

6

Industry-Sponsored / Collaborative Research

Read this chapter if you would like to have the following questions addressed:

- *What are the major problem areas associated with collaborative research programs?*
- *What can be done to minimise the chances of a postgraduate research program collapsing if an industrial collaboration fails?*
- *How can a good collaborative research relationship be maintained?*

6.1 Overview

Postgraduate research programs, which are undertaken as part of a collaboration between a university and an industry partner, place considerable demands upon the research students that are involved in them. A typical collaboration between a university and another partner may involve senior academic and industry professionals, together with other technical and research staff. However, for all these individuals, the collaboration is a day to day work activity whereas, for the research student, each day contributes towards some larger outcome which may only be assessed after two or more years and, even then, this assessment will generally be made by people outside the arena of the collaboration.

A research student, involved in industry collaborations, is often faced with a range of conflicting objectives and time-frames, all of which need to be prioritised. The difficulty, of course, is that each partner in the collaboration tends to place a different level of priority on the problem at hand - the industrial partner generally focussing on developmental and commercial issues and the academic partner focussing on the research issues. Little wonder then that such programs are often the subject of considerable conflict. Within this conflict, the research student can become rather confused and despondent and, for this reason, the probability of a student achieving a successful academic outcome in such programs is generally less than that in an internal "pure" postgraduate research program.

There are a number of reasons why students should be involved in industry collaborations, despite the difficulties that such programs can engender. The first reason is that the difficulties that arise in such programs are also challenges and opportunities. Many recent graduates view the world in a binary way, with opinions appearing altogether correct or altogether incorrect. Collaborative research programs can, on the other hand, graphically illustrate how two, different (seemingly irreconcilable) perspectives can be generated and both appear valid to parties that have developed their thought processes in different environments. Research students that can gain an appreciation of the differing perspectives, and how they can

effectively be bridged, are often far more effective as professionals than those who solely master the processes of pure research.

There are many reasons why research students should endeavour to face the challenges of collaborative postgraduate research. Perhaps, the most compelling is the nature of what is learnt through industrial development processes. The burden of taking esoteric concepts and converting them into applied principles and products, that function reliably and can be delivered for a reasonable cost, is one which places an entirely different perspective on pure research. Research students soon discover that esoteric research ideas can be a relatively insignificant commodity once the complexities of the development and commercialisation process are injected into the cost equation. Pure research papers, in international journals, often take on a different perspective once one realises how far divorced from practical reality many such ideas can be. Hence, in involving oneself in collaborative research, one can become a better assessor of one's own pure research ideas, and a person that can place other pure research work into an appropriate (broader) perspective.

The penalties for addressing the challenges of collaborative postgraduate research can be considerable - time and workload can be the most dramatic. At worst, an industry-based postgraduate research program can be twice the workload of a pure research program, because it takes on the composition of both a developmental project and an academic research exercise. The benefits, on the other hand, are also considerable. Those who succeed in these programs are generally far more desirable industry employees than pure researchers because they tend to:

- Be better communicators
- Have a better grasp of the role of research and how it can lead to commercialisation
- Be better negotiators.

All of these benefits can translate into financial and career returns.

In this chapter, however, the principal objective is to focus upon the serious challenges involved in industry collaborative research programs, and to put forward possible ways of addressing these challenges. In this way, it is hoped that the impact of any negative attributes can be minimised and that problems are more likely to be overcome.

6.2 Industry Perspectives and Time-Frames

The differences that exist between different industry groups, and the companies within those groups, are as diverse as the companies themselves. While it would be naive to endeavour to generalise the behaviour of companies, in the context of finding a generic solution to the problems and challenges of industrial research, there is some benefit in examining a few common traits and perceptions that lead to difficulties for research students.

The most obvious problem that occurs, when universities enter into collaborative research arrangements with a company, is that a company generally has no interest in academic outcomes. In other words, a company generally views a university as a contract supplier of a service and nothing more. Provided that such contracts are fulfilled solely through staff, then the relationship is no different to that between a consulting house and the company. The difficulty, however, occurs when universities involve postgraduate research students within projects, and academic outcomes are sought within the context of an industrial contract.

