# CHAPTER 3: THE RESEARCH DESIGN AND PROCESS

## 3.1 Introduction

So far in this research report I have attempted to underscore foundational issues inspirational to my research relating to the research problem and its context (Chapter 1). I have also surveyed related literature and attempted to position my own thoughts and understanding in the broad discourses reported by other scholars near and far (Chapter 2). It has become apparent, in the previous chapter in particular, that learning and experience jointly remain the most compelling and engaging pursuits for enhancing human development and well-being, both individually and collaboratively. In this chapter I would like to divulge and make known my further learning and experiences that have been facilitated by my interaction as the originator and coordinator of the study with colleagues and other participants, and the processes that generate knowledge to be shared and exchanged between us.

This research was conceived and carried out at a time when Zimbabwe was experiencing severe socio-political and economic upheavals now loosely referred to as 'the lost decade'. In particular, the fieldwork took place towards the end of 2010 and early 2011, when universities countrywide were only just experiencing a turnaround from their worst moments of lean operations where classes were badly disrupted and programmes delayed as students and staff got sidetracked into concentrating on their survival often by doing very little with and in the university. This is not the central issue of investigation in my research. It is incumbent upon me, however, to state that the situation affected the research in many ways, especially in the processes and outcomes of data collection. These effects will be explained and the measures employed to neutralise them will be reported.

The discussions below underscore the theoretical and practical underpinnings of the research study with a view to providing empirical support to claims that will emerge at the end of the study. It is my personal opinion that as a researcher I have an obligation to reveal my philosophical launching pads to justify the persuasive strategies that I use to attract and retain my audiences. I will therefore start by explaining my working paradigm before going on to reporting how it influenced the rest of the processes from

the research design through the actual engagement in data generation and collection to the analysis and interpretation of findings.

### 3.2 Research Paradigm and Underpinning Assumptions

The foundation for inquiry in this research study is the constructivist paradigm or worldview which, according to Creswell and Clark (2007:22), is characterised by the seeking of "understanding or meaning of phenomena, formed through participants and their subjective views". This worldview, also called the *constructionist* worldview by Dawson (2009), is typically less obtrusive, permitting participants' voices to be spoken and heard, rather than privileging only the researcher's voice, as the participants speak from an understanding constructed from their own experiences and from social interaction with others and their environments. This 'bottom up' approach develops individual perspectives into broad patterns, and ultimately to theory (Creswell & Clark, 2007). A multiplicity of realities is thus expressed by different self-motivated participants, particularly if the data collection was conducted with the participants' cooperation, and in familiar surroundings such as at the participants' own workplaces, as was the case in this study.

A paradigm may be understood to be "… a picture of reality that profoundly influences what people view as true, possible, and desirable … a whole way of believing and living as if a particular set of understandings and dynamics were the only true/valid/possible/good one available" (Spady & Schwahn, 2010:7). We need paradigms to create and claim space in our contested environments, and to negotiate our territories, but paradigms create in us a 'closed system', a 'fixed mindset' or make us somewhat 'closed-minded'. We tend to want to filter out and dismiss anything that does not fit or match the closed system's configuration of what we hold to be true/valid/possible/good. Hence we only see one given set of things as being either possible or desirable, or both. Only sustainable learning can bring about change or a 'paradigm shift', which transforms one closed system to another. The interesting observation is that, "When a paradigm shifts, everyone goes back to zero" (Spady & Schwahn, 2010:8).

The constructivist paradigm is often pitted against its main rival, the positivist paradigm, among a couple of others. A positivist worldview often confers authority to the voice of the researcher or the status quo.

A paradigm often encapsulates a set of other sub-worldviews and lenses for understanding and creating knowledge, such as theories, philosophies, ideologies, et cetera. For my purposes, and drawing from my faith in and passion for action and reflection on practice, I have combined participatory and critical interpretivist lenses to approach the collection of data for this study, its analysis and interpretation. The participatory lens allows me to view the university in my study as a playing field in which I assume the role of chief protagonist, while colleagues, students and industry staff are active and conscious players. While I take an interest in watching the holistic activity of play from time to time, and I also have to interpret individual and group performances at other times, I want everyone involved to feel and act naturally and in the way they feel is best to enable us to co-construct reality. I am counting on confident and self-motivated players who can control their game while I support them. Participatory action research is described in more detail below in Section 3.3.2.

The interpretivist perspective holds that reality (or truth) is inter-subjective and socially constructed such that it can be described and represented through diverse perspectives (Butin, 2010). In the study of workplace-based learning for instance, it can be assumed that the truth about effectiveness of such a programme is interpreted by the participants, who create such interpretation based on their experiences and ‘substantiable’ opinions. As Butin (2010:60) puts it, there is no single or authoritative truth since every group or culture privileges the truth of their particular viewpoint. I view such a perspective as one of tolerance and non-confrontation, for in the end no single group can be justified to privilege their knowledge to override another.

My personal understanding of the nature of truth (ontology) inherent in academic discourses is that truth resides in the dynamic knowledge of people in their individual and collective capacities. I illustrate my personally constructed view of this understanding diagrammatically in Figure 3.1. The universal knowledge of a society is composed of personal knowledge of individuals (A-J) and public or shared knowledge (sub-set) found in institutions, organisations, social groupings, et cetera. Some of the

individuals' knowledge overlaps with the public knowledge (A, B, C, E, F); some is completely embedded in public knowledge (D, G, I), while other knowledge falls completely outside (H, J). The knowledge of some individuals overlaps (C and D, G and I, F and H). The illustration below can also apply to a single organisation in which sections, departments, year levels, et cetera. are the sub-groups. Insiders in an organisation or society share some knowledge and thus are likely to have a common ground for truth or reality. The illustration also helped me to understand that my participants were in different positions as they provided their responses to my questions, and thus the multiplicity of realities (Creswell & Clark, 2007) that manifest in the numerous quotes of participants' voices that are used in the next chapter on the research findings.

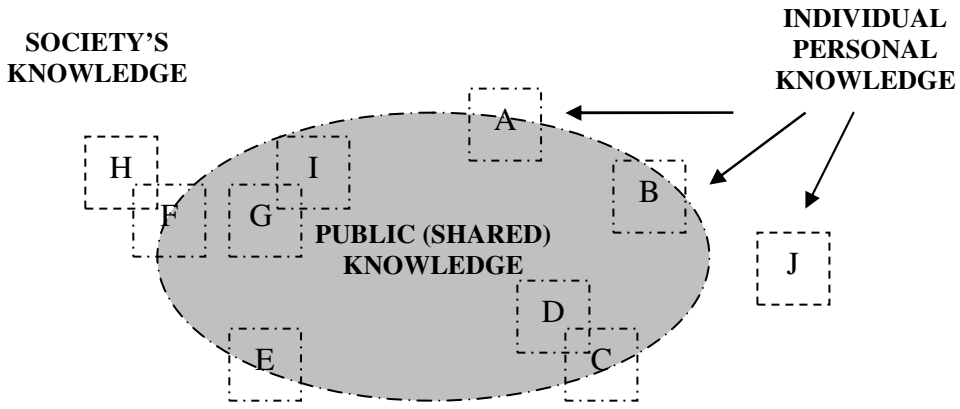


**Figure 3.1 A hypothesised relationship between personal knowledge and public knowledge in society**

In elucidating my conceptual framework for this study earlier (Section 1.5) I alluded to my belief that understanding industry-based learning in a university's programmes necessitates an understanding and application of learning theory. Apart from being regarded as a paradigm, constructivism has been treated as an epistemology or way of knowing. This means that two people may have the same knowledge but we may be interested in how they came to know what they know. It is much like the analogy that various people might own cars, but how did they come to have them? Some will have bought them, some given as gifts, some acquired through work, some inherited, and yet others stolen. Theories around constructivist learning help to explain the 'how' of knowing and construction of reality, and in my conceptual framework I link these with concepts such as self-regulated learning, lifelong learning, cooperative learning and

learning and thinking styles, all these being routes, in my view, to reaching multiple voices of participants busy constructing their own knowledge, albeit at my insistence, and perhaps, more for my short term benefit. How does all this contribute to my study? The constructivist epistemology (way of knowing) has helped me to remain socially and professionally connected to my respondents and their environments. I want to lay my claim to knowledge not only on my own observations and perceptions but also on the voices, views and reflections of the people who I interacted with and got some knowledge from. In this way I combine objectivism and subjectivism, and thus rely for my deliberations on a hybrid of facts and opinions. Research that prepares for change and change management is positioned to influence inevitable organisational transformation, or the 'ontology of becoming' (McNiff, 2000). Organisational transformation rests on learning primarily by adults who engage in communicative learning, which involves understanding what others mean when they communicate with us (Mezirow, 2009).

Thus, as I went through the processes of organising my knowledge throughout the process of generating and collecting data and analysing it, the constructivist perspective guided my assigning of meaning to both facts and events, rather than hang around only the facts themselves, alluding to the fact that all knowledge is a matter of human interpretation, and that knowledge is not just something existing independently in the world waiting to be found out, but it comes into being only when a human being examines data and assigns meaning to it (Hinchey, 2010). I am the learner and the knower in this instance and my current and constructed knowledge guides my analyses and interpretations of unfolding facts and events.

### 3.3 Research Methodology and Design

This being a research study in the social sciences, a plethora of research methodologies, research designs and methods are available in literature and in practice for it. In this study, 'enhanced' case study and the embedded concurrent design of the mixed methods are used. I explain later all the facets of this description, but first let me attempt to situate my approaches into context.

The distinction between and among the terms used to identify the various processes and sub-processes that researchers undertake to transact the business of inquiry and the search for solutions to problems remain very implicit to me. What, for instance, do the following terms refer to and what are the relationships between and among them: *paradigm, epistemology, methodology, design, methods, strategies, techniques, tools,* and *instruments*? Although some are clearer to explain, I find that others are used interchangeably even in some of the well-celebrated literature on research methodology. For instance, in some of the literature, qualitative and quantitative methods are referred to as paradigms, the questionnaire is referred to both as a method and a technique, case study as a research strategy rather than a method (Punch, 2009:119), mixed methods as a design and methodology, and so forth. Some authors allude to the same confusion that I have. For example, Dawson (2009) discusses feminist research, which many authors would call a paradigm, and writes, "There is some argument about whether feminist enquiry should be considered a methodology or epistemology, but in my opinion it can be both."

**Table 3.1 Research study characterisation**

| | **1** | **2** | **3** |
|---|---|---|---|
| **Paradigm** | Constructivist | Constructivist | Mixed Methods |
| **Methodology** | Mixed methods | Case study | Case study |
| **Research Method(s)** | Case study | Mixed methods | Survey |
| **Research Design** | Concurrent embedded | Concurrent embedded | Concurrent embedded |
| **Research Technique(s)** | (qual/quan) | (qual/quan) | Questionnaire |
| **Research Tool(s)** | Statistics, content analysis | Statistics, content analysis | Statistics, content analysis |
| **Research Instrument(s)** | Interviews, Questionnaire | Interviews, Questionnaire | Interviews, Questionnaire |

For my purposes in this study I attempt to integrate those views that I have considered from the accessed literature, and present my interpretation of the terms in a hierarchical form (Table. 3.1) to show the connection between my chosen paradigm and descriptions of all the processes under it. Three closely-related versions of the hierarchy are given.

### *3.3.1 Case study research method*

In a research context, universities can be considered as individual cases. Although between them they are peer institutions exhibiting many operational features in

common, sharing goals and often projecting overlapping visions and missions, they strive to maintain substantial measures of autonomy that aim to keep them uniquely distinct, so that at any moment they may lay claim to accomplishments that help them outdo each other in the battle to compete for scarce resources or to leverage territorial advantage. The nature of case study has to be understood in the context of action and engagement for knowledge generation, knowledge dissemination and for competitive advantage.

As hinted at earlier, Punch (2009:119) observes that case study is more a research strategy than a method, focusing on the holistic nature of the case being studied, aiming to preserve and understand the wholeness and unity of the case. He defines a case study as "a phenomenon of some sort occurring in a bounded context. …, the case may be an individual, or a role, or a small group, or an organisation, or a community, or a nation. It could be a decision, or a policy, or a process, or an incident or event of some sort, and there are other possibilities as well". In many ways, this study fits into what Stake in Punch (2009) calls an instrumental case study, "where a particular case is examined to give insight into an issue or to refine a theory". It is also a single-case study that is 'considered unique, prototypical, salient, or revelatory to the understanding of a phenomenon or problem' (Scholz & Tietje, 2002:11). Further, it is also an 'embedded' case study in that it involves more than one unit or object of analysis, is not confined to qualitative analysis alone, and allows for a multiplicity of methods that may be applied within the sub-units.

