Mapping the Problem Statement and Study Purposes to the Quantitative Analysis: Insights From Mixed Methods Perspectives

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Abstract

This study introduces a novel approach to assess the quality of doctoral dissertations using a mixed methods design, specifically the convergent parallel model. Initially, the research focuses on qualitative data obtained from the context, research problem statement, and study purpose within a doctoral dissertation. As an example of quantitative data, the study examines self-confidence in creating a database based on years of experience using a questionnaire. The qualitative analysis employs semantic and thematic analysis techniques, revealing a clear alignment between the identified themes and the quantitative evidence. These findings underscore the effectiveness of the mixed methods approach in comprehensively evaluating the quality of doctoral dissertations.

Keywords: the consistency of the essential elements, mixed methods, semantic network analysis, thematic analysis

1. Introduction

This study aims to investigate the relationships between the research problem, the purpose of the study, and the instrument used in the development of a doctoral dissertation. During the initial stages, doctoral candidates formulate their research problem statements or research focus, which may vary in terms of quantitative and qualitative designs. Subsequently, the candidates refine and clarify the purpose of their study. Both the mentor and the doctoral candidates mutually agree that the research problem statement or research focus serves as a guiding framework for the candidate's literature review, research design, and subsequent instrument development.

Examining the agreements among these essential elements in doctoral dissertation development, as supported by previous research (Alison, Cooley, Lewkowicz, & Nunan, 1998; Belcher, 1994; Bunton, 1999, 2002, 2005; Cooley, & Lewkowicz, 2003; Dong, 1998; Kwan, 2006; Meloy, 2002), offers the doctoral candidate a valuable opportunity to elevate the overall quality of their dissertation. Diligently attending to the alignment and maintaining consistency among these elements can significantly enhance the logical coherence and robustness of the study. The implementation of these suggestions holds the potential to contribute to a more compelling, rigorous, and academically sound doctoral dissertation. Such an approach aligns with established best practices in the field and draws on the insights of noted scholars, laying a strong foundation for a successful dissertation (Meloy, 2022).

2. Perspectives

2.1 "The Research Problem Statement" in a Dissertation

In the development of a doctoral dissertation, the problem statement plays a vital role as the doctoral candidate focuses on and shares their research ideas with their mentor. Subsequent chapters in the research process can then be developed based on this statement, including the literature review, research design, and instrument development (Kwan, 2006).

Crafting a strong and clear problem statement is crucial to effectively convey the motivation behind your research. This statement should be easily understandable, captivating, and, most importantly, relevant. The dissertation developer should consider how solving it can positively impact the world. The problem statement offers an opportunity for you to express your passion and outline your research plans for effectively addressing the problem.

2.2 "The Purpose of the Study" in a Dissertation

The purpose of the study should directly derive from the problem statement and address the reflective question, 'Why is the research problem emphasized?' This ensures that the audience clearly understands the intentions of the doctoral candidate.

Typically, the purpose of the study involves applying relevant theories and models to solve practical problems. Furthermore, the purpose statement should offer concise information regarding the study's direction, scope, and data sources.

Moreover, the study's purpose should not only correspond to the identified problem and bridge the gap but also maintain consistency with the chosen research method. It is crucial that the purpose statement begins by specifying the research design and the instrument used for data collection. Ensuring alignment between the research purpose and instrumental design enhances the logical flow of the study.

2.3 "Data-Collection Instruments" and "Problem Statement"

In the process of crafting a doctoral dissertation, the significance of the data collection instrument's structure cannot be overstated, as it profoundly influences the research endeavor in several interconnected ways. To begin with, the research problem serves as the foundation upon which the entire dissertation is built. It's the central question that guides the researcher's exploration of the subject matter. Consequently, the formulation and conceptualization of the research problem must precede the creation of data collection instruments. This ensures that the instruments are specifically tailored to address the research problem, thereby enhancing their effectiveness in gathering pertinent information.

However, it's crucial to recognize that this relationship is not unidirectional. Once the data collection instruments are designed and implemented, they exert a reciprocal influence on the research problem and the overall trajectory of the study. These instruments inherently shape and constrain the research problem by determining the scope of data that can be feasibly collected. This means that the research problem must be framed within the boundaries set by the data collection instruments. The instruments also play a pivotal role in defining the methods, techniques, and modes of inquiry that will be employed to extract and analyze data. Researchers must adapt their research methodologies to align with the capabilities and limitations of the chosen instruments.