From a research student's perspective, it is important to recognise that there is no onus upon a company to take a formal interest in a student's progress or, indeed, his/her final research outcome (i.e., a thesis or research paper). If companies (or, more aptly, their collaborating staff) choose to do so then it is often because of a personal relationship between the company and the student or his/her academic supervisors. In the absence of such a personal relationship, a student needs to recognise that the professional relationship with the company should be conducted on a business-like basis, and that the company staff will be judged on the items that can be commercialised by the company, rather than a series of "pure research" outcomes. However, if a good professional relationship exists between a research student and a company then it can deliver, to the student, expert professional industry advice; access to industrial machinery, processes or data and, ultimately, long-term employment or references that will have significant professional value elsewhere.

The starting point for the research student therefore needs to be that the relationship with the collaborating company must be constructed on the basis of mutually beneficial outcomes - the student delivers commercially beneficial outcomes to the company and the company delivers academically beneficial outcomes to the student. The problem, however, is that a company's perspective on what is of benefit (in a commercial sense) may be diametrically opposed to the student's perspective. Similarly, the student's perspective on what is of benefit (in an academic sense) may be diametrically opposed to the company's perspective. Hence, the first step in the relationship is for the research student to acquire an understanding of what research outcomes are beneficial to the company.

In the case of a research student, the industrial perspective can generally only be acquired through weeks or months of ongoing dialogue with the company and, as familiarity between collaborators increases, so too should the depth of understanding of the other partner's perceived requirements. A common problem, however, is for a university partner to enter into such arrangements without a detailed understanding of what is specifically required in terms of industrial outcomes - this, in itself, is a common cause of disputes in such programs. Similarly, companies often enter into arrangements with universities without having a detailed understanding of the academic environment and its constraints. While it could be argued that both partners need to come to a mutual understanding of each other's problems, the reality is that, if a company funds a research program, then the university is a service provider and the onus for collaboration then falls upon the university - the company takes on the role of a customer.

Having acquired an understanding of what a collaborating company expects in terms of outcomes, the second point that a research student needs to consider is how his/her research program can specifically contribute to those outcomes and still remain intact as a postgraduate research program. This is far easier said than done because many companies focus upon developmental and commercialisation issues that are difficult to meld into the context of postgraduate research.

The third point that needs to be considered by a research student is how to formally propose a realistic set of outcomes for the program, given a set of idealistic commercial and academic outcomes. This tends to pose a major dilemma for students - some are eager to please industry partners in the early stages of a program and put forward unrealistic goals that cannot subsequently be met - others dogmatically refuse to move away from academic goals and lose the support of the industry partner. There is no concrete set of rules that can be universally applied to this problem. However, the simple rule is that a research student should only formally propose a set of outcomes that he/she genuinely believes can be delivered by the end of the research program. There is little value in proceeding with any program in which the research student does not genuinely believe the stated outcomes.

After consultation with research supervisors, these outcomes should then be presented clearly and succinctly (in writing) to the collaborating company as a starting point for negotiation on the project.

An employee, within a collaborating company, always needs to be able to report back to higher levels in the organisation, and with a high level of confidence provide the following types of information:

- The current status of the project
- The current set of proposed outcomes that will be delivered
- The time at which those proposed outcomes will be delivered
- The equipment and resources that will need to be provided by the company in order to enable those proposed outcomes to be delivered by the student
- The consequences of not providing appropriate resources to the project on the outcomes of that project.

It must be remembered that there are several key factors that influence a company's decision-making, during the course of a research project, including:

- The company takes a risk by investing funds into a project which only has a limited probability of delivering some commercial outcome
- A company typically has many research projects on its "wish-list". Once one research project is funded, another may go without funds and, hence, the person responsible for an active research program is carefully scrutinised by his/her peers to ensure that the project satisfactorily progresses.

It is therefore critical that the research student does not jeopardise the project or the collaborating partner's interests by overstating the deliverable outcomes. It is also critical that, once a research student and his/her supervisors have decided upon the proposed outcomes, that these are articulated in writing and not just through a verbal agreement. At every stage of the program, there must always be a historical written reference point for all proceeding discussions.

Another important factor that influences the research student within a collaborative research project is the turbulence within a company. It must be remembered that professionals move from company to company, or from position to position, within three to five year time-windows. If, for example, a university decides to enter into a collaborative (three-year) Doctoral research program with a company, then the time between the initial meeting of the collaborators and the commencement of the first research student may be up to a year or more. If the company representative has held his/her position for several years, prior to initiating discussions with a university partner, then, in all likelihood, the representative will move on to a different position before the conclusion of the student's research program. This means that a research student will often need to form a new relationship with a different company representative mid-way through a research program. This tends to have serious

consequences - existing bonds and relationships are broken and, worse still, a new representative is forced to take over an existing research project for which he/she may have little interest or support. All the more reason for the student to ensure, from the outset, that deliverables are clearly outlined (in writing) and preceding discussions carefully documented.

