

# Student-Centered Approach for Facilitating Interdisciplinary Research Collaboration within Academia

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## 1. Introduction

The objective of this paper is to summarize the current state of knowledge regarding the facilitation of research relationships and interdisciplinarity collaboration within academia. Barriers are also identified for each endeavor.

## 2. Student Research

“If you persist, you will get that research job [...] No single strategy always works – expect some rejections, but take them in stride. [...] Realize that some researchers have already made commitments to other undergraduates, some are planning to be on sabbatical or be away for the summer, and others are not yet sure what their summer research plans will call for.” (Targan, 2016). This a direct quote from an article written by an associate dean at Brown University on [How to Get Involved in Research Projects as an Undergraduate](#). . Every major US college has an article to guide undergraduates toward a research position similar to the Targan article. The words shown above showcase a level of confusion that results in a culture of “taking shots in the dark” which is pervasive throughout academia within the United States and perhaps globally to some degree.

The current state not only stagnates student progress, but also has an effect on faculty, the university, and the academic community at large. “The research process impacts valuable learning objectives that have lasting influence as undergraduates prepare for professional service. Faculty members at teaching intensive institutions can enhance learning experiences for students while benefiting from a productive research agenda. The university in turn benefits from presentations and publications that serve to increase visibility in the scientific community” (Petrella and Jung, 2008).

## 3. Defining Interdisciplinarity Collaboration

The most frequently cited definition for ‘interdisciplinary’ amongst the publications is that the result of this type of collaboration, unlike a multi-disciplinary collaboration, “may forge a new research field or discipline” (Facilitating Interdisciplinary Research, 2005). Most of these publications draw from this seemingly accepted definition to go into more detail, such as saying that the “interdisciplinary mode of collaboration differs from the “divide-and-conquer” approach inherent within multidisciplinary collaboration, in which experts work in their own domain and then pass work off to the next expert; instead it requires individuals to cross disciplinary boundaries to synthesize new knowledge through a dynamic exchange of ideas and information” (Richter and McNair, 2009). Another publication mentions that “Such collaborations [...] operate in a dynamic, integrative mode of continuous learning and exchanges of ideas and information” (Richter and Paretto, 2009). One publication, for the sake of application, summarizes that “interdisciplinarity has been defined in a variety of ways [...] but they are all underpinned by a philosophy of inclusivity. Fundamental to inclusivity is the principle of collaboration and therefore engagement with the topic at hand as a team” (Prpic and Hadgraft, 2011).

Of the definitions set by these publications, minor deviations of the Richter and McNair description seems to appear the most frequently, although never cited to any particular source. ‘Divide-and-conquer’ is frequently used to describe multidisciplinary collaboration, primarily in a negative light. The most commonly cited definition for ‘multidisciplinary’ amongst the publications is that during this type of collaboration “researchers/disciplines join together to work on a common problem, then split apart unchanged when work is finished” (Borrego and Newswander, 2008). The implication cast by many of the publications regarding multidisciplinary collaboration, is that is a wasted opportunity for research development.

#### **4. Need for Interdisciplinary Collaboration**

Of the many voices calling for the acceleration of interdisciplinary collaboration, the most cited seems to be publications by the US government. One article states that “the government has expressed a need for engineers to engage in interdisciplinary collaboration through several government reports, including Facilitating Interdisciplinary Research [1] and Rising Above the Gathering Storm [2]. These reports, as well as the National Academies of Engineering’s Educating the Engineer of 2020 [3], recommend introducing undergraduates to interdisciplinary learning” (Richter and McNair, 2009). An emphasis on incorporating interdisciplinary collaboration at the academic level seems to be a consistent recommendation across the state of knowledge. The Richter and McNair article gives some background on the need for this type of collaboration by stating that “in recent years, engineering has begun addressing challenges that cannot be addressed by any single field. For example, efforts in sustainability, such as developing alternative energy sources, managing with global climate change, and providing potable water, all require the skills and knowledge of professionals from multiple engineering fields as well as fields as diverse as ecology, political science, management, sociology, and economics. To develop solutions to these challenges, these individuals will need to collaborate in complex ways by integrating the knowledge and perspectives from all the disciplines involved” (Richter and McNair, 2009). In the government sponsored article ‘Facilitating Interdisciplinary Research’, the literature states that “individuals who are conversant in ideas and languages of other fields [are] central to the continued march of scientific progress in the 21<sup>st</sup> century” (Facilitating Interdisciplinary Research, 2005).

