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# Practical guidance for the use of a pattern-matching technique in case-study research: A case presentation

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## Abstract

This paper reports on a study that demonstrates how to apply pattern matching as an analytical method in case-study research. Case-study design is appropriate for the investigation of highly-contextualized phenomena that occur within the social world. Case-study design is considered a pragmatic approach that permits employment of multiple methods and data sources in order to attain a rich understanding of the phenomenon under investigation. The findings from such multiple methods can be reconciled in case-study analysis, specifically through a pattern-matching technique. Although this technique is theoretically explained in the literature, there is scant guidance on how to apply the method practically when analyzing data. This paper demonstrates the steps taken during pattern matching in a completed case-study project that investigated the influence of cultural diversity in a multicultural nursing workforce on the quality and safety of patient care. The example highlighted in this paper contributes to the practical understanding of the pattern-matching process, and can also make a substantial contribution to case-study methods.

**Key words:** case study, cultural diversity, multicultural nursing workforce, pattern matching, research methodology.

## **Introduction**

Case-study design is an increasingly-popular research approach in disciplines as diverse as education, sociology, psychology, and the health sciences. The methodology's appeal lies in its purported ability to investigate complex phenomena that require in-depth examination in specific contexts (Munhall, 2006). Additionally, case-study methodology can accommodate epistemological diversity. In thoroughly investigating a phenomenon from many angles, case-study projects frequently draw upon multiple paradigms (qualitative and quantitative approaches) and multiple data-collection methods (survey, interview, observation, and chart audit) to comprehensively investigate a research problem (Creswell, 1998; Hancock & Algozzine, 2006; Luck *et al.*, 2006). The problem that can confront investigators new to case-study research is how to reconcile the diverse data types and the worldviews they embody during analysis, because of apparent epistemological conflict. One common strategy to bring disparate data together in case-study research is a pattern-matching technique (Yin, 2009). However, there are scant publications on the strategy and process of this complex analytical tool.

The pattern-matching technique used in case-study projects shares common ground with the more familiar "mixed-methods" research, where qualitative and quantitative data-collection and analysis approaches are categorized as either complementary or sequential triangulation (Teddlie & Tashakkori, 2009). It does, however, differ from these in several important respects. In mixed-method research, complementary triangulation is used when qualitative and quantitative methods overlap in examining the phenomenon of interest, so that one approach to data-collection and analysis complements the shortcomings of the other; for example, interviews provide more in-depth data that complement survey methods. Sequential triangulation is concerned with ensuring that the data-collection and analysis strategies entailed in one method, such as focus-group interviews that investigate the knowledge needs of nursing students, prepare the way for another, such as the development of a survey tool to assess nursing students' knowledge (Teddlie & Tashakkori, 2009). In contrast, in case-study projects, multiple data-collection and analysis methods are intended to simultaneously contribute distinct epistemological perspectives to a multifaceted and highly-contextualized phenomenon.

In this paper, we provide a guide to using a pattern-matching technique when analyzing and synthesizing the multiple findings obtained from a case-study investigation. After discussing the general principles of pattern matching, we demonstrate how those principles are enacted with a practical example from a case-study investigation of the influence of cultural diversity, in a multicultural nursing workforce, on the quality and safety of patient care and the work environment in one hospital in Saudi Arabia (Almutairi, 2012 ).

## **Background**

Although there is no precise definition of what a pattern is, it is generally conceived in case-study approaches as an arrangement of occurrences, incidents, behavioral actions, or the outcomes of interventions that are apparent in the raw data (Wiebe *et al.*, 2009). Pattern-matching techniques subsequently identify and compare the patterns evident in the data against one or several hypothesized patterns that the analyst has developed through familiarity with the field (Yin, 2009; Swanborn, 2010).

