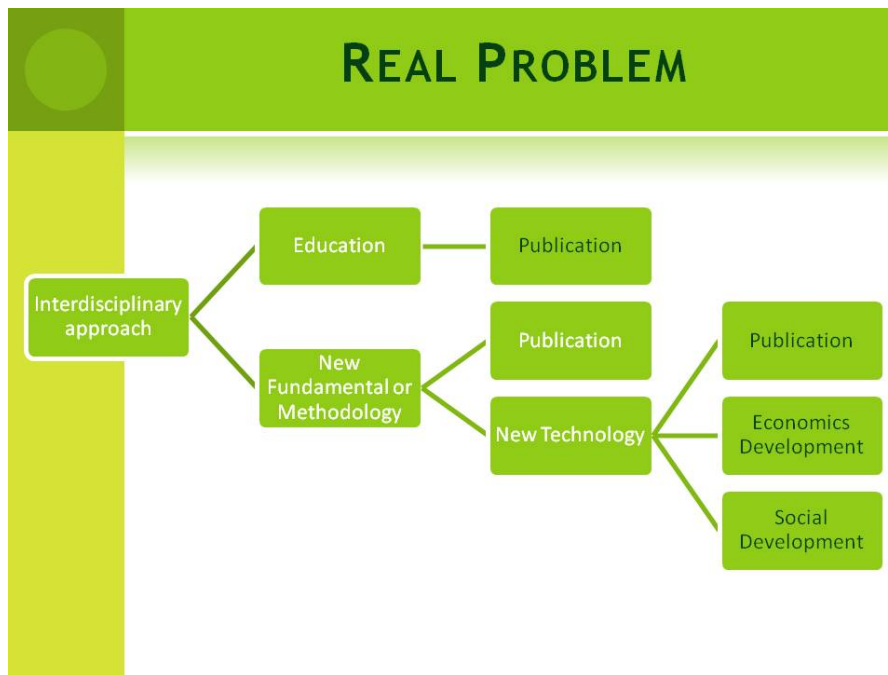


Fig. 2: A schema for an interdisciplinary research of a real problem.

Therefore, a suggestion to accomplish the education part in Figure 2 would be to apply a Problem-Based Learning (PBL) approach. According to Savery in [11]:

*PBL is an instructional (and curricular) learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem.*

Additionally, let us briefly review the Project Management phases of the Project Management Body of Knowledge (PMBOK):

- Initiation: to determine project goals, deliverables and process outputs, to document project constraints and assumptions, to define strategy, to identify performance criteria, to determine resource requirements, to define the budget and to produce a formal documentation.
- Planning: to refine project, to create a work breakdown structure (WBS), to develop the resource management plan, to refine time and cost estimates, to establish project controls, to develop the project plan and to obtain the plan approval.
- Execution: to commit resources, to implement resources, to manage progress, to communicate progress and to implement quality assurance procedures.
- Control: to measure performance, to refine control limits, to take corrective action, to evaluate effectiveness of corrective action, to ensure plan compliance, to reassess control plans, to respond to risk event triggers and to monitor project activity.
- Closing: to obtain acceptance of deliverables, to document lessons learned, to facilitate closure, to preserve product records and tools, and to release resources.

### 3. Results

Inspired by project management concepts and phases in combination with the proposed approach (Fig. 1) and schema (Fig. 2), a methodology for interdisciplinary research is presented in Figure 3 that shall maximize results from a University point of view.

