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Publication details

Cameron, R 2009, 'A sequential mixed model research design: design, analytical and display issues', *International Journal of Multiple Research Approaches* , vol. 3, no.2.
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A sequential mixed model research design: Design, analytical and display issues

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ABSTRACT

A new era in research methods is emerging and has been quietly lauded by several emerging authorities in the field of mixed methods research. Like the mythology of the phoenix, mixed methods research has arisen out of the ashes of the paradigm wars to become the third methodological movement (Cameron & Miller 2007). The fields of applied social science and evaluation are among those which have shown the greatest popularity and uptake of mixed methods research designs. This article provides a brief overview of the rise of mixed methods research, its usage in business and management fields and its relationship to the philosophy of pragmatism. Typologies of mixed methods research designs are discussed and a case study of a sequential mixed model research design in the human resource development (HRD) field is presented. Issues related to design, analytical processes and display arising from utilising this particular mixed method research design are discussed. As a consequence, the article contains several Tables and Figures which exemplify display options that may assist those researchers who are considering utilising a mixed method research design.

Keywords: mixed methods, qualitative research, quantitative research, research designs, triangulation

The paradigm wars

The debates surrounding research paradigms have a long history and were particularly active in the 1980s. Some commentaries on the debate contend that the struggle for primacy of one paradigm over others is irrelevant as each paradigm is an alternate offering with its own merits (Guba 1990: 27). Creswell (1994: 176) identifies several schools of thought in the paradigm debate or so-called 'paradigm wars'. At one end of the debate are the 'purists' who assert paradigms and methods should not be mixed. Another school of thought is identified as the 'situationalists' who contend that certain methods can be used in specific situations. In direct opposition to the 'purists' are the pragmatists who argued against a false dichotomy between the qualitative and quantitative research paradigms and advocate for the efficient use of both approaches.

Proponents of mixed methods research have been linked to those whom identify with the pragmatic paradigm. Historically, pragmatism can be traced to an early period from 1860–1930 and the neopragmatic era from 1960 to present (Maxcy 2003). Many mixed methods researchers and theorists draw strong associations with mixed methodology and pragmatism (Bazeley 2003;

Greene & Caracelli 1997; Johnson & Onwuegbuzie 2004; Maxcy 2003; Tashakkori & Teddlie 2003). Johnson and Onwuegbuzie (2004: 17) summarise the philosophical position of mixed method researchers when they say:

> We agree with others in the mixed methods research movement that consideration and discussion of pragmatism by research methodologists and empirical researchers will be productive because it offers an immediate and useful middle position philosophically and methodologically; it offers a practical and outcome-orientated method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt; and it offers a method for selecting methodological mixes that can help researchers better answer many of their research questions.

Pragmatism has a strong philosophical foothold in the mixed methods or methodological pluralism camps. This paper now looks more closely at the mixing of qualitative and quantitative research methods.

There exists a complex array of research methodologies utilised that can incorporate interdisciplinary, transdisciplinary and multidisciplinary approaches. Due to the limitations of this paper a detailed discussion of this level of complexity is not possible. Therefore, a starting point for the paper will be a brief overview of three main approaches used in the social sciences (Neuman 2006) and the more simplistic dichotomy of research methodologies that are often categorised under two approaches: quantitative (positivist) and qualitative (postpositivist), each with unique strengths and limitations. Neuman (2006: 80) refers to three ideal types in his discussion of the three approaches found in the social sciences. The three approaches are: positivist social science; interpretive social science; and critical social science. Neuman (2006: 80) acknowledges the levels of complexity in research choices and approaches and uses this typology as a means to simplify a detailed discussion of each approach and represent fundamental differences between them:

> They are ideal types or idealized, simplified models of more complex arguments. In practice, few social researchers agree with all parts of an approach. Often they mix elements from each.