While the likelihood of company collaborators moving from one position to another is concern enough, when dealing with large organisations, the student also needs to consider the consequences of dealing with a smaller company. During the course of a three-year program, small companies can suffer considerable turbulence through changing economic conditions or, in the worst-case, face closure or absorption into some other entity. A research student always needs to consider such worst-case scenarios because they do arise from time to time. Again, forward planning and what-if analysis can sometimes prevent corporate turbulence from creating crises with the research student's program which, generally, needs to move on to an academic conclusion even if an industrial partner ceases to exist.

Another issue, in terms of turbulence within a collaborating company, relates to the dynamic nature of the marketplace. Over the course of a three-year research program, a company may change its:

- Collaborating staff
- Corporate strategies
- Product development.

A research student can feel as though he/she has been left out in the cold once such directions have changed. The key factors involved in minimising the potential damage of such changes are to:

- (i) Recognise that directional changes are one of the major challenges in industry/collaborative research

- (ii) Expect changes to occur during the course of the program (pre-empt)
- (iii) Expect to change the direction of industry research programs and to renegotiate potential outcomes
- (iv) Expect to lose industry collaborators along the way and to have to form new relationships with replacement staff that may have only limited interest in the current research project.

In the final analysis, if a collaborative research program is based solely upon a project, rather than a student's ability to interact, negotiate and change with the company, then the research project tends to disintegrate when corporate turbulence does arise.

Industry-oriented research students may well ask why they should be burdened with issues of negotiation and interaction when their ultimate objective is an academic one. The answer is that industry-based research involves far more than just academic ability and the rewards are far more than just academic credentials. Those that enter into such programs need to consider that, if they hone their "collaboration" skills, then they will be able to use the resulting:

- Negotiation
- Interaction
- Planning

skills to great advantage in their later careers.

To this end, those that survive the challenges of the collaborative research environment will potentially be high-calibre researchers with both academic rigour and industrial practicality - they will be individuals who can conduct research and move the research forward towards commercialisation in an industrial sense. In the short term, they will need to endure some complex challenges that

arise from the sometimes awkward relationships between universities and industry.

In understanding the conflicts between industry and academia, it is also important to recognise that an employee, within a collaborating company, who is entrusted with the task of ensuring the smooth progress of the collaboration, will be subject to corporate time-frames that are endemic within the organisation. For example:

- A company which is predominantly based upon unskilled workers, performing manual tasks, will be accustomed to measuring human outcomes in seconds or minutes.
- A company predominantly employing trade/technical staff will measure its outcomes in minutes or hours.
- A company with professional staff will measure outcomes in days or, sometimes, weeks.

A research student, on the other hand, will enter into the company environment with time-frames which are typically measured in years. Even when companies have their own internal research and development facilities, such individual research time-frames are difficult to reconcile against normal corporate practices. A good industry research student will develop the skills that are necessary to bridge the conflicting expectations and to divide his/her research program and its outcomes into units of time that can be digested by the industry collaborator.

6.3 Conflicting Objectives

An important part of improving the probability of success in a collaborative postgraduate research program is to understand where and why conflicts typically occur. If one can recognise that emerging problems are common to many such programs, then one can depersonalise them and minimise the chances of damaging the relationships with partner organisations.

Industry-sponsored/collaborative research programs have a number of common problems, many of which arise from the fact that the individuals within them often have conflicting objectives. Industry representatives have a commercial set of imperatives and they must be accountable, on a commercial level, to their superiors. Academics and research students have an academic set of imperatives and they must be accountable at an academic level. The principal difference between these objectives is that commercial success is generally related to deriving a solution to a problem, which can subsequently be converted into a product or service - academic success is generally related to the rigour and care that can be applied to testing the boundaries of an idea. Even if an idea proves to be infeasible, the research is still deemed successful because it has established the boundaries - in an industrial sense, the outcome is deemed to be a failure because a commercial product cannot be developed.