A research case is studied also in light of, and in relation to its environment. My additional conception of this study is that it is an 'enhanced' case study because even though I concentrate on and analyse issues relating to one university, NUST, I also use data from other similar but obviously differently focused universities to enhance and enrich my understanding of the one case that is central to this study. The enhancing stories from the other universities are not complete for their own purposes, but they come into my court because they make the story of my central case more complete. The main data was collected from within NUST and from its collaborative partners in the industry. Within NUST, the larger numbers of informants were the students, the staff both at lecturing and administration levels, and partners of NUST in industry who were offering attachment places to NUST students. The original intention was to obtain

additional data from universities in neighbouring countries, but this was withdrawn because of limited financial and other resources.

I then come to the issue of what research procedures happen within a case study. Underlining the compatibility between case studies and action research, Scholz and Tietje (2002) state that many case studies are conducted in order to improve action and make better decisions. Yin (2003) distinguishes between single-case and multiple-case studies, advising that a single-case study is analogous to a single experiment, with many of the conditions that justify a single experiment also justifying a single-case study. Yin (2003:41-2) outlines the conditions for a single-case study which include the following:

- When it represents the critical case in testing a well-formulated theory
- When the case represents an extreme or a unique scenario
- When the case is the representative or typical case. Here the objective is to capture the circumstances and conditions of an everyday or commonplace situation. The lessons learned from these cases are assumed to be informative about the experiences of the average person or institution
- When the case is revelatory
- When the study is a longitudinal case

The single-case study method or strategy supports the use of multiple data collection methods within it if the population is small and the research objective is to investigate a problem that appears to be shared by a number of other equivalent cases. This could enhance the study on issues of applicability, generalisability and 'emulability' discussed later in Section 3.7.2.

### *3.3.2 Mixed methods research methodology*

When viewed as methodologies, qualitative and quantitative research procedures have developed an intermediate between them over the years, the mixed methods approach. Mixed methods as a research methodology has found its place in research practice amid both enthusiasm and scepticism. The methodology has been developed and applied over many years as reported in the literature mainly to be used by those in the qualitative research methodology camp. Fitch (2005) uses the method to study outcomes of inter-cultural service learning with college students. Typically, a mixed method study

involves the collection and/or analysis of both quantitative and/or qualitative data in a single study in which the data is collected either concurrently or sequentially, is given a priority, and involves the integration of the data at one or more stages in the process of the research (Creswell et al., 2003). Enthusiasts such as Punch (2009:4) advocates for relaxing the qualitative-quantitative distinction, emphasising that neither approach is better than the other, both have their strengths and weaknesses, and that they can and should be combined as appropriate. He explains:

> …, rather than either-or thinking about the qualitative-quantitative distinction, or tire arguments about the superiority of one approach over the other ... the methods and data used (qualitative, quantitative or both) should follow from and fit in with, the question(s) being asked. In particular, qualitative questions require qualitative methods and data to answer them, quantitative questions require quantitative methods and data to answer them, and research that asks both qualitative and quantitative questions requires mixed methods to answer them (Punch, 2009:4).

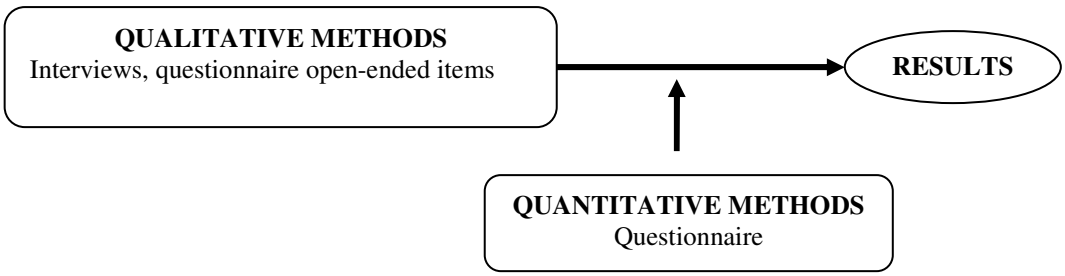


**Figure 3.2: Mixed methods methodology model**

The diagrammatic representation of the relationship between qualitative and quantitative aspects of a design and the results is shown in Figure 3.2. While the debate on whether or not to mix methods rages on, researchers have continued to use the technique and have tried to justify their choices in various ways. The observation by Bergman (2008) that the mixed method research design is one of the fastest growing areas in research methodology today might be encouraging to budding researchers.

### *3.3.3 The concurrent embedded mixed methods design*

In this study I explore, investigate, describe, analyse and interpret the key processes and the accumulated accomplishments of the current industry-based learning (or industrial attachment) programme at the National University of Science and Technology as an exemplar for universities particularly in Zimbabwe, and more generally in Southern Africa and the rest of the developing world. Since mixed methods combine the

traditional aspects of qualitative and quantitative designs (Creswell, 2002) this study employs a concurrent embedded mixed methods design in data collection and analysis, using quantitative methods to identify practices considered useful by respondents, and using qualitative methods to critique and interpret phenomena on the perceptions, experiences and milieus confronting participants in industry-based learning. This confirms the dichotomous categorisation of inquiry into exploration versus confirmation (Denzin & Lincoln, 2005). Similarly the nature of inquiry is open, where I use both deductive and inductive reasoning in a continual cyclic fashion (Leedy & Ormrod, 2005).

The mixed method model used in this study is one in which quantitative methods (quan), are used to embellish a primarily qualitative (QUAL) study, giving the qualitative methods a greater priority over the quantitative, thus the use of QUAL(quan) in symbolic notation. This design is Creswell's (2003:226) concurrent embedded design (Figure 3.3). Data was collected essentially concurrently through interviews and questionnaires from the various selected participating groups and individuals at NUST and in the selected industry organisations (See also Tables 3.2 and 3.3). Additional qualitative views and data on comparable programmes were collected from other selected universities in Zimbabwe.

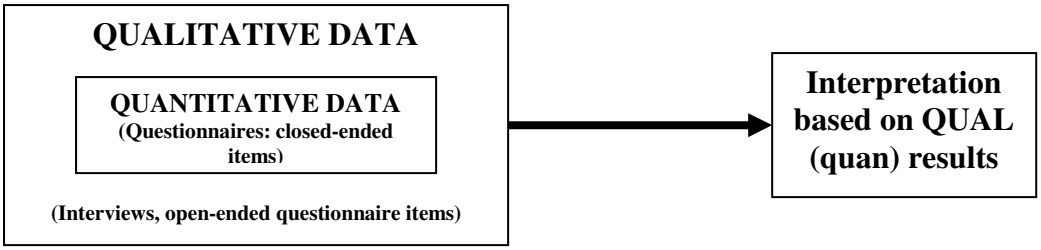


**Figure 3.3 The embedded concurrent mixed methods research design**
(Adapted from: Creswell & Clark, 2007)

Valo (2000:154) notes that the most common method of investigating work-based learning has been the satisfaction survey, but lobbies for the use of qualitative methods instead. He says that:

> Survey questions predetermined by the researcher tend to conceal students' own conceptions and schemata of the topic. Especially when investigating issues involved in experiential learning it is vital to capture the diversity of students' understandings of the essence of learning. Thus, research on the practicum should be carried out qualitatively and inductively, analysing students' individual experiences (Valo, 2000:154).

One underlying objective of this study was to gain new and in-depth perspectives on university industry-partnerships through industry-based learning and the inclusion of various industry players such as small- and medium-scale enterprises. Few studies address this area in any depth, yet it is a potentially important area for socio-economic development in developing countries. This study, too, only raises a few issues which may be a pointer to further research and investigation in future.

The qualitative portion of this study allowed for description, analysis and interpretation of phenomena and settings to give meanings that events had for the individuals who experience them (Lincoln & Guba, 1985). Interviews formed part of the *hermeneutic circle* of processes of developing arguments and conceptions based on experiences, thoughts and perceptions of partnership and learning by respondents. An ethnographic approach linking experiences and viewpoints or 'actors' perspectives' was preferred to a concentration on 'lived experience' rather than voice which can lead to an essentialist, romantic conception of inner meaning (Silverman, 2004:343). The qualitative aspect also allowed for gathering rich data from small samples which provided the 'thick description' of scenarios that fulfils the transferability criterion for judging the standards of qualitative research (Guba & Lincoln, 1989).

**Table 3.2 Comparison of processes in qualitative and quantitative data**

| Qualitative Data | Phases in the Process | Quantitative Data |
|---|---|---|
| • Purposive sampling<br>• Small number of participants | **Sampling procedures** | • Random sampling<br>• Adequate samples (large) |
| • Central authority<br>• Individuals | **Permissions needed** | • Central Authority (esp. children)<br>• Individual informed consent |
| • Semi-structured interviews<br>• Open-ended questions | **Information collected** | • Questionnaire responses |
| • Field notes<br>• Voice recordings<br>• Transcripts | **Recording the data** | • Data coding and capture<br>• Data summaries |
| • Interview protocols<br>• Interview environments | **Administering data collection** | • In large groups (classes)<br>• Populated areas (streets) |
| • Vignettes and discourse | **Analysing the data** | • Statistical methods |

Quantitative research methods (or methodology) include questionnaire surveys and experiments, which employ measurements, statistical analysis and interpretation of significant amounts of collected data. The strength of quantitative methodology lies in

its solid and objective nature that gives it 'an aura of scientific respectability' (Denscombe, 2003:236). However, the quantitative research methodology is not always the most suitable for many contexts and themes in social science studies. For a number of studies including this one, a combination of both the qualitative and quantitative techniques (mixed methods) has been found suitable (See Table 3.2). Mixed method research design is discussed in more detail below.

### *3.3.4 Limitations of mixed methods research*

Research is a largely contested academic activity and the processes of research rarely sail through without one form of censure or other. Mixed methods is a comparatively recent methodology, having been brought into being after many years of separate and competing positioning of the two broad categories (or paradigms) from which it is composed: qualitative and quantitative. It must have taken time and effort to compose a credible hybrid to convince opposing sides to accept the proposition to merge, and to win new researchers who were prepared to put the new methodology to use.

One of the most discernible criticisms against a research study using mixed methods is that its rigour does not easily lend itself to be judged using one set of standards as in the traditional sense. When asked whether a mixed methods research study is valid or not, one has to split the qualitative and the quantitative dimensions used and test them separately before claiming that the research is a valid exercise. As an example, whereas representativeness and generalisability are central to quantitative portions of the study, they are not applicable to qualitative portions, which utilise credibility and transferability instead. To minimise this limitation in this study, a hybrid set of standards as described in the literature (Onwuegbuzie & Tedlie, 2003; Creswell & Clark, 2007; McNiff & Whitehead, 2006, etc) is used. I used concepts of legitimacy, in which both quantitative questionnaire responses and qualitative interviews were recorded and could be traceable to the respondents (without any risk to them). I also used transferability, in which data items for either one respondent (qualitative) or many (quantitative) could be adapted or personalised to other respondents not sampled.

Even with using hybrid criteria for determining the trustworthiness of a mixed methods research, there still remains the possibility of under-rating one dimension against the other. My study had the quantitative dimension with a lower priority than the qualitative,

and the quantitative was embedded in the qualitative data. It was common for me in the construction of questionnaire items, for instance, to overshadow the quantitative part and instead ask questions that would need more probing and follow-ups if a certain response of great interest arose. Questionnaire respondents are very difficult to follow up individually unless special measures have been put in place at the very onset, or unless the respondents are few in number, or tightly controlled, which then defeats the purpose and diminishes the authenticity of quantitative inquiry. I partly dealt with this by using respondent triangulation within NUST and between NUST, industry and other universities (Figure 3.4).