Caulley (1994: 4) asserts that positivist inquiry takes a realist position and involves a dualist epistemology which requires separation of the researcher to the researched. Postpositivist inquiry takes a relativist position and allows for multiple constructions of reality and a monist epistemology where the researcher and the researched interact and are bound together. The differences between qualitative and quantitative research approaches can be explored more fully in King, Keohane and Verba (1994) and Brady and Collier (2004). Brady and Collier (2004: 5) suggest there is a lot of potential for mutual learning between qualitative and quantitative researchers:

> …a meaningful discussion of methodology must be grounded in the premise that strengths and weaknesses are to be found in both the qualitative and quantitative approaches. Regarding the weaknesses…qualitative researchers are perhaps 'handicapped by a lack of quantification and small numbers of observations', whereas quantitative researchers may sometimes suffer from 'procrustean quantification and a jumble of dissimilar cases'.

Brady and Collier (2004: 195) go on to state that the intellectual vitality of the two traditions and associated divergences between them, has produced a 'major new methodological dialogue'.

Neuman (2006: 177) provides the following argument in terms of these two methodological approaches and argues against the rigid dichotomy between the two:

> The qualitative and quantitative distinction is often overdrawn and presented as a rigid

> dichotomy. Too often, adherents of one style of social research judge the other style on the basis of the assumptions and standards of their own style….The well-versed prudent social researcher understands and appreciates each style on its own terms and recognizes the strengths and limitations of each. The ultimate goal of developing a better understanding and explanation of the social world comes from an appreciation of what each has to offer.

Guba and Lincoln (2005: 200) discuss how positivists and postpositivists can be reconciled through mixed methods and can be:

> …retrofitted to each other in ways that make the simultaneous practice of both possible. We have argued that at the paradigmatic, or philosophical, level, commensurability between positivist and postpositivist world views is not possible, but that within each paradigm, mixed methodologies (strategies) may make perfect sense.

In particular, qualitative research can be a site of multiple practices where there is no 'distinct set of methods or practices that are entirely its own' (Denzin & Lincoln 2005: 7) and no one method or practice is rated more highly than another. Nelson (1992) puts forward the following argument in terms of a qualitative approach to research:

> Qualitative research is an interdisciplinary, transdisciplinary, and sometimes counterdisciplinary field. It crosscuts the humanities and the social and physical sciences. Qualitative research is many things at the same time. It is multiparadigmatic in focus. Its practitioners are sensitive to the value of the multimethod approach. They are committed to the naturalistic perspective and to the interpretive understanding of human experience. At the same time, the field is inherently political and shaped by multiple ethical and political positions *(cited in Denzin & Lincoln 2005: 7).*

The rise of mixed methods research designs

Mixed method research has a short history as an identifiable methodological movement which can be traced to the early 1980s and has been described as a 'quiet' revolution due to its focus of resolving tensions between the qualitative and quantitative methodological movements (Tashakkori & Teddlie 2003: 697). Mixed methodologies is an emerging area with a growing amount of interest across several discipline areas and has been particularly popular in the areas of applied social research and evaluation (Bazeley 2003). Tashakkori and Teddlie acknowledge the effects of the residue from the paradigmatic wars but are very positive in acknowledging the signs of change (2003: 699):

> …the mixed methods research movement is a positive reaction to this split personality and to the excesses of both the QUAN (quantitative) and QUAL (qualitative) camps. We believe that mixed methods will eventually pave the way for more commonality in research language that will benefit both the QUAL and QUAN camps.

Several authorities have been emerging as mixed methodologist researchers and theorists (Creswell 2003; Greene & Caracelli 1997; Mertens 2005; Mingers & Gill 1997; Tashakkori & Teddlie 2003) along with the emergence of mixed methods chapters in recent research text books (Creswell 2003; Mertens 2005; McMillan & Schumacher 2006). In addition to this a handbook of mixed methods has been published (Tashakkori & Teddlie 2003) and a number of textbooks have recently appeared (Bergman 2008; Creswell & Plano Clark 2007; Greene 2007; Plano Clark & Creswell 2007; Rihoux & Grimm 2006; Teddlie & Tashakkori 2008; Thomas 2003).

In the field of management research, Mingers and Gill (1997) have been strong advocates for multimethodology as has Bazeley (2003). Mingers (1997: 9) argues for a strong pluralism

or multimethodology which takes the position that most if not all intervention situations would be dealt with more effectively with a blend of methods from different paradigms. Buchanan and Bryman (2007) draw attention to the contextual issues surrounding the field of organisational research. They see the field as being impacted by three major trends which are identified as:

- widening boundaries;
- a multiparadigmatic profile; and
- methodological inventiveness.