Table 6.1 provides a representative sample of the sorts of conflicting perspectives that exist between industry and academia, as exemplified by research students. These incongruities clearly need to be understood and bridged if a collaborative research project is to have a good probability of succeeding in either an academic or a commercial sense. In Sections 6.4 and 6.5, these specific issues are addressed, in turn, both in regard to problem resolution and in regard to problem avoidance. There is also some attempt to subjectively qualify the seriousness of such issues in regard to the relationship between a research student and a collaborating company.

	<i>Industry Perspectives</i>	<i>Research Student Perspectives</i>
(i)	Commercial/financial success	Academic excellence
(ii)	Converting ideas into functional products or systems is paramount	Testing the limitations of ideas is paramount - the objective is to see whether or not ideas can work
(iii)	Ideas that cannot be converted into functional products or outcomes are a failure	Ideas that cannot be converted into functional products or outcomes are an integral part of the research process - the research is to assess boundaries not to achieve a perceived "correct" solution
(iv)	Relative competitive advantage - shades of grey	Absolute solutions - black and white
(v)	Corporate excellence - individuals collectively work towards achieving an outcome for the corporate entity	Individual Excellence - individuals work towards achieving an outcome for the individual
(vi)	Team-based projects with knowledge vested over a range of individuals	Individual project with knowledge vested in one individual
(vii)	Propensity to keep developments confidential	Propensity to publish any new developments as a hallmark of success
(viii)	Projects are multi-disciplinary in nature and may involve marketing, science, production, sales, etc.	Projects are highly specialised in nature and focus on one particular type of expertise
(ix)	Financial indicators are used to measure success	Academic rigour takes precedence over financial considerations
(x)	Projects are successful if they can be rapidly commercialised	Projects are successful if they contribute new knowledge
(xi)	Concepts have little value relative to the overall process of development and commercialisation	Concepts are the end objective

Table 6.1 continued over-leaf...

	<i>Industry Perspectives</i>	<i>Research Student Perspectives</i>
(xii)	An academic solution is only a concept and a starting point	An academic solution is the end-point of a research process
(xiii)	Commercial outcomes take precedence over process rigour	Process rigour takes precedence over commercial issues
(xiv)	Time-frames are backward scheduled from perceived market demands for products	Time-frames are forward scheduled from an original concept
(xv)	Professional time-frames are measured in days or weeks	Professional time-frames are measured in months or years

Table 6.1 - Conflicting Industrial and Academic Perspectives

6.4 Liaison and Management of Conflict

In many collaborative research programs, the research students tend to be the "junior" members of the project team and, hence, can seldom exert significant influence over the remainder of the team until they have established their credibility through some form of accomplishment. This makes an understanding of the typical conflict areas all the more important because research students generally do not have the authority to coerce a project into their own desired form.

The key issue for research students to face is that, having recognised the conflicting perspectives that will arise during the course of a project, it is extremely difficult to change the value set of an individual in a collaborating company - particularly because that individual will have values that are the product of the commercial inertia of the company that he/she represents. Moreover, many of the values and ideas that a company individual will hold may be the product of sound commercial practice, and they cannot be dismissed simply because they do not fit well with a research student's perspective of a particular project. Equally, it needs to be noted that, in an ideal environment, a company individual should recognise and respect the values of the research student. However, if the company funds the research project then, inevitably, the company will tend to view the student as a paid provider of a service and, hence, will expect its own value set to prevail whenever a conflict arises.

Table 6.1 provides a listing of the typical conflicts that arise as a result of differing perspectives on a project. Fundamentally, a research student's only means of bridging the void between the two (often diametrically-opposed) perspectives is through a process of education. In other words, the onus is upon the research student to educate individuals within the company about the academic perspectives to which he/she is bound as an academic researcher. In the final analysis, a company individual may never accept that such perspectives are valid but, at the very least, he/she should come to an detailed understanding of the research student's perspective.

It may also be that, despite the intervention of research supervisors, a research student can never reconcile the differences between a company's expectations and the academic expectations of a project. In such situations, students often feel that they are faced with only two options:

- To simultaneously conduct two programs - a commercial program for the company and an academic program for the postgraduate research program
- To consider an alternative research program.

Given that the latter option is defeatist in nature and really requires some form of personal counselling with supervisors, herein one needs to strongly consider the implications of the former. Firstly, incongruity between industry and postgraduate research programs can mean that a student must literally undertake twice the work of a conventional research program. This can be highly stressful and lead to poor outcomes in both programs but, given sufficient effort, can also lead to the development of a higher level of self-discipline and professionalism.