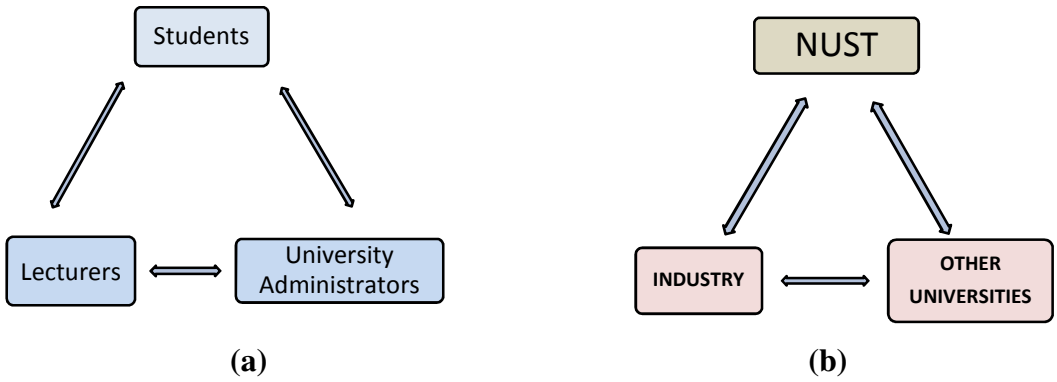


**Figure 3.4: Respondent Triangulation (a) within NUST and (b) between different locations**

I also enhanced the credibility of the data obtained by using two methods of data collection, that is, questionnaires and interviews. The combination of different methods of data collection, multiple respondents from both within NUST and outside produced a crystallisation of data sources which attempted to address the limitations of the mixed methods approach used in this study.

### 3.4 Population and Sample

The population for the study consists of three groups of members of the NUST community comprising students, teaching staff and university administration on the one hand, and industry-based supervisors of students in selected workplaces in the private and public companies that play host to NUST students on workplace-based learning, whether they be large-, small- and medium-scale, in urban and rural settings on the other. Table 3.3 gives an indication of the categories of respondents.

The selection of respondents was a combination of probability and non-probability sampling techniques, depending on the number of respondents chosen. In the norms of

qualitative research methodology, 'maximum variation sampling', a non-probability strategy, can yield detailed descriptions of visibly divergent cases and phenomena, yet also identifying any shared patterns that cut across those cases (Lincoln & Guba, 1985). I have used probability sampling where the selection was between homogeneous respondents, and non-probability sampling where prospective participants varied considerably.

**Table 3.3: Proposed Participants and Respondents**

| Location | Designation/Office | Estimated Population | Target Sample | |
|---|---|---|---|---|
| | | | Questionnaire | Interviews |
| NUST | **Management** | | | |
| | Director Technopark | 1 | - | 1 |
| | Industrial Liaison Officer | 1 | - | 1 |
| | Director Research and Innovation Office | 1 | - | 1 |
| | Deans of Faculties | 5 | - | 2 |
| | **Teaching Staff (Practitioners)** | | | |
| | Department Chairpersons | 30 | 20 | 5 |
| | Lecturers | 140 | 70 | 5 |
| | **Students** | | | |
| | Final Year students | 750 | 500 | - |
| Industry | **Company Industrial Attachment Supervisors** | 300 | 150 | 5 |
| Other Universities | **University Administrator and/or Practitioner** involved in industry-based learning/per university | 22 | - | 5 |

Purposive and convenience sampling were combined for selecting participants for the interviews, namely eight NUST administrators considered suitable for interviews, comprising the Director of the NUST Technology Park (Technopark) who is the key university officer in developing the university partnerships with industry, his subordinate, the Industrial Liaison Officer, The Director for Research and Innovation, and five deans of faculties using the mode of industry-based learning under study. Around 40 practitioners, i.e. chairpersons of departments and/or their departmental lecturers-in-charge of Industrial Attachment were identified for interviews, and convenience sampling was done to select a sample of 10 from these. For the industry interview participants I obtained from the Industrial Liaison Office a list of companies currently involved with attaching NUST students. The Industrial Liaison office could only give a rough estimate of about 150 companies involved at the time of enquiring. I made telephone calls to as many companies as possible on the list in various cities of the country, with the target of interviewing a maximum of five industry supervisors.

Eleven other universities in Zimbabwe were identified as potential data providers and letters of request to conduct interviews were sent to a purposively sampled seven of these that, like NUST, had commercial-, science-, technology- and engineering-related programmes in their curricula, and were using the full-year industrial attachment format.

For the quantitative data about 500 of about 750 registered students in their final year at the time of data collection were targeted for responding to the student version of the questionnaire and all of about 170 practitioners (i.e. lecturers and chairpersons of departments) were included in the sample. An estimated 300 industry supervisors were targeted for answering the industry version of the questionnaire and 100 copies were mailed with self-addressed and stamped envelopes for return.

### 3.5 Data Collection

To address the research question and sub-questions on the needs of various respondents, perceptions of their roles, practices and aspirations, and of their personal and organisational transformation in their current practices, the various research methods cited earlier employed the standard data collection methods and instruments in qualitative and quantitative research found in the literature. For interview data, opinions and views were captured through audio recording as well as note taking. Questionnaires were used with groups of students because of the larger numbers involved to give wider views. The design of questionnaires was done with the assistance of a statistician and a consultant at the University of Pretoria's Department of Statistics that provides research support to postgraduate students and academics.

I made telephone calls, often repeated, to randomly selected chairpersons of eligible departments requesting for interviews with either the chairperson personally or the lecturer-in-charge of Industrial Attachment in their departments. I went on and made appointments with the first ten available, making sure there was at least one from each participating faculty. Administrators and practitioners who agreed to an appointment were given the letter (Appendix II) introducing myself and my research.

Some success was achieved in securing appointments with companies in my resident city, Bulawayo, but telephone calls to outside cities were extremely difficult to make. For all successful calls in and outside Bulawayo, securing an appointment became a further hurdle for the identified potential respondents who gave many reasons including work pressure and unavailability during the proposed period for the interviews. I was able to travel to the workplaces of those who accepted the request for interviews. Prospective respondents were given the consent letter to organisations (Appendix III), requesting for permission to interview supervisors of students on the theme of industry-based learning, and the letter indemnifying them and protecting the data they would supply (Appendix IV).

For interviews in other universities I identified 11 universities practising industry-based learning, and I targeted any administrators and/or practitioners connected with industry-based learning, and who would be made available to me. I sent by post letters of request to carry out the interviews (Appendix V) to the registrars of these universities, giving the approximate dates on which I would be able to visit them.

### *3.5.1 Research instruments*

Two instruments, namely the questionnaire and the interview, were used in this research study to capture both the qualitative and quantitative aspects of the study. The details of the development and administration of these instruments are explained below.

#### *3.5.1.1 The Questionnaires*

The questionnaire method is a fundamental and universal one, particularly for quantitative studies and other surveys. Indeed, questionnaires are probably a much over-used research technique because they are assumed to be easy to construct, a fallacy in the sense that what is true is that they are easy to construct badly (Gillham, 2000:78). In practice a researcher can either create his or her own original questionnaire or obtain one from off the shelf or published questionnaire, usually referred to as a scale or inventory. Bringle, Phillips and Hudson (2004:25) have provided a rationale for using research scales in general and using published or existing scales in particular. They have also published descriptions and samples of over forty different scales in the area of service learning developed and applied in the United States, and covering factors such

as motives and values, moral development, self-concept, student development, attitudes, and critical thinking. While not writing off the possibility and the temptation by novice researchers to develop their own scales, they show preference for published ones, and they write:

> Using existing scales has many advantages over developing original scales. Existing scales take less time to incorporate into research, are usually prepared by researchers who have professional expertise, may have norms available against which a particular sample can be compared, and have a known record of psychometric qualities (although these may vary from sample to sample).

It is to be noted that existing scales may be modified, usually with permission of the author(s). The modification is an attempt to adjust the pre-existing scale to suit a particular research context or question associated with identified respondents. For a learner researcher, adapting a scale appears to offer the advantage that most of the work has been completed and the resulting scale may be more appropriate than an original scale crafted specifically for the research at hand. Modifying a scale, however, runs the risk of changing a known quantity in unknown ways (Bringle, Phillips, and Hudson, 2004:25). The option of developing one's own original questionnaire is often reached when one analyses the other options above and finds them unsuitable. (Bringle et al., 2004:25) further write:

> Developing an original scale allows the researcher to design a scale for a specific need. However, developing a new scale takes time and resources (e.g. literature review, pilot testing), requires knowledge of scale development procedures, and runs the risk that the result may not be a good scale. The rudiments for scale construction are found in the nature of construct validity. Constructing a good scale requires articulating a clear theoretical statement for the construct, delineating the content domain, evaluating the uni-dimensionality and factor structure of a preliminary pool of items, and obtaining evidence of construct validity.

#### 3.5.1.1.1 Questionnaire construction and design

This study has employed three matched versions of the same questionnaire for three groups of respondents: one version each for students, university lecturers and industry supervisors. I chose to develop my own questionnaire because the existing ones that I gleaned in the literature did not appear to answer my research question or sub-questions adequately. I wanted to address particular questions relevant to my line of enquiry in my study in a way different from the published scales. Also I wanted to develop my own skills of developing a research instrument, such as a questionnaire, and I leaned on the expertise of my research promoter and statisticians for guidance in this.

I developed the student version (Appendix V) of the questionnaire first, working progressively on the questionnaire items derived mainly from the research question and sub-questions (See Table 3.4). In the end I would use the student questionnaire as a base to convert most of the items on the lecturers' and industry staff questionnaires accordingly to match those on the student template. The objective of this was to compare the congruence of opinions and views obtained from the three groups of respondents.

The questionnaire was administered anonymously to all the respondents. It is divided into two sections: Section A for background information on the respondent, and Section B for information pertaining to the theme of the study, i.e. industrial attachment (or industry-based learning). The overall questionnaire required five types of response in different item categories: select and mark the appropriate option (items 1 – 6 and 33), a 4-point Likert scale (items 7 – 25), Yes/No (items 26 – 31, 34, 35 and 36), ranking (item 32), and open-ended responses (items 33-37).

Items 1 to 6 in Section A of the students' version of the questionnaire solicited information on selected background attributes of students such as faculty, year of study, age, gender and work experience prior to enrolling at university. The same section on the lecturers' version (Appendix VI) solicited information on their faculty, year levels of students they taught, age, gender, and previous non-educational working experience; the industry staff's version (Appendix VII) sought information on the organisation's location, sector, size and type of business as well as sources of industrial attachment students and preferred duration of student attachments in their companies. The response type in Section A was to select and mark the appropriate option.

Section B consists of four groups of item that are matched in the three versions of the questionnaire. These groups of questions are an attempt to 'vary the type and length of questions as variety provides interest' (Dawson, 2009:97). The largest group consisting of items 7 to 25 makes use of the 4-point Likert scale response type with the following response choices and codes:

**1 – not at all; 2 – slightly; 3 – moderately; 4 - greatly**

Items 26 to 31 and the first parts of items 34, 35 and 36 employed the dichotomous yes/no type of response, itself a type of two-point Likert scale but of the nominal or categorical scale of measurement. Item 32 required respondents to rank and indicate the top three choices, with the provision to add more options if desired. Item 33 is another select and mark, while the second parts of items 34 to 36, and item 37 are open-ended response types, requiring respondents to write responses in their own words.

#### 3.5.1.1.2 Choice of Likert scale

In choosing the number of response choices in the Likert scale for items 7 to 25, a consideration of the literature and consultation with contemporary researchers revealed a diversity of opinions based on their experience and subjective judgements. The question was: Should I use few (two, three or four) or many (six, seven) choices, and should I make use of an odd or even number of response choices, giving the respondent an opportunity to offer a neutral response or not? Anderson (1998) concedes that the Likert scale is one of the most useful question forms in eliciting vital grades of information from respondents using a questionnaire. In its most popular form the respondent is presented with a sentence and is asked to agree or disagree, usually on a three, four, five, six or seven-point scale. Anderson (1998) notes further:

> While Likert scales can have many response points (three to seven being most common), a 5-point scale is the most practical for most common purposes. It is easy to respond to, straightforward to analyse, and sufficient for most needs. Young children, however, are more comfortable with a 3-point or even a two-point scale. The issue of whether or not to have a neutral mid-point is often debated. I lean to having a neutral position for two reasons. Without one, some people will leave the item blank or mark a mid-point anyway, and second, research has shown that the proportion of people responding to non-neutral positions when there is no neutral position is similar to the proportion so responding when there is a neutral point and the neutral responders are discarded.