These trends are impacting on organisational research as it is a field where many disciplines meet. Organisational research includes such disciplines as human resources, economics, social psychology, public policy, finance, marketing just to name a few. Management science researchers need to keep abreast of these trends as do management educators. Buchanan and Bryman (2007: 486) sum this up when they say:

> The paradigm wars of the 1980s have thus turned to paradigm soup, and organisational research today reflects the paradigm diversity of the social sciences in general. It is not surprising that this epistemological eclecticism has involved the development of novel terminology; innovative research methods; non traditional forms of evidence; and fresh approaches to conceptualization, analysis, and theory building.

Another method gaining momentum in the social sciences is that of Qualitative Comparative Analysis (QCA). Charles Ragin (1987, 1994) developed a set of systematic case analysis techniques which were born out of his frustrations as a comparative sociologist with the qualitative/quantitative split in comparative social science. Since then comparative design and analysis has gained momentum. Rihoux (2006: 680) has mapped recent advances and challenges for QCA and related systematic comparative methods. and states there have been new attempts to engage in an informed debate between quantitative and qualitative empirical traditions:

> …generally speaking the explicitly comparative design is gaining momentum. The choice of such a strategy often reflects the intention of scholars to meet two apparently contradictory goals. On the one hand, one seeks to gather in-depth insight in the different cases and capture the complexity of the cases – to gain intimacy with the cases (Ragin & Becker, 1992). On the other hand, one still wishes to produce some level of generalization (Ragin, 1987). Indeed, in empirical social science, both case-orientated work and techniques that allow one to generalize (typically quantitative, i.e. statistical, techniques) are useful.

The metaphor of the phoenix has been used to illustrate the emergence of the third methodological movement that has arisen from the ashes of the paradigm wars (Cameron & Miller 2007). Mingers (2003) refers to the ceasefire of the paradigm wars being announced whilst Johnson and Onwuegbuzie (2004: 14) state very clearly, 'Mixed methods research: A research paradigm whose time has come'. Nonetheless, it is a developing and evolving field and recent studies of the use of mixed methods in the field of information systems (Mingers 2003), counselling (Hanson, Creswell, Clark, Petska & Creswell 2005), management disciplines (Cameron 2008; Hurmerinta-Peltomaki & Nummela 2006), and qualitative research conducted in Switzerland (Eberle & Elliker 2005) is providing empirical evidence of the extent of utilisation of mixed methods in contemporary research.

Mixed method typologies

Mixed methods research designs use both quantitative and qualitative approaches in a single research project to gather or analyse data and several mixed method theorists have developed mixed method typologies (Creswell 2003; Creswell & Plano Clark 2007; Greene & Caracelli 1997; Mertens 2005; Miles & Huberman

1994; Morgan 1998; Morse 2003; Tashakkori & Teddlie 2003).

Typologies are the study or systematic classification of types that have characteristics or traits in common and form part of models and theories. Neuman (2006: 55) defines typologies as a way to classify theoretical concepts which is created by 'cross-classifying or combining two or more simple concepts to form a set of interrelated subtypes'. Typologies are used by theorists to assist them in organising abstract and complex concepts. The mixed method typologies developed by Mertens (2005), Caracelli and Greene (1997), Creswell and Plano Clark (2007) and Tashakkori and Teddlie (2003) will now be presented.

Mertens (2005) has mapped the definitions and characteristics of mixed methods and mixed models designs. Both utilise both qualitative and quantitative features. However, Mertens (2005: 292) distinguishes between mixed method design that uses both methods to answer a research question in a single study as compared to mixed model designs that are part of a larger research program. These are designed as complementary and inform several of the research questions, each having a different methodological approach. In addition to this distinction Mertens (2005: 292) adds parallel and sequential data collection forms and defines these as:

> **Parallel Form:** Concurrent mixed-methods/-model designs in which two types of data are collected and analysed.
>
> **Sequential Form:** One type of data provides a basis for collection of another type of data.

Caracelli and Greene (1997) have published extensively on mixed methods in evaluation research and have developed a typology of mixed methods designs that include three component designs and four integrated designs. Table 1 depicts these in tabular form.