A more positive option that needs to be considered when examining the incongruity between a research program and industry expectations is that there may be a possibility of changing the form of the research program to create a better fit between the two. In particular, the research student needs to carefully reconsider the potential academic merits of the industry portion of the research from a broader perspective. For example, an industry sponsor may be concerned with the design and development of an end product (e.g., a pharmaceutical product) - the academic research program may, in the first instance, only be concerned with the development of a theory (e.g., a biochemical process) and an examination of its boundaries. A middle-ground solution may be that the research student should examine, as an academic postgraduate research exercise, the complexities of converting the theory into the end product. This would not only bridge the void between the two programs but would also provide a sound academic base for the research (in the sense that

it moves towards testing the boundaries of a theory) by exposing it to practical implementation problems and constraints.

In general, however, it is preferable to avoid making such changes to research programs by endeavouring to avoid the problems of incongruity in the first instance. Table 6.2 proposes some potential mechanisms for bridging the void between the industry and academic perspectives cited in Table 6.1.

<i>Item</i>	<i>Incongruity Between Perspectives</i>	<i>Possible Mechanisms to Employ to Remove Incongruity</i>
(i)-(iii)	Definition of Outcomes	<p>Verbal communications from the student to the company, regarding outcomes and deliverables are inadequate</p> <p>From the outset of the program, and at every subsequent stage, the research student needs to clearly state, in writing, the specific outcomes that will be delivered to the company partner and the dates that they will be delivered.</p> <p>If there is a possibility that a physical product or service cannot be directly derived from the research, then the student must clearly state, in writing, that the outcomes that will be delivered to the company will be an investigation and study which the company can use as the basis of future decision-making</p>
(iv)	Definitions of Success	The research student needs to make it clear to the company, from the outset, that the research needs to be complete in an academic sense and that, while the company may wish to take advantage of intermediate results, the research must continue until it provides a rigorous set of results

Table 6.2 continued over-leaf...

Item	<i>Incongruity Between Perspectives</i>	<i>Possible Mechanisms to Employ to Remove Incongruity</i>
(v) - (vi)	Excellence	<p>The research student needs to realise that a company, as an entity, is not concerned with individual excellence but, rather, with the excellence of the entity, which may be judged, not on technical or scientific grounds but on a financial basis</p> <p>The research student must avoid making arguments on the basis of personal excellence but, instead, by demonstrating how personal achievements can lead to benefits for the company as an entity</p>
(vii)	Confidentiality of Outcomes	A common problem and a difficult one to resolve. If a student requires peer review of work and a company is unwilling to have the work published then it is possible for a student to develop a formal research paper and to have that paper confidentially reviewed by international peers as though it was to be published. This may satisfy research requirements and company requirements.
(viii)	Nature of Projects	A research student needs to demonstrate to a company the need for specialisation - in many instances companies do not perceive a need for external specialists because they are seen as a threat to internal professionals. Often, a reassuring discussion, in which the research student highlights the skills of the existing staff and then expounds on how these skills can contribute towards the specialist project can defray common fears.

Table 6.2 continued over-leaf...

<i>Item</i>	<i>Incongruity Between Perspectives</i>	<i>Possible Mechanisms to Employ to Remove Incongruity</i>
(ix)-(xiii)	Project Processes and Outcomes	<p>A research student needs to acquire a detailed understanding of the company and its products in order to develop an understanding of the place of his/her own research project. The student also needs to develop a respect for the work of others within the company if his/her work is to be considered.</p> <p>The research student needs to acquire a detailed understanding of how others in the company will benefit from his/her research. Asking staff for their opinions on how the research can be skewed to increase its potential benefits can often create important links.</p> <p>The student must develop an ability to always put the research into a commercial context - otherwise industry staff will lose interest. Above all, the student must avoid overstating the significance of the project but, rather, gain support by relating the outcomes of the project to the specific needs of others within the organisation.</p>

Table 6.2 continued over-leaf...