In essence, the interplay between the research problem and data collection instruments is dynamic and symbiotic. They continually inform and adjust each other throughout the research process, ensuring that the study remains on course and that the collected data effectively addresses the research problem. This intricate relationship underscores the importance of a well-thought-out and meticulously structured data collection instrument. It serves as a cornerstone of a successful doctoral dissertation, enabling the researcher to precisely target and investigate the research problem while also influencing the study's overarching methodology and purpose.

2.4 "Problem Statement" and "the Purpose of the Study"

The relationship between the problem statement and the purpose of the study is one of alignment and interdependence within the context of a research project. The problem statement serves as the foundational element, setting the stage for the entire dissertation, while the purpose of the study refines and narrows down the scope of the research based on the identified problem.

The problem statement, often framed in the form of a question or issue, defines the central challenge or area of concern that the research seeks to address. It typically operates at a more macro or general level, providing a broad overview of the problem to be investigated. This problem statement establishes the overarching context and significance of the research.

Conversely, the purpose of the study is to specify the particular aspects or dimensions of the problem statement that will be explored or examined in-depth. The purpose statement refines the focus of the research, clarifying what the study aims to achieve. Within the purpose of the study, specific, action-oriented phrases like "This study is to examine..." or "This study is to explore..." provide a clearer and more concrete direction for the research.

Importantly, the purpose of the study often draws inspiration from the research instrument or study design. This connection underscores the dynamic nature of the research process. As the researcher develops the instruments and study design, they gain a deeper understanding of how best to investigate the problem statement. This, in turn, informs the articulation of the purpose of the study.

In essence, the purpose of the study acts as a bridge connecting the broad, conceptual problem statement with the practical, actionable objectives of the research. It translates the theoretical into the practical, enabling a more concrete and specific understanding and approach to addressing the research problem. This alignment between

the problem statement and the study's purpose is crucial for maintaining coherence and relevance in the research project, guiding it towards meaningful and focused outcomes.

3. Research Methods and Data-Coding Design

3.1 Research Methods

This study employs a mixed methods research design with two phases: qualitative and quantitative. It is guided by the paradigm of pragmatism. The mixed methods parallel design, as described by Creswell and Pablo-Clark (2011), was utilized in this study. This approach involves the simultaneous collection and analysis of both quantitative and qualitative data, enabling a comprehensive and holistic understanding of the research problem by integrating different data types and perspectives. By employing the mixed methods parallel design, researchers can gain valuable insights from multiple sources and triangulate findings, thereby enhancing the depth and validity of their study.

4. Data Sources, Evidential Contexts and Data Coding

4.1 Data Source

The data sources utilized in this study were drawn from an unfinished doctoral dissertation draft titled "Professional Development for Teaching in the Digital Age: Addressing Teachers' Digital Competency" (Ibarra, 2023).

During the qualitative analysis phase, the authors examined various resources including research study contexts, research problem statements, and the purpose of the study, which provided valuable insights for the qualitative analysis.

The quantitative data were derived from a well-designed quantitative research study wherein the data collection instrument used was a structured questionnaire. A well-structured instrument can triangulate our perspectives with the results of qualitative data analysis. In other words, the research design can facilitate researchers in summarizing a comprehensive view of the research problem by bridging the distinctions brought about by both qualitative and quantitative analyses. Consequently, we were able to paint a more holistic and detailed picture of the research context, discern the causes behind the phenomenon, and understand the relationships among these variables. This integrative approach significantly enriched our findings, making them more robust and informative in the study report.

4.2 The Data Coding Design

The data analysis in this study was conducted using Saldana's Coding Models (2016), which provided a structured approach and guidelines for the analysis process. The first step involved open coding, entailing transcribing the data into a text-based format and identifying emerging codes or categories (Zhang & Ramos, 2023a). The coding process counted the frequencies of words occurring in the texts. Next, meaningful words were selected based on the authors' analytical frameworks and rules. This step involved identifying critical concepts relevant to the study (Zhang & Ramos, 2023b). In the third step, central words with the potential to become themes were highlighted. These central words represented important elements within the data (Zhang & Ramos, 2023c). The final step involved recognizing the themes, serving as highlights derived from the authors' perspectives and research purposes (Zhang & Smith, 2023).

By following this systematic approach, the study effectively analyzed the data and identified key themes and insights within the dataset.

4.3 Data Analysis Techniques

In the quantitative analysis phase, the primary software employed was SPSS (2023). For qualitative data analysis, two techniques were utilized: Semantic Network Analysis (Segev, 2022; Zhang & Ramos, 2023a) and thematic analysis using BayesiaLab (Conrady & Jouffe, 2015; Zhang, 2018; Zhang & Ramos, 2023b).