DeVellis (2003) reports that a common practice is to include six possible response options; “strongly disagree”, “moderately disagree”, “mildly disagree”, mildly agree”, “moderately agree,” and “strongly agree.” These form a continuum from strong disagreement to strong agreement. A neutral point can also be added. Common choices for a midpoint include “neither agree nor disagree” and “agree and disagree equally”. It would appear to me that choices based on the foregoing would require clear understanding and control of the English language, something that cannot be taken for granted especially with younger respondents of first language other than English. Lewis-Beck, Bryman and Liao (2004:573) writes:

> There has been some debate with bipolar scales about whether there should be an odd number of response choices with a neutral response in the middle (e.g. neither agree nor disagree) or an even number without the neutral response. Those advocating an odd number argue that one should not force an ambivalent person to make a choice in one direction or the other. Those advocating an even number point out that the neutral response is often misused by respondents (e.g. to indicate that the item is not applicable) and that it may encourage people to be non-committal. There is generally little practical difference in results using even or odd numbers of response choices.

Gray et al. (2007) concur that usually Likert response formats contain between three and seven alternatives as more choices might be confusing to subjects and also probably futile because there is a limit to the subtleties of opinion that people have, or think they have. The number of categories for responses should always reflect as closely as possible the estimated or expected variation in the answers to be given. The choice of answer format can be difficult. If the range of answers is too restricted, information loss may result; on the other hand, generating a large number of response options that are not chosen does not usually add much to what we know about the respondents. Teddlie and Tashakkori (2009) underscore the tendency to go for the 5-point scale:

> The traditional Likert scales are 5-point scales with a variant of 'neither agree nor disagree' as the midpoint of the scale … Some researchers prefer 4- or 6-point scales because there is no neutral option.

Maree (2010) says that, to his knowledge, there is no one single or prescribed format in the literature or at the University of Pretoria; it is a matter of choice of the researcher, as long as the scale suits the needs of the researcher. For my questionnaire in this study my supervisor and I in collaboration with the statisticians involved agreed to settle for a 4-point scale.

#### 3.5.1.1.3 The Content of questionnaire data

As stated earlier, section A of the questionnaire sought for general and biographical data from all the three groups of respondents. The content or substance of the items in Section B of the three versions of the questionnaire is to answer research sub-questions of the study (see Table 3.4).

Items 7 to 31 were created to answer the first sub-question: (*a)(i) To what extent has the NUST brand of industry-based learning been jointly perceived as significant in enhancing quality academic practices in university teaching and learning by participating students, lecturers and industry supervisors?* In these 25 items, seven factors indicating quality practices in teaching, learning and research were identified

and anticipated, namely, curriculum coherence (CC), active learning (AL), self-directed learning (SDL), cooperative learning (CL), learning styles (LS), assessment processes (AP), and learning processes (LP). The open-ended item number 37 would also provide the opportunity for those respondents who wanted to add more information to address sub-question (a)(i).

**Table 3.4: Research data collection matrix**

| | Research Questions/Sub-question | Sources of data | |
|---|---|---|---|
| | | Questionnaire Items | Interviewees |
| ***a)*** | ***What understanding do participating students, lecturers and industry supervisors wield on the nature and quality of academic practices realised through industry-based learning at NUST?*** | | |
| *a)(i)* | *To what extent has the NUST brand of industry-based learning been jointly perceived as significant in enhancing quality academic practices in university teaching and learning by participating students, lecturers and industry supervisors?* | 7 – 31, 37 | NUST Lectures |
| *a)(ii)* | *How do the participants' views on the potential for, and the achievement of, research-driven learning and learning-focused research and development (R&D) in the current industry-based learning format indicate concern for an effective university service?* | 37 | NUST Lecturers and Management |
| *a)(iii)* | *How is the proposed and developed model for university-industry engagement conceived by lectures as a contributor to sustainable transformative learning and mutual benefit to both partners?* | 36,37 | NUST Lecturers |
| ***b)*** | ***How do the views of participants inform analysis of the local relevance and impact of university education on national socio-economic development?*** | | |
| *b)(i)* | *How does the perceived value added by industry-based learning indicate an upturn on the traditional and prevailing modes of university teaching and learning, as well as on the subsequent performance of graduates in the workplace?* | 37 | NUST Lecturers and Management |
| *b)(ii)* | *What contributions are perceived to be attributable to industry-based learning in knowledge growth and holistic economic development of the country?* | 32 – 35, 37 | NUST Lecturers and Management |
| ***c)*** | ***How do opinions shared between NUST and other Zimbabwean universities engaged in industry-based learning indicate awareness and personification of qualitative, relevant and responsive university education suitable for a developing country?*** | | |
| *c)(i)* | *What motivations have popularised the NUST brand of industry-based learning among sister universities and why?* | | NUST Staff<br>Staff of other Universities |
| *c)(ii)* | *What quality academic practices are expressed and how do they signify goal-directed university education?* | | NUST Staff<br>Staff of other Universities |

Some of the open-ended responses to item 37 were also expected to answer the second research sub-question: (*a)(ii) How do the participants' views on the potential for, and*

*the achievement of, research-driven learning and learning-focused research and development (R&D) in the current industry-based learning format indicate concern for an effective university service?* This sub-question was going to be addressed mainly during the interviews.

Research sub-question (a)(iii), which seeks information on the proposed model and changes and improvements of the current industrial attachment system was partially answered by questionnaire item number 36, as well as the open-ended item number 37. The research sub-question reads: *(a)(iii) How is the proposed and developed model for university-industry engagement conceived by lecturers as a contributor to sustainable transformative learning and mutual benefit to both partners?*

Sub-question (b)(i) is partially addressed by the open-ended questionnaire item number 37, but most of the information would come from the interviews. The sub-question reads: *(b)(i) How does the perceived value added by industry-based learning indicate an upturn on the traditional and prevailing modes of university teaching and learning, as well as on the subsequent performance of graduates in the workplace?*

Sub-question (b)(ii) reads: *What contributions are perceived to be attributable to industry-based learning in knowledge growth and holistic economic development of the country?* Questionnaire items 32 to 35 both closed-ended and open-ended sections, as well as item 37 would answer this question.

To conceptualise the contribution of both the questionnaire and the interviews in answering the research questions and sub-questions and to indicate the sources of data, Table 3.4 has been constructed. The table shows the instruments and the respondents that addressed each particular research sub-question.

The development of the student and lecturer versions of the questionnaire took place in a series of iterative steps between me and my supervisor in the initial stages with items being drafted and revised. Finally the questionnaire was referred to statisticians at the Department of Statistics. The qualified statisticians recommended further amendments to some items in a bid to improve them to reduce ambiguity and so that the responses would be easily captured by the computer packages that would be used. While the

original idea had been to have only two versions (student and lecturer) of the questionnaire, the statisticians advised the development and inclusion of the industry supervisor version as well.

#### 3.5.1.1.4 The Pilot testing of the questionnaires

When the questionnaire (student version) had passed the content checks and had achieved the desired structuring and wording format, it was administered to a small sample of a population similar to the target population, i.e. the final year NUST students who had returned from their prescribed industrial attachment in mid- to late 2009. These students were one year ahead of the target group. Some of the objectives of administering the pilot questionnaire were to do the following:

- Identify items that were ambiguous or unclear to the respondents
- Identify language errors and inaccuracies
- Estimate the reliability and validity of the questionnaire
- Give an indication of the nature of responses and subsequent data analysis

The results of the pilot test provided the grounds for rewording and restructuring some of the initially created items, such as item 32 which was altered from requiring an open-ended list to providing the top three ranked options. There was room for adding more options to the suggested responses.

#### 3.5.1.1.5 The administration of the questionnaire

Permission to start the data collection within the university was sought through the University Registrar and this was granted (Appendix XIII). The timing of administering the questionnaires to the target students and the lecturers coincided with a time when there were unanticipated alterations to the normal academic calendar of the university and many programmes were running behind schedule by close to three months. Because of the prevailing harsh economic situation in the country at the time, many of the students were visibly not in attendance in their classes since they had to juggle between attendance and going out looking for money for tuition and other fees as well as for general living expenses.

With permission from the university granted, I proceeded by verbally asking permission from my colleagues, Chairpersons of departments and from Deans of Faculties where it

was necessary to access both the students in their classes and the lecturing staff. The ultimate permission was sought from the individual lecturers who had accepted to participate and whose lecture time slots were to be used to distribute or even to administer the student questionnaire.

- *Questionnaire to students*

The estimated population of about 750 registered final year students in five different faculties targeted for responding to the student version of the questionnaire was scattered in different departments. These were the students who had just returned from their industrial attachment in the previous academic year and who were in their final year to complete their degree programmes. The majority of those were in the faculties of Applied Sciences, Commerce, Communication and Information Science and were in their fourth year while those in the faculties of the Built Environment and Industrial Technology were in their fifth year.

All 750 odd students were targeted as the sample for questionnaire administration, thus a census. This was done so that the numbers of respondents could be reasonably large. Once a period of about a week to a fortnight had been earmarked for questionnaire administration, a working schedule was drafted for the orderly administration by class. With the first scheduled classes I handed over the appropriate numbers of questionnaires to chairpersons of departments from whom I would later collect the completed questionnaires. However, on noticing the very poor or nil returns that followed from this arrangement, I proposed and proceeded further by requesting for time (the first 15 to 20 minutes of a lecture) at specified and agreed timetable slots to administer the questionnaires to the classes. This worked better although there still were some students who would come late into class, thus missing the questionnaire administration. I also missed completely some classes whose lecture time-slots had been re-scheduled or had their lecture venues changed.

Most students were willing to fill in the questionnaire while I waited but there were instances where students specifically asked for more time to study the questionnaire after class to respond at a later time. Noticeably, the majority of these did not return their completed questionnaires to me. Thus it was very difficult to obtain a high return rate of the questionnaire. I noted that sometimes, even when I waited for the

questionnaires, there were some students who opted not to fill them in, withholding them or handing them back to me blank, usually avoiding being noticed. I accepted this as a manifestation of their freedom to choose whether to participate or not to participate in my research.

The normal procedure with each class of students was to start by explaining briefly the objectives of the study, moving to the contents and the structure of the questionnaire. In this I would alert them of the cover letter (Appendix V) which spelt out their right to participate voluntarily and to withdraw at any time when they felt like it. In a few cases students sought further clarification to some items in the questionnaire which they said they were not sure about.

- *Questionnaire to lecturers*

The lecturers are the university staff members directly involved in the planning, implementation and assessment of student industrial attachment, interacting with the students and with industry personnel each year for different groups of students. The chairpersons are partly administrative officers in the university's organisational structure, but they perform most academic duties in much the same manner and frequency as the lecturers they supervise in their departments. For purposes of the questionnaire administration I have treated chairpersons and lecturers as one group, designating them the practitioners. Among this group were teaching assistants, who are basically learner lecturers so to speak. A number of departments have had a substantial complement of teaching assistants in their establishments, doing lecturer duties, largely due to the prevailing academic staff shortage in some disciplines caused by the brain drain. I specifically requested chairpersons to include in the questionnaire distribution only those lecturers and teaching assistants who had been practically involved in the conduct of industrial attachment through participation in the key processes that included preparation of students, follow-up visits to industry, assessment of students' written and oral reports, processing of student results and overall student assessment. These would have experience of the type of information I needed in the questionnaire

The estimated population of the category of practitioners, i.e. chairpersons, lecturers and teaching assistants eligible for responding to the lecturer version of the questionnaire was about 170. Thus there was no sampling as I had prepared enough questionnaires for

all of them. Questionnaires were handed out to chairpersons or their department secretaries for distribution to eligible lecturers and teaching assistants, and in a few instances they were given directly to the individual lecturers. I would personally make follow-up queries and reminders by telephone or physically visiting some of the practitioners in their offices.

- *Questionnaire to industry supervisors*

It was difficult at the time of collecting data to establish the accurate number of all industry organisations involved in attaching students at different locations around the country. Estimates were put at around 150 for practical purposes.

The first step I took was to approach the director of Technopark who agreed to take copies of the questionnaire to administer at scheduled meetings, seminars and conferences of organisations that brought together representatives of commerce and industry such as the Zimbabwe National Chamber of Commerce (ZNCC) and the Confederation of Zimbabwe Industries (CZI). We relied on our knowledge that among those attending those meetings were supervisors of some of students on industrial attachment in their organisations. This strategy, however, did not produce any positive results; none of the questionnaires were filled in.