The notion of pattern identification arose in the 1960s, when Campbell (1966) argued for a “holistic” method of analyzing diverse data within the context in which they occurred. This approach differs from the prevailing “atomistic” approach that reduced data into their discrete constituents and analyzed them without regard to the influence of the context that produced them (Wiebe *et al.*, 2009, p. 663). The logic of pattern-matching techniques that has since evolved is drawn from traditional hypothesis-testing strategies; albeit, the pattern-matching process is not driven by statistical hypothesis testing methods. Trochim (1989) described pattern-matching techniques as distinct from traditional hypothesis testing in that “pattern matching encourages the use of more complex or detailed hypotheses and treat(s) observations from a multivariate rather than a univariate perspective” (p. 357). In case-study research, pattern-matching techniques are designed to enhance the rigor of the study; if the empirically-found patterns match the predicted ones, the findings can contribute to and strengthen the internal validity of the study, and result in the confirmation of the hypotheses/propositions (Yin, 2009). In contrast, if the predicted and experienced patterns do not match, the researcher must examine alternative explanations for the findings.

Yin (2003; 2009), a key writer in the area of case-study design, described different types of pattern-matching techniques. For example, depending on the precise nature of the research problem and its questions, the analyst might relate the patterns discerned in the data to one or more dependent variables, to one or more independent variables, or to all variables. This classification is what Yin (2009) refers to as “non-equivalent dependent or independent variables”. The task of the researcher is to specify whichever single variable or multiple dependent variables represent the relevant outcomes based on an a priori proposition derived from theory, the literature, or the researcher’s experience. Then, depending on the epistemological nature of the question and hypothesis being addressed, each dependent variable might be assessed using different methods of comparison. Whatever pattern-matching approach is used, the researcher should have stated an expected overall pattern that embraces all the variables that are examined. Then, the pattern of the actual findings will be compared to the expected one.

There are different case-study designs; for example, exploratory, explanatory, and descriptive; single and multiple; and embedded or holistic. The description of these design combinations is beyond the scope of this paper. It is sufficient to state that Yin (2009) emphasized that, irrespective of design, data analysis using pattern matching is entirely appropriate for all case-study designs if its use is consistent with the purpose of the study and the research questions to be answered.

Despite the numerous theoretical explanations of pattern matching in the literature, it is conceptually and practically challenging to implement this technique in case-study research. There is little guidance from published literature that explains how to apply pattern-matching techniques to bring the diverse results together, particularly when both qualitative and quantitative methods are used. The following sections provide practical guidance in this field, by demonstrating the use of pattern matching as an analytic strategy in one case-study project.

### **Summary of the Study**

The pattern-matching technique demonstrated in this paper was used in a study that investigated the influence of cultural diversity, in a multicultural nursing workforce, on the quality and safety

of patient care and the work environment at a tertiary hospital in Saudi Arabia. An exploratory case-study design was chosen for this particular project, because the variables contributing to the research problem were largely unknown, although the problem itself was clearly contextual, complicated, and multifaceted. The complexity of this situation resulted from the large expatriate nursing workforce employed in the Saudi context; the members of whom comprised a mix of European, Indian, Filipino, South African, US, Australian, and British nurses who differed in terms of culture, language, and educational preparation for practice. They also differed in these terms from their indigenous Saudi colleagues and the Saudi patients with whom they practiced. This situation gave rise to questions about the quality and safety of care able to be delivered in a setting where many different perspectives and levels of nursing preparation operate. The study questions were:

1. For nurses who are working in a multicultural nursing workforce, what are the perceptions of the safety climate?
2. What are the experiences of nurses working in a multicultural nursing workforce in terms of cultural competence?
3. In a multicultural setting, to what extent do the organization's policy documents and the processes of recruitment, employment, authorization, and induction reflected in the documents meet the needs of nurses from diverse cultures?
4. What educational opportunities are provided to support nurses from culturally-diverse backgrounds to deliver culturally-appropriate care to the indigenous people of Saudi Arabia?
5. How does the organization prepare and support expatriate nurses in terms of managing adverse events and occupational health and safety?

Given the complex nature of these questions, multiple methods and data sources were necessary to investigate the problem. These included:

1. A survey ( $n = 319$ ) of the Saudi and non-Saudi nurses' perceptions of the safety of the clinical environment (hereafter called the "safety climate"). The survey tool was the Safety Climate Survey, which was developed by the University Of Texas Centre Of

Excellence for Patient Safety Research and Practice (McBride-Henry & Foureur, 2006; Sexton *et al.*, 2006). This tool has been validated in numerous settings and contexts (Kho *et al.*, 2005; Pronovost & Sexton, 2005; Shteynberg *et al.*, 2005; Sexton *et al.*, 2006).