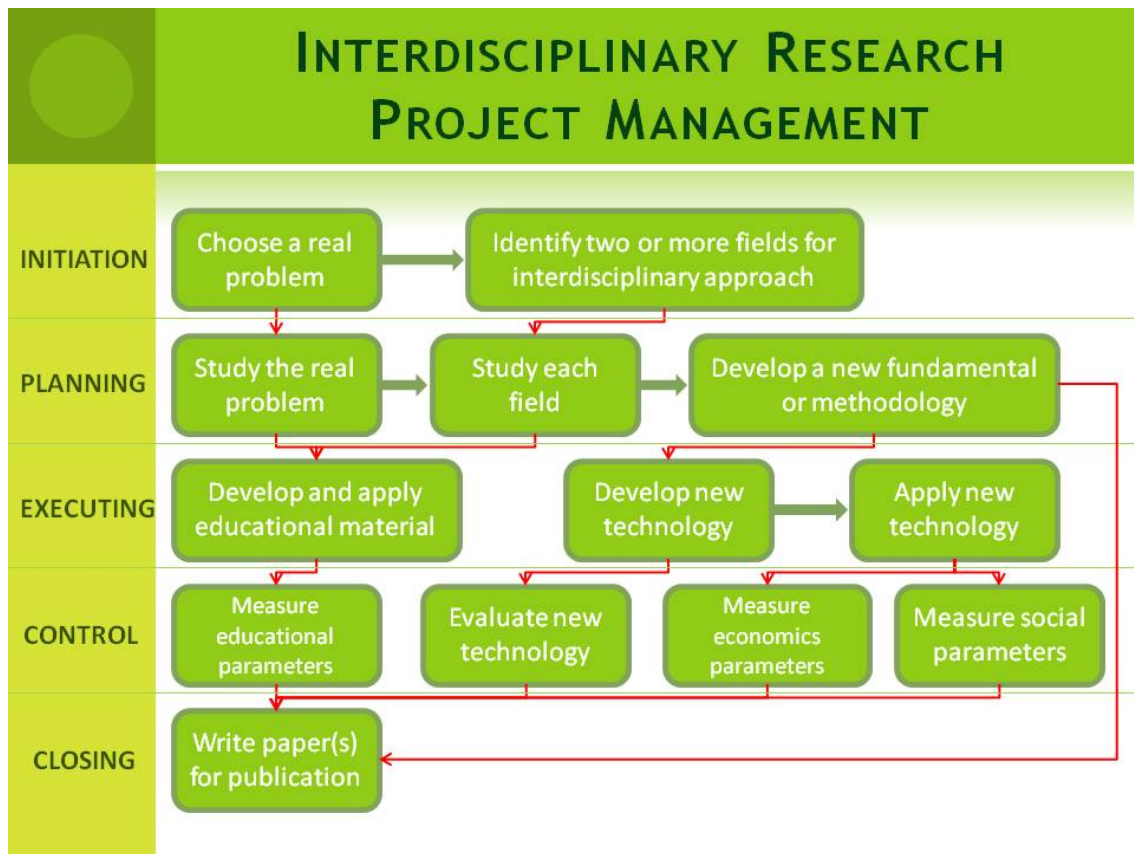


Fig. 3: The Interdisciplinary Research Project Management model.

In Project Management, in the Initiation phase the determination of the project goals are performed, deliverables and process outputs, or let us say to choose the real problem to solve. And to understand what its solution is, it shall be useful to identify two or more fields for an interdisciplinary approach, in order to document its constraints and assumptions, to define strategy, to identify performance criteria, to determine resource requirements, to define the budget and to produce a formal documentation. It is worth to highlight that in some real problems it may be a requirement to have an interdisciplinary approach.

The Planning phase consists of refining the project and to do that a more profound study of the problem and the chosen fields may be performed. These studies shall promote a new fundamental or methodology. Therefore, in the executing phase, an educational material may be prepared and applied in a classroom for a PBL approach, even if new concepts are not generated. Clearly, if they are developed a new technology may be developed and used.

If in the Planning phase controls are established then educational, technology, economics and social parameters are defined and available for measurement, allowing the Control phase to be performed. Finally, depending on the results of the measured parameters papers may be written, at that would be the closing phase.

#### 4. Discussion

This work proposes an interdisciplinary research methodology that aims to maximize results, or more specifically papers, which shall be called Interdisciplinary Research Project Management. Although the name suggests that it is merely the application of Project Management techniques to an interdisciplinary research, because of the approach and schema presented in the section 2 – Methods, it is actually a model to be used to real problems that may or not require an interdisciplinary approach. An example of the use of this model is the project presented in [13].

This model shows that it is possible to obtain up to five papers in case of success and at least one paper otherwise. Of course, depending on the size and quality of results more papers may be produced and the model works as a guideline for the possible ramifications of interdisciplinary research in general.

Additionally, the model shall be understood as a strategy to work with interdisciplinary problems, in particular for a Doctorate project, where its application may increase the successful conclusion probability of a PhD candidate.

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