I later mailed 100 questionnaires to 50 handpicked companies around the country, in and outside my resident city, Bulawayo, from a list given by the Industrial Liaison Office. In Bulawayo and the surrounding areas, I hand-delivered questionnaires, in many cases requesting respondents to respond while I waited. Only a few agreed to this request, promising to look at the questionnaires later.

For some key companies in the main cities other than Bulawayo which attached groups of more than one student in their different departments, I took extra questionnaires with me when I went around on my visits to universities and hand-delivered questionnaires to workplaces I could access in the limited time at my disposal.

#### 3.5.1.1.6 The Quality of Questionnaires

The questionnaire used in this study was constructed during and for this particular study. As stated before, such an instrument has never been put to the test and its potency

and weaknesses were not known. However, some measures were taken during the construction to ensure quality. The instrument is not significantly different, except in specific content, from similar ones that have been developed and used elsewhere.

- *Validity*

The format and structure (face validity) of the questionnaire used in this study were developed using samples provided by the university and by referring to the literature as well. In terms of content, the three versions of the questionnaire went through iterative processes of drafting and revision before being released for administration to ensure compliance with accepted norms and standards. Part of the revision was to address the language and the intended meanings of statements and questions. In the process of instrument construction, I sought and made use of advice from experienced and knowledgeable people such as my supervisor and the statisticians from the Department of Statistics, all this on top of the lectures, research support sessions, meetings and seminars that I attended as a postgraduate student working towards producing an acceptable research product. At the stage of verifying whether all the questionnaire items would be analysable using computer programs, we held a joint discussion with my supervisor and the statisticians reviewing each item to ascertain its inclusion in the questionnaire in the light of the research questions and sub-questions as well as the objectives of the research study.

The pilot testing that I carried out was partly an attempt to assess whether a small sample of respondents would interpret the questions in the intended manner, and that it was giving the results I desired, thus consolidating its validity. If the pilot questionnaire had produced unexpected results, it would have had to be revised.

- *Reliability*

Validity is a function of reliability; in other words, an instrument is valid only if it is already reliable, but not the other way round. Reliability is about consistency in giving the same results if an instrument were to be administered many times, theoretically to the same respondents, assuming one administration does not affect responses in the next. In practice with human beings, it is not possible to administer an instrument to the same group repeatedly without experiencing maturation or other accretion effects. In this study, the consistency or replicability of the questionnaire as a quantitative data

collection tool was enhanced in large measure by the same validity checks discussed above. It was not feasible in the available time to subject the questionnaire in this study to the documented reliability checks such as the test-retest, equivalent-form and split-half approaches (Goddard & Melville, 1996:46). However, the fairly rigorous measures taken as well as the different people involved in drafting and redesigning it are a good reason for my confidence in the questionnaire reliability.

#### 3.5.1.1.3 Objectivity

The objectivity criterion for quality in an instrument such as a questionnaire is often partly addressed by reliability. Objectivity may be viewed as consistency of meaning, to various people or to the same person at different times, allowing the instrument to be uninfluenced by whoever is using it or is being subjected to it, their personal beliefs and feelings. I am confident that my questionnaire could be administered by anyone as competent as myself, and that it could be administered on any respondents comparative to those who participated in my study. This was partly made use of in the pilot testing.

### *3.5.1.2 Interviews*

Alongside observation, discussion, record reviews and others, interviews are the most common data collection techniques in qualitative research studies. The rationale, principles and the types of interview for different types of research methodology are widely documented in the literature both peripherally and in depth (for example Gillham, 2000; Rubin & Rubin, 2005; Dawson, 2009; Silverman, 2006; Flick, 2006). I explain below those procedures that I went through in the use of interview as one of the data collection techniques in my mixed methods study. To the extent that interviews focus on the few selected questions or topics under discussion, they provide depth and detail which constitute the 'thick description' rooted in the interviewees' first-hand experiences that make up the material that researchers gather and synthesise (Rubin & Rubin, 2005).

I have taken an interest in what Rubin and Rubin (2005) call 'responsive interviewing', which is what they term an approach to depth interviewing research. They have this to say about it:

> The responsive interviewing model relies heavily on the interpretive constructionist philosophy, mixed with a bit of critical theory and then shaped by the practical needs of

> doing interviews. The model emphasises that the interviewer and interviewee are both human beings, not recording machines, and that they form a relationship during the interview that generates ethical obligations for the interviewer. In the responsive interviewing model the goal of the research is to generate depth of understanding, rather than breadth (Rubin & Rubin, 2005:30).

This was the cornerstone of my approach to the interviews: that it encouraged the respondent to discuss freely issues based on the trust that was allowed to build up between us. It was apparent that with responsive interviewing, the design of the research remained flexible throughout the project, regarding the timing, the structuring and the administration of the interviews. The flexibility of the research referred to also includes the needs for interview follow-ups, redesigning instruments, et cetera. Dawson (2009) says that for qualitative data the researcher may analyse as the research progresses, continually refining and reorganising in the light of the emerging results.

#### 3.5.1.2.1 Constructing the interview schedules

Like the questionnaires, my interview schedules (or interview protocols) for the various targeted interviewee categories were designed to contribute to the answering of the key research question and sub-questions.

The interview questions were developed and then incorporated into a one-page report template or summary form which would be used for each interview. The top part of the template was designed to record information about the interviewee, namely the name, place where interviewed, date and time of interview, the interviewer and information on the location of the voice-recordings. This would assist with any follow-ups on the data providers.

The interview schedules for the various categories of respondents contained between five and nine basic open-ended questions serving as the guideline for the semi-structured interviews requiring open-ended responses. According to Max Bergman (2008), open-ended questions reflect the interviewee's conceptions while closed-ended questions reflect those of the interviewer. In the actual interview, the questions were asked not necessarily word for word as given in the interview schedule, and they were posed to different respondents not necessarily in the same sequence. This was due to the responses provided by the respondents that sometimes necessitated that a later scheduled question be brought forward to link quickly with a point or points raised by

the respondent in response to an earlier question. Discussions with the interviewees prior to the main interview would have some effect on the recorded interview.

The last question posed to all the respondents was a request to add their own information on anything within the research topic, whether discussed earlier or not. Semi-structured interviews allowed respondents the freedom to expand and provide open-ended responses to the depth that they wished and allowed me to probe interviewees further or seek explanations where I thought necessary. Through expanded and open-ended responses, interviewees would reveal the depth of their knowledge or opinions about the things they were talking about. These 'thick descriptions' would then provide me with the opportunity for analysis of espoused opinions and perceptions around the topic and the research questions.

Semi-structured interviews are a very important form of interview in a case study. In their simplicity, they allow for rich data, with tremendous flexibility whose 'naturalness' rests on a clear structure, carefully developed and practised (Gillham, 2000:65).

- *Interview schedule for NUST management staff*

The interview schedule (Appendix VIII) for this category of respondents was primarily meant for the category including the director of Technopark, the director of Research and Innovation Office, the deans of faculties, and chairpersons of departments. The chairpersons, whose functions overlap very closely with those of lecturers or practitioners, were included in this category this time because they form the foundation of university administration and most of them have been in the university a long time. In the questions I asked them I was interested in how they bring in issues of quality in academic practices on their own without my asking them that directly. After initially administering the schedule and noticing from the early respondents that some areas such as research were not being addressed in depth, and that most respondents were not adequately bringing up the comparison between traditional degree programmes and the current NUST model, the interview schedule was modified for the Director of Research and Innovation.

The interview questions 1 to 3 required the respondents to recount the trends and challenges they had so far experienced and perceived with the industrial attachment exercise in their respective capacities in the university. They were to address this in comparison with other universities locally or internationally. In this I would expect the administrators to reveal their understanding on one angle of how the exercise contributes to university missions and objectives. This was expected to answer in full or in part research sub-question (a)(i) which reads: *To what extent has the NUST brand of industry-based learning been jointly perceived as significant in enhancing quality academic practices in university teaching and learning by participating students, lecturers and industry supervisors?*

Questions 3 to 5 were also expected to address research sub-question 1.3 which reads: *How is the proposed and developed model for university-industry engagement conceived by lectures as a contributor to sustainable transformative learning and mutual benefit to both partners?*

Questions 6 and 7 sought to obtain views of administrators on the relevance of the graduates from the NUST industry-based learning background, as well as the views of respondents on the involvement of small and medium-scale enterprises (SMEs), thus addressing research sub-question (b)(ii): *What contributions are perceived to be attributable to industry-based learning in knowledge growth and holistic economic development of the country?*

The modified version of the interview schedule (for the Director of Research and Innovation) addressed specifically sub-questions (a)(ii) which reads: *How do the participants' views on the potential for, and the achievement of, research-driven learning and learning-focused research and development (R&D) in the current industry-based learning format indicate concern for an effective university service?* and (b)(i) which reads: *How does the perceived value added by industry-based learning indicate an upturn on the traditional and prevailing modes of university teaching and learning, as well as on the subsequent performance of graduates in the workplace?*

The final question or request in the interview schedule was the open-ended offer for the respondents to add any other points or ideas they wanted. This allowed for views which

would answer any of the research sub-questions and also to gauge the respondents' passions and strengths of their views on the research topic.

The question on the proposed model, which would answer sub-question 1.3, was inadvertently left out of the interview schedule for administrators. However, the question was posed to some of the respondents.

- *Interview schedule for NUST lecturers*

There were overlaps between the questions for this category and the one for administrators described above. For instance, questions 1 to 5 on the lecturer interview schedule (Appendix IX) sought to address research sub-question (a)(i) which reads: *To what extent has the NUST brand of industry-based learning been jointly perceived as significant in enhancing quality academic practices in university teaching and learning by participating students, lecturers and industry supervisors?* Answers to questions 1 to 5 related to the nature and quality of student learning and were meant to reinforce corresponding quantitative data obtained through the questionnaires.

Question 6 required respondents to expound on the benefits that local and participating industry were obtaining from the industry-based learning, and this sought to find out how the issue of research was being brought out, thus answering research question (a)(ii): *How do the participants' views on the potential for and the achievement of research-driven learning and learning-focused research and development (R&D) in the current industry-based learning format indicate concern for an effective university service?*

Question 7 and 8 were similar to those posed to administrators on the relevance of graduates to developing Zimbabwe's needs and particularly how the industry-based learning affected SMEs as part of the country's economic development vehicles alongside bigger companies.

Question 9 addressed the proposed three-tier model, i.e. research sub-question (a)(iii): *How is the proposed and developed model for university-industry engagement conceived by lecturers as a contributor to sustainable transformative learning and mutual benefit to both partners?*

- *Interview schedule for industry staff*

The interview schedule for industry supervisors (Appendix X) contained six questions as well as an open question where respondents could add any points they wanted. Questions 1 to 4 were meant to answer the research sub-question 1.1: *To what extent has the NUST brand of industry-based learning been jointly perceived as significant in enhancing quality academic practices in university teaching and learning by participating students, lecturers and industry supervisors?*

Additionally, question 4 would also partly address the research aspect in sub-question 1.2: *How do the participants' views on the potential for and the achievement of research-driven learning and learning-focused research and development (R&D) in the current industry-based learning format indicate concern for an effective university service?*
Question 5 would address sub-question (b)(ii): *What contributions are perceived to be attributable to industry-based learning in knowledge growth and holistic economic development of the country?*

- *Interview schedule for other universities*

The interview schedule for sister universities (Appendix XI) in Zimbabwe that had adopted the same full-year integrated industry-based learning model was designed to provide backup to the ideas and information supplied by the participants at NUST.

Interview question 1 was meant specifically to address research sub-question (c)(i): *What motivations have popularised the NUST brand of industry-based learning among sister universities and why?*

Questions 2 to 4 were designed to provide answers mainly to research sub-question 3.2: *What quality academic practices are expressed by participating universities and how do they signify goal-directed and needs-based university education?*

Question 5 addressed sub-question 3.3: *How is integrated industry-based learning perceived to respond to local needs of Zimbabwean society?*

*3.5.1.3 Reliability and validity of interview instruments*

Self-constructed data collection instruments have the disadvantage that they have not been used before and their quality and effectiveness are not known beyond the measures taken in their development to ensure such quality and effectiveness. A rigorous process in the creation of such instruments will often produce instruments with a certain measure of respectability, in particular reliability and validity.