2. In-depth interviews of ( $n = 24$ ) Saudi and non-Saudi nurses, which covered topics, such as cultural awareness, knowledge, skill, interaction, and desire, in accordance with Campinha-Bacote's (1999; 2002) cultural-competence model.
3. Document analysis of written policies related to the preparation of non-Saudi nurses to work in a culturally-safe way in this particular tertiary facility. Those policy documents, comprising 800 pages, were analyzed through the lens of the conceptual framework of cultural competence.

Consistent with the approach developed by Yin (2009), each data source was initially collected and analyzed independently. Descriptive and inferential statistics were used in the analysis of the survey data. The interview data were analyzed by way of deductive then inductive approaches, and content analysis was used for the policy documents. Each of these methods and their results are described elsewhere (Almutairi *et al.*, 2012; Almutairi *et al.*, in press). Each method provided distinct understandings of the phenomenon under investigation. The next task was to synthesize the understandings gained from these multiple methods and epistemologies using a pattern-matching technique to develop the outcomes of the study. Figure 1 provides a graphic depiction for the pattern-matching process we undertook.

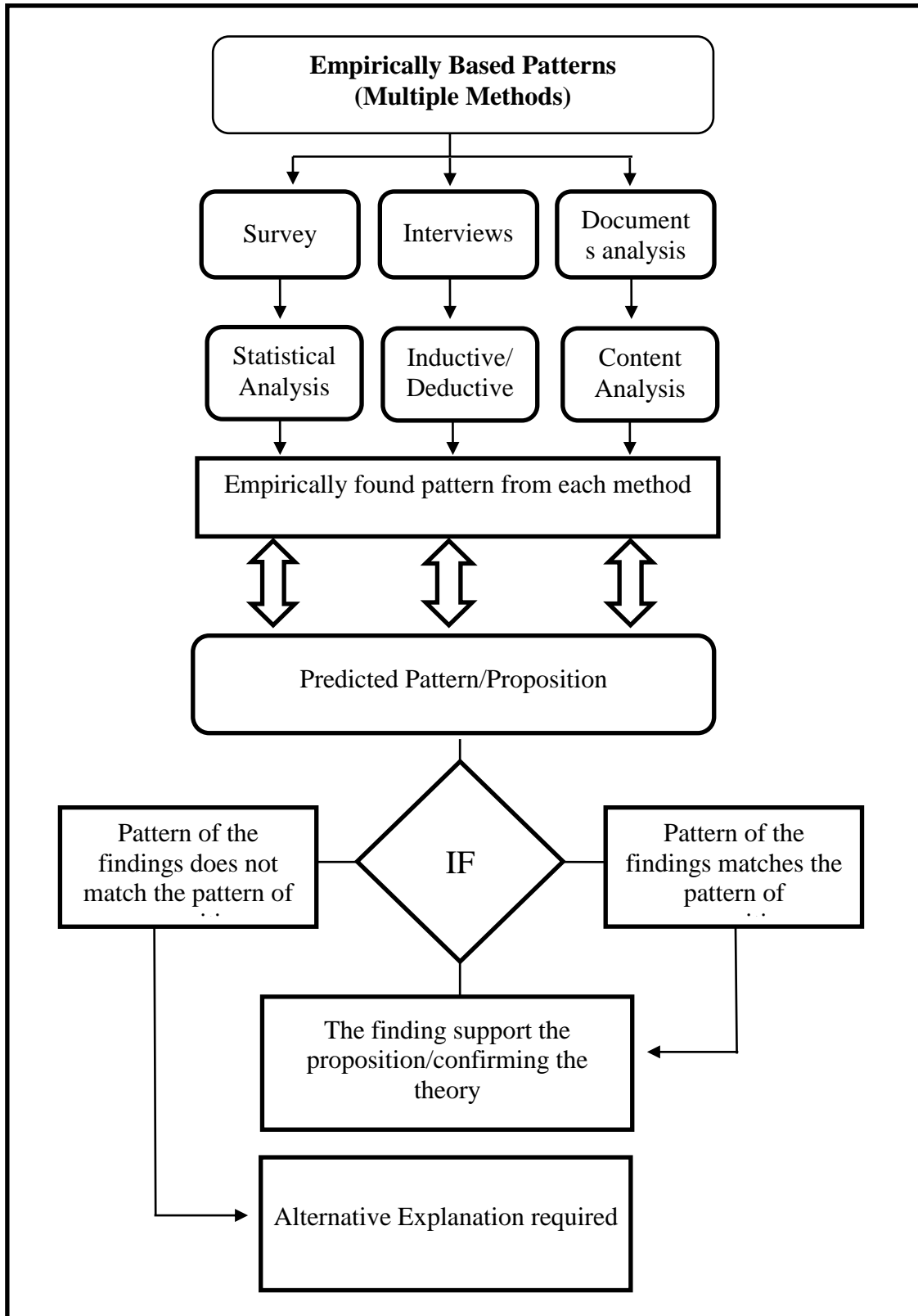


Figure 1: Illustration of the pattern matching process



## **Pattern Matching in Practice**

In this example, the process of pattern matching is divided into three practical steps or phases. These comprise: (i) stating the study's proposition; (ii) testing the empirically-found pattern from each distinct method against the predicted one; and (iii) providing theoretical explanations and developing research outcome. Each of these is explained below.

### **Stating the study's proposition**

Developing a proposition or hypothesis prior to undertaking the study is the first step in pattern matching. According to Trochim (1989), the predicted pattern or the proposition can be derived from the literature, from theory, or from hunches developed from the researcher's experience in the field. The proposition in this case study, which was mainly derived from the literature, as well as the principal investigator's experience in this particular multicultural context, was: Cultural diversity within a multicultural nursing workforce can influence the quality and safety of patient care and the work environment as perceived and experienced by nurses and published in organizational policy documents.