Creswell and Plano Clark (2007) have built on Creswell's earlier work in terms of mixed methods research designs and have developed a four type typology. These four major mixed methods research design types are classified using categories associated with variants, timing, weighting and mix. The four designs are: triangulation; embedded; explanatory; and exploratory. Table 2 summarises the Creswell and Plano Clark (2007) mixed methods research designs typology.

Table 1: Designs for mixed methods research

Component Designs	Integrated Designs
Triangulation Different methods are used to assess the same phenomenon toward convergence and increased validity.	**Iterative** Dynamic and ongoing interplay over time between the different methodologies associated with different paradigms. Spiral type design.
Complementary One dominant method type is enhanced or clarified by results from another method type.	**Embedded/nested** One methodology located within another, interlocking inquiry characteristics in a framework of creative tension.
Expansion Inquiry paradigms frame different methods that are used for distinct inquiry components. The results being presented side-by-side.	**Holistic** Highlight the necessary interdependence of different methodologies for understanding complex phenomena fully.
	Transformative Give primacy to the value-based and action-orientated dimensions of different inquiry traditions. Mix the value commitments of different traditions for better representation of multiple interests.

Source: Caracelli & Greene (1997: 23)

TABLE 2: MAJOR MIXED METHOD DESIGN TYPES

Design Type	Timing	Mix	Weighting/ Notation
Triangulation	Concurrent: quantitative and qualitative at the same time	Merge the data during interpretation or analysis	QUAN + QUAL
Embedded	Concurrent and sequential	Embed one type of data within a larger design using the other type of data	QUAN(qual) Or QUAL(quan)
Explanatory	Sequential: Quantitative followed by qualitative	Connect the data between the two phases	QUAN → qual
Exploratory	Sequential: Qualitative followed by quantitative	Connect the data between the two phases	QUAL → quan

Source: Adapted from Creswell & Plano Clark (2007: 85)

Tashakkori and Teddlie (2003) have developed a very comprehensive typology of mixed methods which results in six types of multistrand mixed designs. Mixed method designs involve the mixing of the quantitative and qualitative approaches only in the methods stage of a study. Mixed model designs involve the mixing of the quantitative and qualitative approaches in several stages of a study. This results in six types of multistrand mixed designs as depicted in Table 3. The authors of this typology assert that it is the multistrand mixed methods designs which are the most innovative and widely used mixed method designs (Tashakkori & Teddlie 2003: 685). Multistrand designs use more than one methodology and are characterised by three dimensions. They have single or multiple approaches. They use two methods to answer either exploratory or confirmatory research inquires. Another dimension is the stages of integration or the incorporation of both qualitative and quantitative data sets. The third dimension is the procedures for linking the strands either sequentially or concurrently. These dimensions create six types of multistrand research designs of which the sequential mixed model design has been applied to this research. The methodologists also note the parallels between this particular type and Creswell's explanatory and exploratory mixed method designs (Tashakkori & Teddlie 2003: 688).

Mixed methods typologies and research designs are not without critics and McMillan and Schumacher (2006: 401) draw attention to both the advantages and disadvantages of using mixed methods. They list three disadvantages. The first being the need of the researcher to be proficient and competent in both qualitative and quantitative methods. The second disadvantage is the extensive data collection and resources needed to undertake a mixed method study. The last refers to a tendency to use the mixed methods label liberally to studies which only superficially mix methods. Tashakkori and Teddlie (2003), Bazeley (2003) and Earley (2007) have all attempted to address these issues through advocating for research education that explicitly covers mixed methods in the research syllabus for novice researchers.

TABLE 3: TWO-DIMENSIONAL FRAMEWORK FOR CONCEPTUALIZING MULTI-STRAND MIXED DESIGNS

Procedure	Mixed Method	Mixed Model Study
Concurrent	Concurrent mixed method design	Concurrent mixed model design
Sequential	Sequential mixed method design	Sequential mixed model design
Conversion	Conversion mixed method design	Conversion mixed model design

Source: Tashakkori & Teddlie (2003: 687)

Having outlined the emergence of mixed methods research designs and reviewed some of the key typologies, this article will now describe a research study which utilised the sequential mixed model research design from the Tashakkori and Teddlie (2003) typology of designs.