#### **5. Barriers to Interdisciplinary Collaboration**

Although the need for interdisciplinary collaboration seems to be clear, properly facilitating the practice seems to be a challenge, especially within academia. One article states that “simply putting [...] students into interdisciplinary teams is not itself sufficient” (Richter and McNair, 2009). This seems to be an issue restated across the state of knowledge. Despite the resounding need, achieving interdisciplinarity in collaboration seems to be a paradigm shift that is not easy to make for professionals or students. Multiple barriers to student interdisciplinary collaboration have been identified in the state of knowledge. One article states that some of these barriers include “student [lack of] ability to: identify the contributions of multiple fields to a given complex problem; value the

contributions of multiple fields; identify the information needs and constraints of experts in other disciplines to insure effective collaboration; integrate approaches and expertise from multiple fields in a synthetic way; learn from both the methods and content of other disciplines to both contribute to the project and inform future work” (Richter and McNair, 2009).

In order to explain this phenomenon, the state of knowledge seems to have accepted the term ‘disciplinary egocentrism’. Disciplinary egocentrism “is a[n] [...] individuals’ inability to think beyond their own perspective [...] For example, a materials engineer might mistakenly assume that she has nothing to contribute to the design of a water purification system because that is the domain of civil engineers; similarly, an electrical engineer might assume that LCA has no relevance to his major because his work involves only designing circuits, not manufacturing them” (Richter and Paretti, 2009). Another key barrier within academia is that “often interdisciplinary teams lack the same kind of shared physical space [...], such as student lounges or common study areas, and conflicting course schedules can make it more challenging to schedule out-of-course meetings (Richter and McNair, 2009).

## 6. Breaking Barriers

Though there is a volume of barriers to interdisciplinary collaboration presented by the state of knowledge, its contributors present just as many, if not more potential solutions. One such solution suggests asking students who are forming a new interdisciplinary group to “rank items needed for survival in situations such as a plane crash, desert, or wilderness [...] Each participant is asked to produce his or her own ranking privately, and then small groups come together to negotiate a group list. The exercise is particularly useful in promoting interdisciplinary collaboration because it can highlight the ways in which different areas of expertise provide necessary insights” (Richter and McNair, 2009). Methods such as this allow students to get a better understanding for the perspectives and values of another discipline, while also keeping the process light and entertaining.

Another proposed solution is to utilize “analogical and constraint-based approaches to [ease] disciplinary border-crossing” (Geller, Dreyfus et al., 2013). This article describes a biology student named Hollis who is having difficulty jumping “across what she perceived to be a large conceptual gap between physics and biology” (Geller, Dreyfus et al., 2013). The proposed solution is to give her a way to “draw upon other resources that [she] possess for bringing physics and biology into contact. In modeling the cell membrane as a capacitor, for example, Hollis is able to leverage her substantial biological knowledge in a way that makes the capacitor analogy immediately meaningful. [...] The capacitor analogy not only allows Hollis to make sense of a capacitor’s properties in a way that is more meaningful to her, but it also allows her to more easily question the limits of the analogy itself. Her familiarity with the cell membrane affords her the opportunity to search for ways in which the capacitor model could be extended and the mappings could be made more clear, and in so doing she may actually gain a deeper appreciation for the modeling process generally” (Geller, Dreyfus et al., 2013). Developing analogies such as this for other disciplines would help address disciplinary egocentrism by allowing “students to make interdisciplinary connections directly and without the need for extensive deduction” (Geller, Dreyfus et al., 2013).

Addressing technology and space issues, another proposed solution suggests “introducing tools such as common server spaces for file exchanges, chats or online discussion forums for meeting minutes and collaboration, and providing neutral central locations for teams to meet can be invaluable in promoting successful collaboration” (Richter and McNair, 2009). Currently these aspects are left up to the interdisciplinary group to establish. However if systems that facilitate this kind of interaction are able to put these tools in place before collaboration occurs, the students ability to adapt to the situation is greatly improved.

## 7. References

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