### **Testing phase**

#### *Survey*

In this phase, we used a pattern-matching technique to examine the correctness of the proposition of this study in terms of the nurses' reported perceptions of the clinical safety climate. As cultural diversity is a significant factor in the study's context, the independent variable in this regard is related to the cultural backgrounds of the nurses, and the dependent variable is their perception of clinical safety climate. Referring to Figure 1, the patterns of both the empirical finding and the propositional pattern were compared accordingly.

- The propositional pattern was: Cultural diversity in the multicultural nursing workforce can influence the nurses' perception of clinical safety climate.
- The empirically-based pattern was: The cultural background of nurses has an impact on their perception of clinical safety climate.

The comparison process indicated that the pattern of the findings matched the predicted pattern; therefore, the proposition is supported by the phase I findings. The researcher must now provide

explanations and justifications of how the patterns are matched according to the empirical findings. In the opposite situation, alternative explanations must be provided for how and why these patterns did not match. In this example, explanation of matching both patterns is out of the scope of this paper.

### *Interview*

We also used a pattern-matching technique with the qualitative findings obtained from the multicultural nurses' experiences of cultural competence when providing care for indigenous Saudi patients and in terms of their interaction with each other. The value of using a pattern-matching technique in this phase is its ability to link the research data to the theoretical proposition that can be obtained from prior research, knowledge, or theory (Saunders *et al.*, 2009). It is noteworthy that the aim is not about confirming or disputing the proposition itself; it is more about building explanations on whether and why the patterns are matched or not (Yin, 2003), which eventually results in greater validity and supporting or modifying the theory or conceptual framework underpinning the study (Yin, 2003). In this study, the Campinha-Bacote cultural-competence model (1999, 2002) provided the framework for the data collection and analysis. In phase I, we applied the same logic of the iterative process of pattern testing as used in phase I above:

- The experienced pattern was: The cultural competence of multicultural nurses has an impact on the quality and safety of patient care
- The predicted pattern was: Cultural competence of the multicultural nursing workforce can influence the quality and safety of patient care as experienced by nurses

In this phase, it can be seen that the experienced pattern of findings matches the one predicted, which is based on the theoretical framework of this study. The significance of this finding supports the theoretical framework that dictates the value of cultural competence in a multicultural context in order to manage the potential risks and difficulties posed by cultural differences.