A CASE STUDY OF MIXED METHODS RESEARCH DESIGN

Recently completed research in the broader field of human resource development (HRD) will be presented here as an example of the utilisation of mixed methods research design. The research focused on the learning experiences of those disadvantaged in the labour market and was essentially a qualitative exploratory study. The research design is based on a sequential mixed model research design that has two phases and research design subtypes within each phase. Phase I includes an ex post facto design (retrospective design) subtype whilst Phase II utilises a combined process and product evaluation design subtype. Ex post facto research design is defined by Cohen and Manion (1989: 176) as:

> …a method of teasing out possible antecedents of events that have happened and cannot, because of this fact, be engineered or manipulated by the investigator.

Ex post facto research designs are used in a variety of discipline areas and literally means 'after the fact', hence the essentially retrospective nature of the research design. The Learning Survey in Phase I of the research asked respondents to answer questions relating to current and past learning related activities and skills. A combined process and product evaluation design was utilised in Phase II to evaluate the effectiveness of the developed model in the field. The general aim of a process evaluation model is to research the extent the program (model) achieves its objectives and products. The aim of a product evaluation design is to research the worth of the program (model) as reflected by process and outcomes. Combined these two approaches can help decide on program (model) modification, improvement and program certification and adoption (McMillan & Schumacher 2006).

In Phase I of the research a quantitative Learning Survey and qualitative focus groups were conducted. The Learning Survey was administered to approximately 250 labour market program (LMP) participants and was followed by a seminar that presented preliminary data to representatives of the participating organisations. During this seminar focus groups were conducted. Phase I of the research resulted in the development of a model to assist those in career and learning transitions. Phase II of the research encompasses the development and formative evaluation of the model in the field and utilised a combination of both qualitative and quantitative data collection methods. This research process was non-linear and allowed for emergent themes to develop which enabled the most appropriate method for progressing the research to be chosen. Neuman (2006: 152) describes this process very succinctly:

> Rather than moving in a straight line, a non-linear research path makes successive passes through steps, sometimes moving backward and sideways before moving on…It can be highly effective for creating a feeling for the whole, for grasping subtle shades of meaning, for pulling together divergent information, and for switching perspectives.

Figure 1 depicts the overall research design and design subtypes of the research.

The sequential mixed model design utilised in the research is adapted from Tashakkori and Teddlies' (2003) typology of multistrand mixed method research. Figure 2 represents the application of this design to the research described in this case study.

The mixed model design allows for the research questions for the second strand (phase) of research to emerge from the inferences of the first strand (phase) (Tashakkori & Teddlie 2003: 687). The first strand is usually exploratory and data collection, analysis and inferences are in one

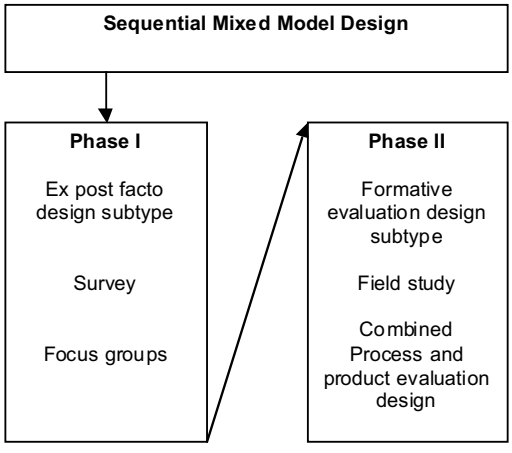

FIGURE 1: RESEARCH DESIGN OF THE STUDY

approach, as was the case with the Learning Survey in Phase I of the research which took a quantitative approach. The second strand (phase) is often confirmatory and the new data, its analysis and inferences are in the other approach, as was the case with the qualitative approach undertaken in the model development, its testing in the field and formative evaluation in Phase II of this research. The resulting final meta-inferences are made as either confirmatory or disconfirmatory of the inferences made at the end of the two strands (phases) (Tashakkori & Teddlie 2003: 688).