- *Reliability*

The ability of the research instrument, in this case the interview schedule, to give the same result consistently is called its reliability (Goddard & Melville, 1996). This happens with an appropriate sample chosen from an appropriate population. Determining reliability requires repeated trials of the draft instruments to produce the final draft instrument that is to be used for the intended purpose in the research. In my research I used the first interview to put the instrument to the test and to apply and assess my own competence of interviewing. I changed a few aspects after my first interview, and I continued refining my instruments and my techniques following each interview.

The fact that I conducted all the interviews myself aided in the attainment of some measure of reliability in that I could explain a question when a respondent needed such explanation. My continued participation in the whole research assisted me to carry forward the learning from my experiences from one interviewee to another. For instance, if an earlier interviewee misunderstood or misinterpreted one of the questions, I would make sure that I worded the same question differently, hopefully more clearly, with later interviewees. This would ensure that my interviewees interpreted the question in the way I wanted them to, that is in keeping with my research questions and the objectives of my research study.

In content and thematic analysis of interview transcripts in general, the requirement for reliability is that the themes or issues analysed are sufficiently precise to enable other research analysts to arrive at the same results when examining the same material (Silverman, 2006). I did not engage other researchers with my interview schedules prior to administering them but I am convinced that the efforts I put in their development and the measures to maximise respondents' comprehension of the questions posed

contributed to the trustworthiness of the interview schedule as a data collection instrument.

The very fact that I recorded all the interviews electronically, painstakingly transcribed the recordings myself, and that I provide long extracts of data in my report of findings in the next chapter, satisfies the requirement for low-inference descriptors (Silverman, 2006). Low-inference descriptors, according to Silverman, provide concrete evidence of what the respondents say, rather than the researcher's reconstructions of the general sense of what was said, 'which would allow researchers' personal perspectives to influence the reporting'.

- *Validity*

As with reliability, in normal research practice, an elaborate iterative process of testing whether the final instrument correctly achieves or measures what it is intended would be necessary. The most applicable type of validity to my interview schedules would be *content validity*. The language and the terminology used in the interview were carefully selected and checked with my supervisor.

In general the practical administration of the interviews was carefully planned for beforehand, and the interviews were conducted by mutual arrangement and agreement to be located in the respondents' familiar environment as recommended in the literature. Since interviews are predominantly aimed at a few carefully selected respondents, it was appropriate for me to check the content of the interview schedules scrupulously before administering them because there was not enough time available for a full validation process.

In considering criteria for validity in qualitative research, Silverman (2006), alludes to the researcher's influence (or bias) on the setting, values of the researcher, the truth status of a respondent's account, as well as triangulation and respondent validation. My impact on the settings in which I conducted interviews with colleague staff members at the university would be essentially that of equal partners, and this would be enhanced by the understanding university academics have for research and researchers in general. In industry, where I was not part of the organisation and almost always a stranger, the assumption was that my relationship with respondents was unfolding as our interaction

took shape, before and during the main interviews. Those respondents I had communicated with by telephone or face-to-face during the preparations for the interviews would be expected to show less 'halo' effect. And the duration and tenor of the opening discussion just prior to each interview would be important in influencing the settings. Similarly my values as the researcher would affect the interview if I let them shape my discourses and allowed my preferences to dominate the interview. I tried to be neutral and not allow my personal views on side issues such as politics and the economic situation to be heard or deduced through the interviews.

On the truth status of the respondents, I have no reason to doubt the accounts given by any of my respondents, many of whom I met for the very first time and made interview arrangements only minutes before the interview, while with others I had communicated about the interview much longer in advance. However I could not rule out the possibility that I could have been listening to answers portraying ideal situations rather than elucidation of actual events and situations experienced. An example would be a lecturer who described how students should be orientated before going out on industrial attachment, instead of describing what he/she and others had actually done. In general though the validity of my interview instruments and the actual interviewing process were, in my view, moderately preserved by being free from extreme influences from either myself or my respondents.

*3.5.1.4 Conducting the Interviews*

My initial task was to organise interviews with selected university administrators and lecturers at NUST with the aim of running them concurrently with interviews of industry supervisors in my home city. This was in an attempt to obtain data from across the various target respondents in the first few encounters so that I could use issues raised to sharpen my subsequent approach to asking questions and guiding the overall discussions with later interviewees. I personally conducted all the interviews.

Among the NUST management staff, the Director of the Technology Park (Technopark) and the Director of Research and Innovation Office (RIO) were purposively selected as respondents, and of the five deans of faculties, two deans were ultimately conveniently selected to take part on the basis of their willingness and availability during the period

in which the interviews were conducted. The difficulty of using purely random or purposive sampling arose when a targeted respondent was continually busy usually with management and administrative tasks or was away on leave or on official university business. Appointments were also arranged with available and willing chairpersons of departments, as was done with purposively selected senior lecturers. Among the lecturers purposive sampling was done once more, and when a selected member agreed to the interview, an appointment was made. To gain access and obtain permission to interview willing industry supervisors, I made telephone calls, sometimes followed by email messages, through the Human Resources Offices of selected organisations participating in the industrial attachment exercise that would then assist me in making appointments with the appropriate respondents at times convenient to both of us.

The interviews, which at certain times took place concurrently with the administration of questionnaires, were conducted over an extended period of nine months. My first interview was with one of the university managers and it took place in July 2010. This introductory interview helped me to get warmed up to the whole exercise and allowed me to make adjustments where necessary. Following an unanticipated break of about four months, further interviews with the rest of the respondents resumed in mid-November to mid-December and proceeded into February and March of the following year.

In each interview encounter, I had a preliminary discussion with the interviewee in which I introduced the topic and gave a brief outline of the general information that I would be requiring, setting the stage for an open exchange. The interviewees did not have the exact questions that I intended to ask beforehand. This was done in order to reduce the possibility of respondents providing prepared answers, but encouraging spontaneous opinions and accounts coming from their internalised knowledge. This, however, has the disadvantage that the respondents might leave out things they might have forgotten. This happened a few times when a point forgotten was later on visited after the conclusion of the interview.

Although intended to last around 20 minutes, the actual interviews lasted between 15 and 38 minutes, with some respondents giving brief answers while others provided wide and elaborate descriptions of the ideas they had to offer. Guided by the interview

schedule, I would attempt to pose questions in the given sequence with few interjections, except where there was a clear need to probe or guide the interviewee.

With the permission of the interviewees, all interviews were recorded using a digital voice recorder, as well as an audio cassette recorder for backup. A few notes were written down. After each interview I would play back a few lines of the interview to confirm the recording and to confirm approval from the respondent. At the end of all the interviews the voice recordings were transcribed into text through word processing for concrete storage, closer scrutiny and discourse analysis. I personally did all the transcriptions, which took me a whole month, so that I could visualise and recreate the interview encounters in my mind as I did the transcriptions.

### *3.5.2 Development of the three-tier model of university-industry collaboration*

I was inspired by Ebong (2004) to think about various levels in which associations could occur between universities and their industry partners in a developing country. Contexts and situations in which universities exist are very diverse. Ebong (2004: 558) writes: “The universities in Nigeria have maintained contact with industry at two levels: the informal and the formal levels.” He goes on to outline the characteristics of each level and the history behind it. I set to thinking that it was possible to view universities as being aligned to their countries’ economic development and thriving on the synergy achieved between them and the level of industrialisation in the country. In other words, universities in less industrialised countries with predominantly agricultural economies would set their programmes to suit that scenario. My assumption was that through the many possible avenues of formalised university-industry collaboration, each university would select a group of activities that most suited its mission and capabilities. Through this, it was therefore possible for new universities to grow in tandem with the levels of their collaborations with industry, starting from the lower level and progressing higher up.

I initially drew up a list of possible activities of engagement which I had obtained from reading the various literature sources. No single source would provide all the components or ideas that I eventually had to put together to characterise the stages and activities within stages of the model. I also drew insightful examples from common

practices drawn from my observation and experience in the conduct of workplace-based learning in my institution and others. The model as it stands, assists me to conceptualise and organise the various industry-based learning activities in some form of hierarchy. It would assist to determine from the interviews with university staff and industry supervisors what issues they raised which connected with and corroborated the model. However, because it is still rudimentary and is yet an unrefined and untested inclusion in this study, it serves as a useful link for further investigation in future research endeavours.

For the implementation of the model, the activities had to be discussed and agreed upon between the university and industry participants. In preparation for my interviews, I would discuss the model and ask the respondent to study it before I would ask them questions on it during the actual recorded interview.

Below is a description of the activities and outputs suggested at each of the levels of the three-tier model.

*3.5.2.1 Level 1 - Basic Student Industrial Experience*

This is the level of the least engagement between the university and industry and it is meant basically for students' learning and preparation for joining the workplace on completion of their studies. The students get attached to their discipline-related workplace, either chosen by them or they may have been placed by the university. The students are expected to perform specified duties that fit into the curriculum requirements of their degree programme. Because students in a specific degree programme or discipline (say applied chemistry) get attached individually at different companies, they gain individualised work experience, albeit with the possibility that several of them may perform similar tasks and thus acquire similar knowledge. Students will be assessed through performance observation and periodic interviews by both university and industry supervisors, and through oral and written reports, the assumption being that each student produces a uniquely different written report from his/her colleagues. The attachment should also help students to initiate their final year project that must address a problem or issue encountered at the place of attachment. By

and large, the experiences and the learning of individual students remain distinct from those of colleagues.

*3.5.2.2 Level 2 – Improved industrial experience and research*

At this level several improvements are made on level 1. One is that all students get attached deliberately to both LSEs and SMEs, with a formula being worked out on the proportions of the periods spent in each sector. Another improvement is the inclusion of lecturers on short-term attachments (or sabbatical leave) to the same industries (both LSEs and SMEs) that their students go to, for say one month once every three years for each lecturer. This is meant to address the training needs of the people who do the training, and will help lecturers to be able to speak collectively the same language as their students and industry partners, to update their own industrial knowledge, to revive their work-related skills, and to maximise opportunities for applied industry-relevant research and consultancy, individual or collaborative. Choy and Haukka (....) pledge that:

> Industrial attachment is seen as an effective professional development activity for TVET [technical and vocational education and training] practitioners to maintain the currency of their vocational knowledge and expertise, including their knowledge of technologies and practices commonly used in contemporary workplaces .... This on-going development is necessary because the role of TVET practitioners is constantly changing. (p. 1368)

Staff would be encouraged to engage in collaborative multi-disciplinary, multi-departmental or multi-faculty research with colleagues and industry partners. At this level too, students are attached preferably in small groups of three to five in one industry, and assigned to work on the design of a prescribed project, such as renovating the production department of a plastics manufacturing company or division of a company. The actual task may not necessarily be undertaken, but students get to experience conceptualisation and documentation of their design ideas in real life settings. The collaborative engagement of these groups of students would enhance their tackling of issues relating to different disciplines such as finance, information technology, communication(s), design, construction, management, machinery, et cetera. The relationship between the university and industry at this level would be such that it would be possible for all students at the university (other than those on industrial attachment) to engage in fieldwork or short visits where learning sessions are offered in industry settings by industry personnel in real life working environments.

*3.5.2.3 Level 3 - University-Industry Research and Academic Development*

This final level signifies the highest form of mutual and collaborative engagement between the university and industry. The improvement on the previous level includes the requirement that industry will trust and engage the university as a major partner in its growth and development through inviting the university regularly and integrating it in identifying challenges and opportunities, and in finding solutions to mutually identified problems. The disadvantage here is that most companies, in particular large-scale and multinational foreign aligned ones, would perhaps not feel comfortable bringing 'outsiders' into their territory for fear of letting out confidential material that would eventually reach their competitors. For student learning this level would advocate increased implementation of the problem-based learning model during the whole degree programme, which necessitates learning of concepts around real problems encountered in workplaces. Lecturers and industry staff would be expected to engage in more collaborative research and development activities mutually conceived and resourced. This collaboration would be aiming at capitalising on the academic's wide theoretic approach to complement the industrialist's practical and focused outlook. Table 3.5 shows a summary of the different activities and components of the proposed model.