### *Document analysis*

In the documentary review, we applied the same iterative logic of pattern matching to test the

pattern of findings with the predicted one:

- The pattern of the findings was: The policy documents do not adequately protect patients from the risk of cultural differences and do not meet the nurses' needs to work safely in a multicultural environment
- The predicted pattern was: The multicultural nursing workforce has an influence on the safety and quality of patient care as demonstrated by the organizational support to manage cultural diversity

The comparison process indicated that the pattern of findings of the policy-document analysis matched the predicted pattern. In this regard, organizational commitment to cultural competence is essential to enhance the cultural competence at the individual level, which will eventually result in safe and effective care that meets patients' cultural requirements and preserve their cultural safety (Pearson *et al.*, 2007).

### **Theoretical analysis and research outcome**

In this section, an explanation of the overall understanding of the investigated case should be provided. As in this example, the case, multicultural nursing workforce, was investigated by using multiple methods, as explained above, and each reveals a portion of the story that contributes to the complete understanding of this multifaceted case. Weaving these threads together leads to a definitive conclusion about the investigated case, and overall pattern of the findings can be produced. In this example, the overall pattern of the findings in general confirms the study's proposition (stated above). The overall pattern is as follows: The multicultural nature of the nursing workforce in this setting is attended by clinical, personal, and professional difficulties that could result in profound consequences on the safety of the nurses, patients, and their families, as well as general healthcare outcome.

This is a result of conflicts in the different cultural norms, beliefs, behaviors, and languages operating in one clinical space. Such diversity can also often provide a climate for implicit and/or explicit discrimination and racism that operate at both the individual and institutional levels, with detrimental effects on health (Dorazio-Migliore *et al.*, 2005). Thus, the overall findings emphasized that applying and promoting cultural competence in a multicultural context is essential to manage the difficulties arising from cultural diversity.

The focus of the majority of cultural-competence models is on patients, with aims to create a healthcare workforce that is able to provide effective and sensitive care that attends to patients' needs and maintains their rights during cross-cultural encounters (Ramsden, 2002; Suh, 2004; Betancourt *et al.*, 2005; Jirwe *et al.*, 2006). However, the findings from this study revealed that both patients and nurses were at risk in a multicultural setting, due to cultural and linguistic differences among the nurses themselves, as well as those of their patients.

The significance of pattern matching in this study is that it helped to address the strengths and limitations of the underpinning theoretical framework through multiple perspectives. It helped to modify and theoretically enrich the concepts embedded in the cultural-competence model (Campinha-Bacote, 2002) in a way that can fit a multicultural context. Campinha-Bacote's (1999; 2002) cultural-competence model posits that the process of attaining cultural competence is mainly based on the healthcare providers' agency to learn through the development of cultural awareness, cultural knowledge, cultural skill, cultural encounter, and cultural desire. The findings in this study, however, revealed that individual agency is only one approach to this process, which also requires adequate support through organizational policy, continuous professional development, and adequate resources. Significantly, this model of cultural competence does not take into account the disempowerment of the nurses in such a context. Despite efforts to address the difficulties raised by cultural diversity in this particular organizational context, the findings indicated that these efforts probably do not adequately address the problem of cultural diversity, and do not sufficiently support the multicultural nursing workforce or protect patients from the risks that attend cultural differences.

## **Conclusion**

Case-study design is powerful in that it allows the employment of multiple methods and data sources to bring different epistemological perspectives together on a given problem, and provides a new understanding of the case under investigation. The difficulties in how to reconcile the multiple perspectives of knowledge in case-study research can be overcome by using a pattern-matching technique. This technique has been theoretically explained in the literature; however, its implementation remains practically difficult and confusing for novice

researchers to utilize in research. Thus, in this paper, we discussed a researched-based example of using a pattern-matching technique as one method of case-study analysis. Pattern matching is a significant step in the metasynthesis of the results of diverse data sets in case-study research. This work provides an important contribution in explicating the steps in pattern matching using a practical application, and contributes to building methodological strategies for case-study research.

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### **Contributions**

Study Design: AA, GG, AM

Data Collection and Analysis: AA, GG, AM

Manuscript Writing: AA, GG, AM

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