Inferences, as used in mixed methods research, refers to the inferences made from what is studied, as opposed to the results of a study. Mixed methods

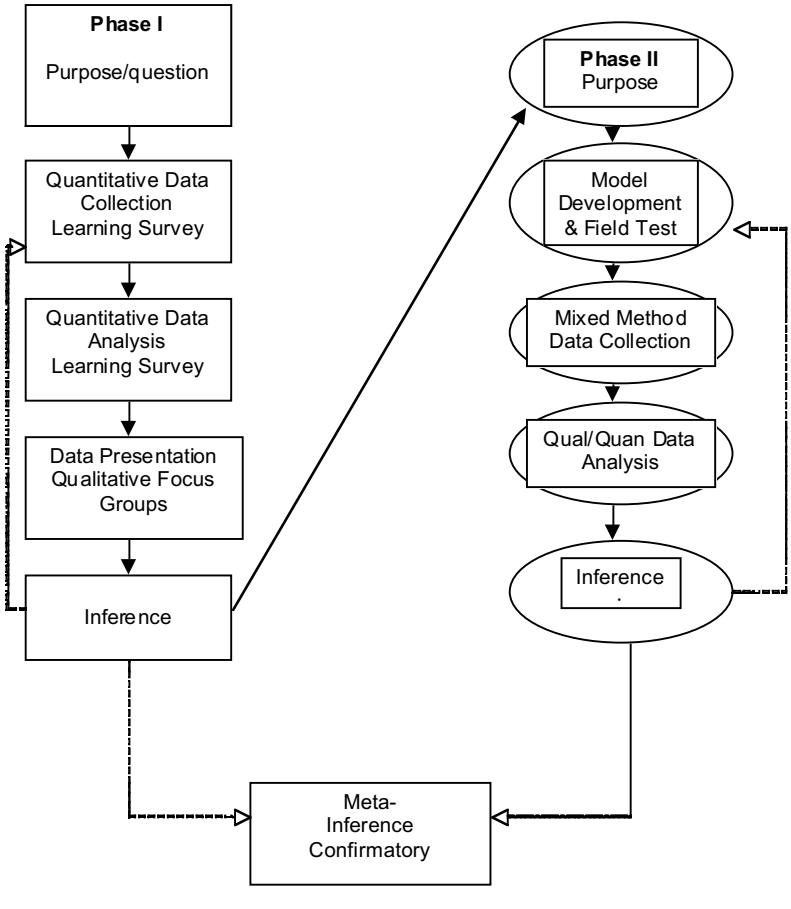

FIGURE 2: SEQUENTIAL MIXED METHOD DESIGN
Source: Adapted from Tashakkori & Teddlie (2003: 688)

lead to multiple inferences that can either complement or confirm each other. In mixed methods research inferences are obtained from each strand of a mixed method study and are distinguished from meta-inferences which are obtained by integrating the initial inferences. Teddlie and Tashakkori (2003: 35) define inferences as:

> …an umbrella term to refer to a final outcome of a study. The outcome may consist of a conclusion about, an understanding of, or an explanation for an event, (a) behaviour, (a) relationship, or a case (e.g. in qualitative research). We use the term 'inference' as a mixed methods term because it may take a variety of meanings ranging between a purely quantitative connotation to a purely qualitative connotation.

In the case of this research the meta-inferences were confirmatory and resulted in the development of a conceptual framework that consists of a continuum of models of Recognition of Prior Learning (RPL), a hierarchy of recognition and a model to assist those in career and learning transitions.

Design, analytical and display issues arising from the study

The two phase design did not in itself present any major issues. In fact, it allowed for a much needed theoretical framework for the organisation and flow of the research processes. Due to the emergent and cyclical nature of the research study the sequential mixed model research design was not fully applied until the end of the first phase of the research. This was due to the fact that the results or inference of the first phase would, to a large degree, determine the research activities and directions that would follow that phase. This is not to say that the research design was retrofitted to the study, but that the ultimate research design was not fully known until part way through the research process. Any number of directions could have been employed depending on the results of the first phase. For example, if the results of the Learning Survey in Phase I inferred a large discrepancy between what the previous research and literature had found and what was anticipated, then any number of research strategies could have been employed. In retrospect, had this occurred, then other mixed method typologies would have been considered.