Item	<i>Incongruity Between Perspectives</i>	<i>Possible Mechanisms to Employ to Remove Incongruity</i>
(xiv)- (xv)	Time-Frames	<p>A research student must learn to adapt to industry needs and time-frames if he/she is to retain support from the industry partner.</p> <p>Backward scheduling of research projects is useful for developing self-discipline in research and setting hard deadlines can often improve, rather than hinder, research outcomes</p> <p>If companies have difficulty in dealing with abstract outputs, delivered over a long period, then it is the research student's task to ensure that he/she can divide his/her task into smaller segments with which the company is more familiar - for example, the student can provide the company partner with a weekly or monthly report sheet that summarises past progress, future developments and final outcomes in order to make the company more comfortable.</p>

Table 6.2 - Mechanisms for Bridging Industry/Academic Perceptions

6.5 Communication in Problem Resolution

One could readily summarise a solution to all the problem issues raised in this chapter with one word - communication. This is the key factor in improving the probability of success in industry-sponsored/collaborative research programs. Such programs are highly dependent upon the communications skills of the research student - not the research supervisors or the company collaborators but the research student. The student is the link between academic and industrial perceptions, and it is the student that must acquire and communicate information between the two entities in order to ensure a smooth progression of the research.

Research students often harbour a belief that verbal communication (in itself) is sufficient for ensuring a flow of information. This, however, is seldom the case. Certainly, in the role of liaison between differing groups in a collaborative research program, verbal communication is the first step for the following reasons:

- It is a matter of courtesy and professionalism to discuss potential courses of action with interested parties
- In the early stages of a dialogue, verbal communication is less threatening to individuals than written communication
- Verbal communication provides an important means of acquiring an understanding of another individual's perspective. This provides a sound basis for subsequent written communication.

Once a verbal dialogue has been completed, it is absolutely critical for research students to detail proposed courses of action; requests for equipment and funding; proposed project outcomes and timing, and so on, through written communication. As a matter of professionalism, all regular meetings should be summarised, in writing, by the research student, with documents issued to all

interested parties - this ensures that no individual can excuse their lack of knowledge about the research project and its deliverables. As a matter of courtesy, it is also important for a research student to informally disclose such documents to interested parties prior to formally tabling them.

In the absence of any prior project management experience, many research students naively believe that other individuals are intimately aware of their daily activities and work-load simply through the verbal communication process. However, verbal communication tends to be transient in nature because:

- Individuals who receive it are generally busy and preoccupied with numerous other activities
- Humans have a limited ability to mentally retain administrative details associated with projects.

It is therefore often the case that students become frustrated when company representatives ask them what they have been doing during the course of a week or a month. Worse still, in the absence of any formal (written) communication, many company professionals believe that research students are not achieving any outcomes at all and feel that they need to give the students day to day work targets - worse still, in the absence of other documentation, some students accept the day to day tasks in order to preserve goodwill - the end result being that the research project gradually diverges from its originally-stated objectives and all parties become dissatisfied with the outcomes. This is one of the single, most common problems in collaborative research programs and the only manner in which it can be managed is through a combination of verbal and written communication by the student. The time-frames for this communication must be selected by a student in consideration of the time-frames to which a collaborating company is normally accustomed (e.g., weekly or monthly).

Given that one corollary of inadequate communication is the allocation of peripheral company duties to the student, a question that

needs to be addressed is how a research student should respond to such requests. Generally, a research student, involved in a collaborative research program, needs to be pragmatic about both his/her role and the company's role in the program. Typically, a company commits to provide cash and in-kind contributions to a collaborative project through some formal agreement with a university partner. Additionally, it also becomes evident that a student may require access to other company professionals, specialised equipment and facilities and so on. Many research students, who adopt a purist stance, and refuse to deviate from an academically stated course of research, to accommodate the needs of a company, often discover that when the needs are reversed (and the student requires resources from the company) then the company becomes equally uncooperative. The moral is that a genuine research collaboration needs to be a two-way street, with concessions and considerations on both sides. Without such concessions and considerations, many such research programs become unworkable.

In the final analysis, the probability of a collaborative postgraduate research program succeeding is inevitably lower than that in a pure (university-only) research program. There are numerous dimensions and incongruities to the problem and each dimension and incongruity requires a considerable effort on the part of all the participants in order to ensure a successful outcome. The research student, in such a program, is the catalyst for its success or failure. More specifically, it is the research student's ability to win support for his/her views, through communication and negotiation that ultimately determines the final outcome of the program. Hence, the starting point for such a program is a recognition, on the part of the student, that collaborative research entails significantly greater challenges than the mere acquisition of research skills and, if well conducted, it also provides far greater professional rewards.