The above proposed model was shown primarily to the lecturers and some of the chairpersons of departments and discussed briefly at the introduction just before the start of the interviews. A question would then be asked during the interview on what the respondent thought about the model.

**Table 3.5 Activities in the industry-based learning model**

| Level | Attachment | Activities | Location | Assessment | Research Projects |
|---|---|---|---|---|---|
| **1** | • Student only | • General specified | • LSE | • Supervision<br>• Written/oral reports | • Student final year |
| **2** | • Student and lecturer | • Staff consultancy | • SME and LSE | • Direct supervision<br>• Reports | • Group<br>• Multidisciplinary |
| **3** | • Student and lecturer | • Problem-based learning | • SME and LSE | • Supervision<br>• Contribution to industry | • Mutually beneficial to university and to industry |

## 3.6 Data Analysis

In keeping with the nature of the concurrent embedded mixed methods study, the qualitative and the quantitative data were analysed separately but essentially concurrently in that it was not important which data type should be analysed first. But since the qualitative portion of the study was of greater priority than the quantitative, the discussion below starts with the former.

In this typical concurrent or parallel/simultaneous mixed methods design in which I collected both qualitative and quantitative data at essentially the same time, data analysis was done after all the data had been collected as proposed by Onwuegbuzie & Teddlie (2003). Analysis of data in mixed methods may be viewed as the use of quantitative and qualitative analytical techniques from which interpretations are made, and such analysis may be design-independent (Onwuegbuzie & Teddlie, 2003). In other words, quantitative data can be subjected to both quantitative and qualitative data analysis techniques, and so can qualitative data. Dawson (2009) writes about the qualitative data analysis continuum, in which there are highly qualitative, reflective types of analysis at one end, and on the other types of analysis that treat the qualitative data in quantitative ways by coding and counting data. In my questionnaires the open-ended portions of items, for instance, were subjected to both quantitative and qualitative data analysis, in a bid to get more out of the same data.

### *3.6.1 Qualitative data analysis*

The interview transcripts, generated from 'oral narratives of personal experience' by respondents (Lewis-Beck, Bryman & Liao, 2004) allowed for textual analysis with some hindsight of some of the contexts in which the interviews took place since I was the interviewer, remembering and mentally recreating at least some of the dynamics of the interviews.

I used content analysis, also referred to as narrative analysis by Lewis-Beck et al. (2004) in relation to the questions and ideas I discussed with respondents, and relating to the research sub-questions from which they were derived. I read through the transcripts one by one in each group of interviewees, often several times, highlighting what I considered to be the substantive statements made by the interviewees based on

Gillham's (2000) ideas. Then I categorised these statements and coded them according to both my expected themes and emerging themes.

Thematic analysis, according to Dawson (2009), is inductive, allowing themes to emerge from the data and not being imposed by the researcher, with data collection and analysis taking place often simultaneously. According to Lewis-Beck et al. (2004) thematic analysis is only the first and most basic of four types of *narrative analysis*, and its emphasis is on the content of a text, 'what' is said more than 'how' it is said. Language is important in thematic analysis because it is a 'direct and unambiguous route to meaning', a resource rather than a topic of investigation in the research.

> The thematic approach is useful for theorising across a number of cases - finding common thematic elements across research participants and the events they report. … Because interest lies in the content of speech, analysts interpret what is said by focusing on the meaning that any competent user of the language would find in a story. … The contexts of an utterance - in the interviews in wider institutional and cultural discourses - are not usually studied. Readers must assume that when many narratives are grouped into a similar thematic category, everyone in the group means the same thing by what he or she says (Lewis-Beck et al., 2004:706).

Item 37 on the questionnaires was the very open-ended request: *In this space feel free to write any additions, concerns or explanations to some of your answers to the previous questions.* In analysing this item I sought to collect all the themes, whether already included in my list of expected or new and emerging ones brought in by respondents. I categorised all the substantive statements and then cross-checked with my list of expected themes using a content analysis grid (Appendix XV). This was my thematic analysis, in which I did both the *count* analysis and the *meaning* analysis. Thematic analysis helps to identify commonly expressed themes by respondents, whether expected or emerging.

### *3.6.2 Quantitative data analysis*

Both descriptive and inferential measures were used in the analysis of the closed-ended questionnaire items. I coded all the responses to the questionnaire as provided for in the design. The same statistician and consultant at STATOMET in the Department of Statistics who had helped in the questionnaire design worked with me in the analysis of questionnaire data. Data from all the three groups of questionnaires (student, lecturer, and industry supervisor) were captured into the computer. A series of meetings to

discuss the data outputs and the meanings and to decide on further action were held between my supervisor, the statisticians and me.

*3.6.2.1 Descriptive data*

The computer program SAS was used to generate summaries for all the variables in all sections of the questionnaire, e.g. absolute frequencies, percentage frequencies, cumulative absolute and percentage frequencies, means, medians, ranges and standard deviations. The summaries were done for the whole samples, and also for sub-samples such as by factor, faculty, age, gender, previous work experience, and others depending on the class of respondents. After the first round of printouts of raw data and summaries, there arose the need in a few cases to readjust the coding with respect to open-ended items to cater for additional response categories that had not been anticipated during the design stage.

*3.6.2.2 Inferential data*

The students' version of the questionnaire was the only one qualifying for a factor analysis because the number of respondents (363) was more than 20 times greater than the number of items (19) requiring the factor analysis. Thus, after all the data had been captured, a confirmatory factor analysis using the BMDP4M computer software program was carried out on items 7 to 25 that used the Likert scale format of response. A confirmatory factor analysis tries to confirm the factors expected from the responses since the factors were created during questionnaire design.

A comparison of factor means for sub-groupings by faculty, age, gender, et cetera. was generated. The Chi-square test was used with each of the categorical (yes/no) items (number 26 to 36, omitting 32 and 33) in the three categories of respondents.

## 3.7 Justification for the Research Approach

The decision to settle for the mixed methods approach for my study partly arose from the realisation that mixed methods provide for complementarity between quantitative and qualitative data. They aim to attain holism as described by Copley in Du Toit (2008), that is, the conception that the combination of methods achieves more than the sum of the different methods treated separately. For a case study, this is desirable because a single case may very often not be typical of all other cases.

In general in the literature there is a question often raised: Should we trust mixed methods? Describing the divide between QL and QN methods as based on highly questionable premises, on positivist versus constructivist paradigms rather than processes, Bergman (2008:19) recommends that "mixed methods research will need more elaborate explanations with regard to its methods and purposes, as well as how and for what purposes the results from the different methods are being combined. Thus, mixed methods research cannot claim to bridge the unbridgeable gap between positivism and constructivism. Furthermore, it does not automatically provide better answers to research questions in principle, and it is unlikely to replace well-designed mono method research designs (Bergman, 2008).

Bryman (2008) expresses his increasing uneasiness in recent years 'about the current wave of enthusiasm for mixed methods research'. His uneasiness comes from the fact that in his own experience and analysis, mixed methods research is often insufficiently justified in published journal particles and in review articles preparing for publication, as well as in research grant applications.

Explaining what he terms 'research for understanding one's own situation and problems', Suwanwela (2008: 132) notes that one of the greatest mistakes in the past was to import solutions for local problems. Research that starts out from a local practical problem is immediately relevant and usable, and the nature of the research questions is determined more by the questions than by a consideration of whether to use qualitative or quantitative methods.

### *3.7.1 The quality of research methods*

The traditional criteria of determining the rigour of research methods and judging the quality of scientifically sound research are given as validity (internal and external), reliability and objectivity. These are particularly applicable to quantitative research but parallel versions have been provided for qualitative research in the past few decades. The notable contribution in this effort has been by Lincoln and Guba (1985); and their arguments are discussed below in broader contexts with inputs from more recent

literature. Lincoln and Guba (1985) actually prefer the term *trustworthiness* to rigour in dealing with qualitative studies, while Butin (2010) speaks of *trustworthiness* and *authenticity*.

*3.7.1.1 Credibility and Internal Validity*

The truth value of a research effort is determined in different ways by researchers and consumers of research. Lincoln and Guba (1985) suggest that findings must be approved (or approvable) by the constructors of the multiple realities being studied, a process called 'member-checking'. Silverman (2006:292) refers to 'respondent validation' where tentative findings are taken back to the people studied to see whether they conform to their own 'experience', and then refined in the light of the respondents' reactions. In my case this has not been fully possible beyond follow-up interviews on the data provided by some respondents.

As a member of the institution in which the case study is centred, I believe I satisfy the requirements of prolonged engagement and persistent observation (Lincoln & Guba, 1985). My use of mixed methods and multiple methods, interviews and questionnaires (open- and closed-ended) also satisfies the method triangulation strategy to increase the credibility of my research. Particularly the triangulation of data sources within my university and from respondents from outside the university helped me to produce a more complete, and perhaps credible picture taken from various angles.

Other strategies such as peer debriefing, negative case analysis (or deviant case analysis) were also mildly used in this study. For instance, I held free discussions with some of my interview respondents both before and after the interview sessions discussing aspects related to the research. This had the desired effect of relaxing the atmosphere between me and the respondents, and increasing the much-needed mutual trust and assurance of the authenticity to the exercise.

*3.7.1.2 Transferability and External Validity*

The question of whether the findings of a research project can be applied elsewhere answers to the criteria of generalisability in traditional quantitative research. In qualitative research, especially case studies, the more relevant concepts, according to Lincoln and Guba (1985) and other authors are transferability, portability and emulability. This shifts the onus for usability of research findings to 'the person seeking

to make an application elsewhere' (Lincoln & Guba, 1985), and requires empirical evidence about contextual similarity between the case studied and the case elsewhere which wishes to emulate the findings. I am convinced that my rich descriptions of findings provide enough data and grounds on which similarity judgements can be made by similar and like-minded universities.

*3.7.1.3 Dependability and Reliability*

The stability, consistency and replicability criteria used in quantitative research are satisfied by how dependable the methods and the outcomes in qualitative research are, and these seem to rely on the credibility described above. The stability of an interview schedule, for instance, is judged by whether it produces the same results in both natural and contrived settings (Lincoln & Guba, 1985). My use of both questionnaire open-ended items and interviews is an indication of overlapping methods, a form of triangulation. My developing and adjusting the interview schedule and techniques as the research progressed is an indication of 'stepwise replication', where the data gathering process was improving as I was progressing with the data collection. Since this is a supervised research effort, my supervisor acted as my 'inquiry auditor', but I am inviting my readers to join in and be my auditors on my processes and the product.

*3.7.1.4 Confirmability and Objectivity*

Qualitative and interpretive research does not claim to be totally neutral or free from all bias from the researcher. Indeed the researcher is part of the ensuing narrative, and rather than pretending to come into the situation with no biases at all, researchers have to declare the influences of their own prior experiences and cultural lenses (Rubin & Rubin, 2005:31). However, qualitative researchers still need to assure their audiences of trustworthiness in their processes and the resultant products. I trust that my evaluators will indeed focus on the quality of the data that I present more than on any of my characteristics as a person or researcher. My personal involvement in the research puts me in a position that I was responsible and answerable for my actions and claims. Audit trails (diaries, notes and recordings) assisted me in confirming some of the work I did and in supporting my claims to knowledge generated in this report.

### *3.7.2 The quality of mixed methods*

If the processes of data collection and analysis are of acceptable quality and are trustworthy, the chances are that the results obtained will also be of high quality as well.

As seen in the discussions above, the criteria for judging qualitative research are traditionally different from those of judging quantitative research. In a mixed methods case study such as this one, the assumption is that there are two avenues possible for ascribing quality to the overall research. The first is to apply qualitative criteria to the qualitative portions of the study separately, and the quantitative criteria to the quantitative portions. The second is to find hybrid criteria that seek to assess both criteria simultaneously. One issue is the emergence of a language of research, a bilingual language. Creswell and Garrett (2008) recognise the emergence of a bilingual language of research, a language that is neither quantitative nor qualitative.

Onwuegbuzie and Teddlie (2003) prefer to ascribe rigour in mixed methods research in terms of representation and legitimation. In representation, that is the ability to extract adequate information from the underlying data, five purposes of mixed methods evaluations are fulfilled, namely *triangulation*, *complementarity*, *development*, *initiation* and *expansion*. In legitimation, that is the validity of data interpretation, Onwuegbuzie and Teddlie (2003) allude to five types of validity seeking 'legitimacy', which, they say, incorporate validity, credibility, trustworthiness, dependability, confirmability and transferability of research findings. These are *descriptive* validity, *interpretive* validity, *theoretical* validity, *evaluative* validity and *generalisability* (internal and external).