In terms of data alignment and display issues the second phase of the study provided some challenges. The second phase involved the testing of the developed model in the field and its evaluation utilising a combined process product evaluation design. What resulted was a complex blend of mixed methods data collection across three data collection points. Figure 3 provides a visual depiction of the complexity of the mixed methods used in this phase and an example of how to display this aspect of the research.

Another dimension of complexity was added by the use of one of the LMP trainers becoming a co-researcher or internal evaluator. This enabled a more comprehensive level of triangulation to be achieved. For Phase II of the research data, investigator, combined levels, time and methodological triangulation were achieved. Data triangulation was attained through the mixed method data collection techniques from each phase of the research. Investigator triangulation was achieved through the use of both internal and external evaluators in the formative evaluation of the model in the field. Combined levels of triangulation were attained through the incorporation of more than one level of analysis (refer to Figure 4). Individual and interactive group responses were collected from the LMP participants along with organisational responses during Phase II. Time triangulation was achieved through a longitudinal approach during Phase II, as opposed to a cross-sectional approach during Phase I through the Learning Survey. Methodological triangulation has been incorporated through the overall sequential mixed model research design of the study, and through the use of both qualitative and quantitative data collection methods within Phase II of the study. Figure 4

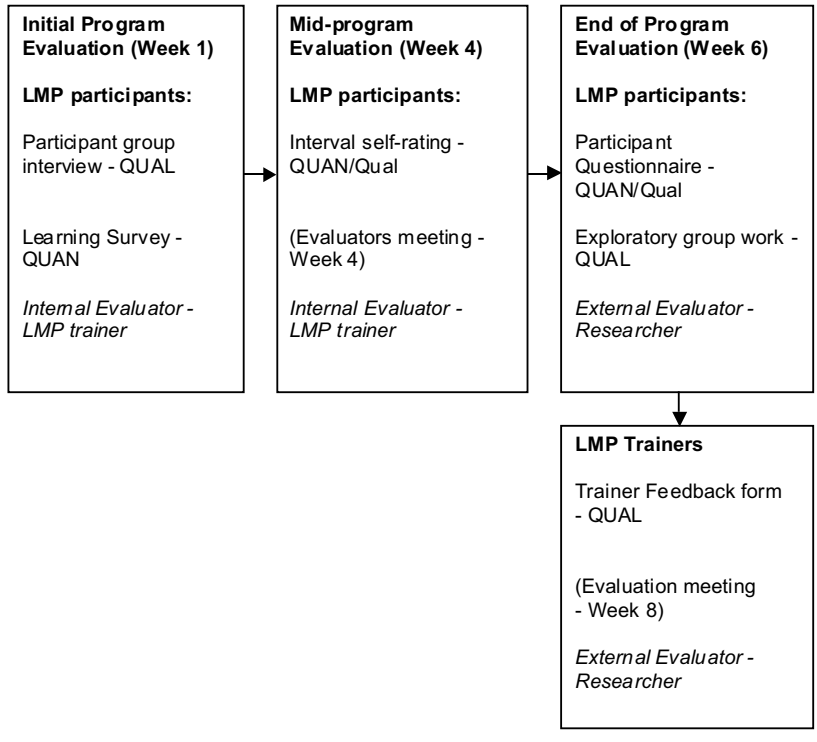

Figure 3: Phase II – Mixed method data collection

QUAN = quantitative data; QUAL = qualitative data; QUAN/Qual = predominantly quantitative with supplementary qualitative

provides a visual depiction of the forms of triangulation achieved during Phase II of the study. Again, this figure provides an example of how this aspect of the research can be displayed.

The triangulation achieved in both phases of the research study is depicted in Figure 5.

In terms of data analysis and alignment, the decision was made to categorise the qualitative data codes to reflect the structure of the developed model. The developed model consisted of four components: self-concept; learning and recognition; career and life planning; and new literacies. These components became the data code categories for the qualitative data codes and allowed for a level of alignment and analysis between the results of the quantitative data analysis in Phase I (the model and its components) and the different forms of qualitative data collect-

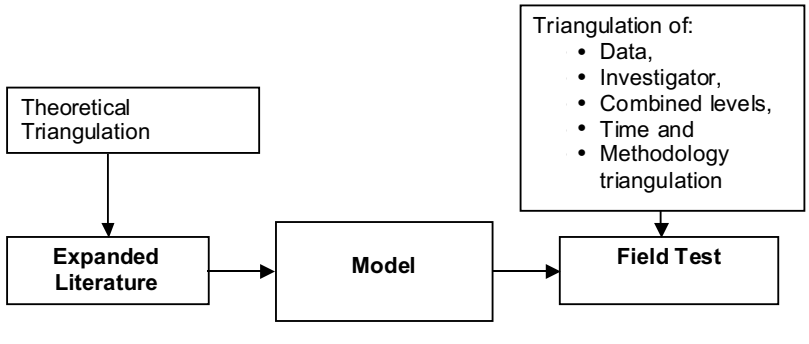

Figure 4: Phase II – Triangulation

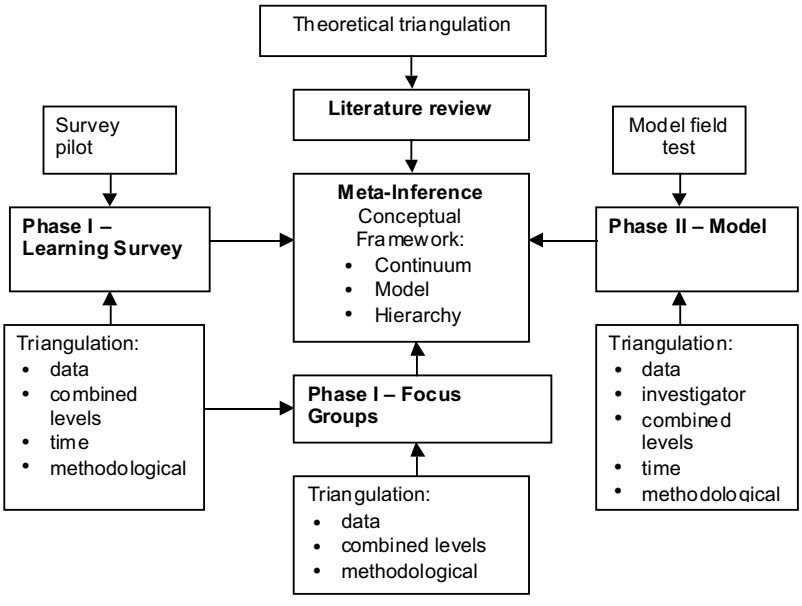

FIGURE 5: TRIANGULATION OF THE STUDY

ed within Phase II of the study (group interview; exploratory group work). An example of this from Phase II is depicted in Table 4. This displays the alignment between the model components, the qualitative data codes and the qualitative exploratory group work (visual data) collected at the End of Program data collection point.

CONCLUSION

This article has mapped the emergence of mixed methods research as a third methodological movement which has resulted from the tensions of the paradigm wars and is related to the philosophy of pragmatism. Several authorities in the area are becoming prominent commentators in the field and an emerging literature base is developing. An overview of some of the major mixed methods research design typologies was discussed before presenting and describing research that utilised a sequential mixed model design. The case study allowed for some discussion of issues that utilising a mixed method design can present in terms of design, analysis and display options. These issues relate to: the structure such designs can provide for emergent and exploratory approaches to research; levels of complexity that can result due to the

TABLE 4: DATA CODE ALIGNMENT – EXPLORATORY GROUP WORK (VISUAL DATA)

Model	Qualitative Data Codes	Exploratory group work (visual data) – Groups 1–5
1. Self Component	Self-esteem/confidence	1, 3, 5
2. Learning and Recognition Component	Skills	5
	Interaction	1, 3, 4, 5
	Self-recognition	1
3. Career and Life Planning Component	Employment	1, 5
	Direction/challenge	1, 2, 5
	Enjoyment	1, 2, 3, 4, 5
4. New Literacies Component	Information	1
	Financial	1, 5

blending of mixed methods of data collection across data collection points; how to align quantitative and qualitative data; and the comprehensive level of triangulation such approaches can generate. Future research is planned to examine and categorise the research designs employed by Doctor of Business Administration (DBA) candidates from an International Centre for Professional Doctorates at an Australian based University. This planned research will add to the growing body of knowledge concerning the use of mixed methods research designs in the management sciences.

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Received 2 May 2008 *Accepted 5 November 2008*

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