Creswell and Clark (2007) recommend the use of the terms *validity* and *inference quality* to address issues of quality in mixed methods. They define validity within a mixed methods study context as the ability of the researcher to draw meaningful and accurate conclusions from all the data in the study. This means that both qualitative and quantitative portions of the data need to be integrated first before the analysis is done. I am in favour of this approach for my study, since the two portions overlap in seeking out the same data. However, inference quality is defined as the accuracy with which researchers draw inductive and deductive conclusions from a study.

Punch (2009:121) poses the question whether researchers would want to generalise from a particular case study. He says, "… whether a case should even to seek to generalise, and claim to be representative, depends on the context and purposes of the particular project". Quoting Denzin, Punch (2009) says that generalisation should not necessarily be the objective of all research projects, whether case studies or not. An

instrumental case study does not have generalisability as its objective, since the case studied is often unique and atypical, requiring a deeper understanding of its peculiarity. Yin (2003) says case studies, like single experiments, are generalisable to theoretical propositions (analytic generalisation) and not to populations or universes (statistical generalisation). This implies that another university planning to adopt processes and findings depicted in a particular case study may adopt only selected theoretical aspects rather than the whole picture.

A case study may, however, produce generalisable findings explains Punch (2009). This happens when the study 'conceptualises', that is, it studies some phenomenon in depth so that "the researcher develops one or more new concepts to explain some aspect of what has been studied". For example, in this study, if the objective is to bring to the open the operations and intricacies of industry-based learning, many like-minded universities would like to emulate the case. In explaining how the problem of generalisation is approached by different earlier writers, who suggested different kinds of generalisation such as analytic generalisation, retrospective generalisation, assertion, propositional generalisation, intrinsic case study, illuminative evaluation, evaluative case study and qualitative generalisation, Bassey (1999:35) refuses to offer a summarised single view, arguing that to draw such comparisons is a dangerous game.

While Onwuegbuzie and Teddlie (2003) suggest otherwise, McNiff and Whitehead (2006) recognise a significant difference between validity and legitimacy, and they explain it thus:

> Validity refers to establishing the truth value of a claim, its authenticity or its trustworthiness. This is a matter of rigorous methodological procedure. Legitimacy refers to getting the account accepted in the public domain, by getting people to listen to you and take your work seriously, in the hope that they may be open to learning from it or trying out something similar for themselves. Establishing legitimacy is a matter of power and politics, because people may or may not want to listen, in spite of your having demonstrated the validity of your work (p. 157).

The point made above is that legitimacy does not rest in the author's work or research competence but with stakeholders, particularly those wielding power, ranging from a supervisor through institution authorities, up to the journal editor. It is important for me therefore to keep updating these key stakeholders on the issues emerging throughout the process of my research, while maintaining control and exercising mature independence

of them. McNiff and Whitehead (2006) advise that both validity and legitimacy involve getting the agreement of others that what I have to say should be believed and incorporated into public thinking, adding the following:

> While you have some control over validation processes, by showing the internal logic and methodological rigour of your claim, you have less control over legitimation processes, because you are presenting your claim within the socio-political context of other people's interests, including their personal and professional ambitions. This can be tricky, because those people may or may not agree that your work is valuable depending on how it suits their purposes (p. 166).

One final consideration of the rationale and potency of assessing any research study is that there very often are endemic problems in judging research quality. Cooper (2010) mentions as some of these the predispositions of the judge or judges, the judges' disagreement about what constitutes research quality, and the differences among quality scales.

### 3.8 Challenges and Practical Constraints

In carrying out this study, as is expected, there were some unexpected happenings and outcomes that impeded the processes intended and experienced in the study. I have already alluded to the prevailing country's economic problems, which accounted for most of the challenges that were experienced.

At the time of data collection, the telecommunications system in the country was operating in a reduced capacity and the effect was felt by all sectors of the country's economy. Telephone communications were often problematic, especially inter-city trunk calls that were crucial for arranging appointments with respondents. From the experience I had with participating companies in my home city, it was virtually impossible to secure an appointment in one attempt, partly because the targeted supervisors were not always in the offices. The postal system was very unreliable, slow and sometimes completely dysfunctional in some areas of the country. I had to post questionnaires twice to some places, but still got discouraging feedback. The modern methods of communication using information and communication technologies were no better. Internet connectivity and electrical power supplies were very unreliable at the time the field work for this study was conducted.

A profound effect on the research was financial constraints. A careful budgeting plan was adopted for the limited funds allocated by my university under the Research Board facility, but I still had to use my own resources to see the research get carried out. The requirements of the Research Board assume a straightforward situation in which research visits are undertaken smoothly and as per plan. In practice, however, I had to visit some places more than once, make telephone and cellular phone calls repeatedly, sometimes ultimately giving up with no positive results forthcoming. I intended interviewing more respondents in industry from places all round the country but my budget allowed me only one week out of my station to cover universities and industry visits. The result was that I could not wait when appointments required me to extend my stay away from home.

Within the university under study the general availability and motivation of participants for an academic exercise appeared reduced from what I had been used to in the previous normal years. Even when a person would have agreed to an interview appointment, some did not treat this seriously and were not available at the agreed time. Personal and family problems were sometimes given by members who failed to honour appointments. Also, it appeared that scheduled programmes, timetables and calendars often were difficult to adhere to both in the short and long term. Some administrators genuinely failed to honour appointments because emergency meetings or other unanticipated commitments had come up in their diaries.

In a similar vein, industry supervisors and managerial staff were often very busy people. I could sense the difference between academics and industrialists where the latter could not commit themselves to an exercise such as answering a questionnaire that would not produce tangible results for them. Academics did make promises although they too failed in the main to honour them.

### 3.9 Ethical Issues

Research that deals with people as subjects of inquiry is laden with issues of fairness, propriety and effects. The consideration of ethical issues affecting participants in this research study was done during the development of the research proposal as is the norm at the University of Pretoria. The application for ethical clearance was made before commencement of data collection, and subsequent procedures were carried out to

maximise adherence to ethical means and thoughts. Various aspects of ethical practice are considered below.

### *3.9.1 Trust and respect of participants*

Throughout my interaction with the respondents, I went out of my way to show them all the respect I believed they deserved by considering their situations and agreeing to make arrangements that suited them ahead of my own desires and plans. The participants were all adults above the age of majority who happened also to be well educated, and thus trusted to make informed decisions about their participation. Most of all, they were aware of their rights and what sort of treatment they were entitled to. While any research effort may conjure up effects ranging from raising participants' expectations through feelings of being exploited, deceived to causing anxiety, I did my best to present myself generally unobtrusively and in a modest but business-like manner. I did make out that some of the respondents associated this type of research with rewards such as funding or some privilege on my part even if I was researching on a topic (industrial attachment) that touched many people in the university. This was partly because of the university's science and technology focus, where social research plays a smaller role compared to laboratory and experimental investigations dealing with non-human subjects and materials. Another explanation could be the constrained economic situation in which people expected any contribution of their precious time and effort to be rewarded somehow. For my part, this study was an effort to engage all as cooperating partners professionally thinking and reflecting on our practices. I also was conscious of the requirement that I needed to be respected and trusted by all my informants in order for them to be truthful in their responses to my questions and requests for information.

### *3.9.2 Access*

I have pointed out in my description of the data collection processes above that I sought appropriate prior permission to gain access to all the respondents that I required to engage in my study through face-to-face, telephone, email and written communication. This permission was sought, where necessary, from the 'gatekeepers' of organisations, as well as from the individual respondents. Fortunately, all organisations I engaged with were 'closed' or 'private' settings, allowing me 'overt' access based on informing subjects and getting their agreement often through gatekeepers (Silverman, 2006). In

negotiating entry into organisations, I was guided by their tendency to concentrate more on building trust in the relationship between them and me or my organisation rather than on merely providing me with information as Flick (2006) suggests. With regard to universities, some were more open than others. The responses to my request to go into the institutions and carry out the study ranged from outright refusal (See Appendix XIIIb) through conditional and delayed acceptance to lukewarm acceptance (see Appendix XIIIc).

### *3.9.3 Informed consent*

All the respondents were by virtue of their age and level of education competent to decide on whether the research was harmful to them or not to determine their participation. I made all efforts to explain the objectives of my research to all the respondents and I informed all of them of the voluntary condition to participate and the option to withdraw at any point once they were in the process. The language of communication was English, a second or third language for most respondents, but it being the country's official language, I was satisfied with all respondents' competence and confidence in what they were saying, and in how they interpreted what I said to them.

### *3.9.4 Anonymity*

The questionnaires offered full anonymity in that the respondents did not write their names. On the other end interviews were conducted face-to-face with the respondents, and during the voice recordings I intentionally made full identification of who was providing the data. The report on findings from the interviews in the next chapter relies heavily on respondents' views presented in direct quotations. The people responding are thinly disguised since they can be identified by their positions and by the content of their answers. But for most of them it was difficult to conceal their professional identities and it is possible some readers will be able to identify the individuals referred to. Since all of them are adults I anticipate that not much harm is awaiting them. Anonymity of the respondents in the report was protected by using codes (Appendix XIV).

### *3.9.5 Confidentiality*

This study can be characterised as a low sensitivity one with little intrusiveness into personal and organisational details of everyday life or personal occupation. By and large, the information I sought from all the respondents was not intended to include confidential matters that would inadvertently affect other people within or outside the study. If any potentially confidential information arose in the interviews, I would use my discretion and perhaps follow up on the affected respondent to check if he/she wanted his/her responses published as part of the results; otherwise any sensitive information such as gossip would be left out of the report.

### *3.9.6 Safety and consequences of participation*

Issues of physical safety did not arise in this study because respondents were not subjected to any manipulation, change of environment or unfamiliar practical activity. They were all approached and engaged in their day-to-day working or study locations. Just as there were no envisaged material benefits accruing to respondents as a consequence of their participation, there were also no physical risks intended either. There were, however, conceptual benefits expected for all participants in that their awareness of the industry-based learning activities would be enhanced when they were called up to give analytic views on the subject.

## 3.10 Conclusion

Research practice hinges on underpinning theory and philosophy. This has been the subject of discussion in the opening sections of this chapter. The conceptions of the research and the terminologies used are important to understand before any attempt to categorise the research. The constructivist, interpretivist paradigm and framework have informed the design of fieldwork processes that were aimed at generating desired knowledge in this study. The research questions and the study objectives have necessitated the use of mixed methods in an enhanced case study that employed questionnaires and interviews for data collection.

The processes and procedures carried out in this research study describe a case study utilising the concurrent embedded design of mixed methods research. It is observed that mixed methods best answer research questions that seek to delve into both quantifiable information and in-depth personalised constructions of reality and truth. However,

mixed methods of inquiry have their own limitations and problematic nuances that are voiced by staunch adherents of either qualitative or qualitative research paradigms, and discussed elsewhere in this chapter.

The appropriate fieldwork processes have been described in considerable depth, starting from the conception and leading to the development, validation, administration and analysis of the data collection instruments. Some justification for the choice of methods, instruments, and information sources is provided alongside descriptions of these in the text. In addition, some of the observed strengths and weaknesses of the procedures undertaken have been brought out in the hope that the reader may understand the attempts at acceptable scientific research practice.

In putting the perceived quality of this study under spotlight, this chapter has attempted to justify the design, content and administration procedures used in the light of recommendations in the literature. The contested conceptions used for identifying criteria for judging mixed methods as compared to judging purely qualitative or quantitative designs are presented to provide the reader with glimpses of conceptual gaps encountered in the literature. This chapter has also touched on the researcher regarding potential and real bias. How does one know whether the respondents are telling the truth in the information they give? I have tried to show how the threats to validity in data collection were neutralised, in the selection of participants, in interactions with them, and in follow-up interviews. The ethical concerns in this study have been minimised by the fact that all respondents were adults or young adults who could be trusted to understand the impact of the research on them and make informed decisions about their involvement. Threats to quality in data analysis are addressed in the next chapter following a presentation and analysis of the findings. Also the contexts in which some of the results were obtained are analysed. This should clear the way for interpretation and the resolution of the research questions.