The Semantic Network Analysis encompassed open coding and the tallying of word frequencies, offering insights into relationships among selected concepts. To visually depict these connections, a graph was generated (Zhang & Ramos, 2023c; Zhang & Smith, 2023).

BayesiaLab was used to develop the thematic network, building upon the structure established through Semantic Network Analysis. The directed graph techniques in BayesiaLab facilitated the exploration of connections within the data (Zhang, 2022a, 2022b; Zhang & Guanzon, 2022; Zhang & Zhang, 2020). By employing these techniques and tools, the authors conducted a comprehensive analysis that integrated both quantitative and

qualitative perspectives. This multi-faceted approach enhanced the depth and understanding of the research findings.

5. Analysis and Results

The results can be categorized into three main components: qualitative data analysis results, parts of the quantitative analysis results, and the instrumental structure.

5.1 The Qualitative Analysis and Results

In this study, the qualitative data were derived from the dissertation chapter one, which encompassed the research study context, research problem statements, and the purposes of the study (Ibarra, 2023). The semantic analysis (Segev, 2020, 2022; Zhang & Ramos, 2023a) was conducted to extract open coding outputs. Following this, selective coding was performed, involving the selection of potential concepts as keywords. These keywords were then transferred to a column that could be further converted into network segments. The resulting Semantic Analysis Network Model is presented in Figure 1.
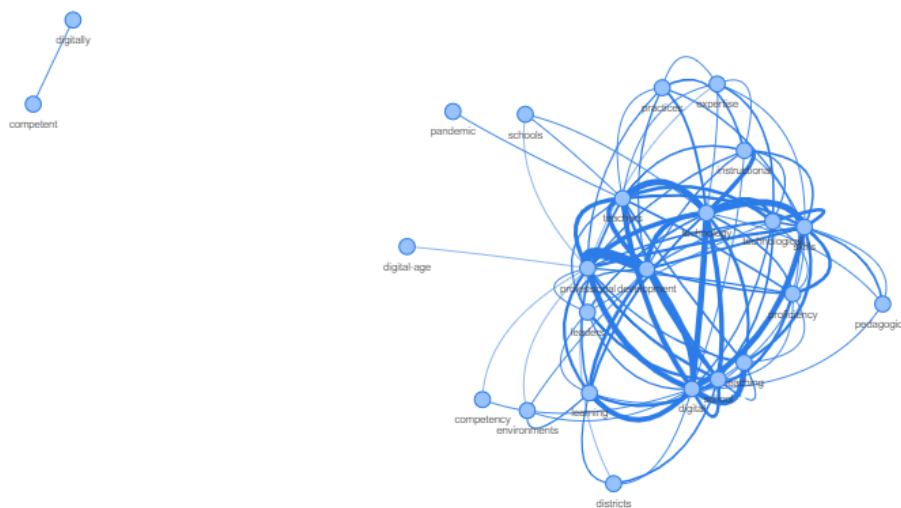

Figure 1. The Semantic Graph of the Problem Statement and Relevant Elements

5.1.1 Open Coding and the Results From the Semantic Network Analysis

The words 'professional' and 'development' are central in this semantic network graph. When examining the pairs, it becomes evident that several exhibit higher frequencies than others:

Technology and skills, technology and teachers, digital and development, digital and teaching, technology and digital, digital and professional, digital and skills, digital and learning, digital and teachers, technology and development, technology and school, teachers and development, technology and professional, technology and instructional, teachers and professional.

The frequencies of the pairs ranged from 8 to 25. These keyword frequencies suggest potential central words that warrant further exploration as themes within the study's context, the research problem statement, and the purpose of the study in Dissertation Chapter One. Although the paragraphs under the aforementioned subheadings may not cover the entire text, they do form the core content of Chapter One.

5.1.2 Thematic Development From Semantic Network Analysis to Thematic Analysis

As depicted in Figure 2, alongside 'Development' and 'Professional,' 'Technology' and 'Digital' emerge as significant central themes contributing to the subheadings of the research problem statement and the study's

purpose (Zhang & Smith, 2023). Moreover, 'Technology' supports the development of 'Expertise,' closely intertwined with 'Learning,' 'Instruction,' and 'Pedagogy.' Additionally, it fosters the acquisition of 'Skills' crucial for teachers' engagement in 'Professional Development.' Consequently, it is evident that 'Development' and 'Technology' stand as the two pivotal concepts shaping data analysis. These foundational concepts form the bedrock of the study, reflecting their importance in the thematic exploration of our research problem statement and overarching study purpose. 'Development' symbolizes growth and evolution within our subject area, while 'Technology' plays an integral role in shaping our investigative landscape.
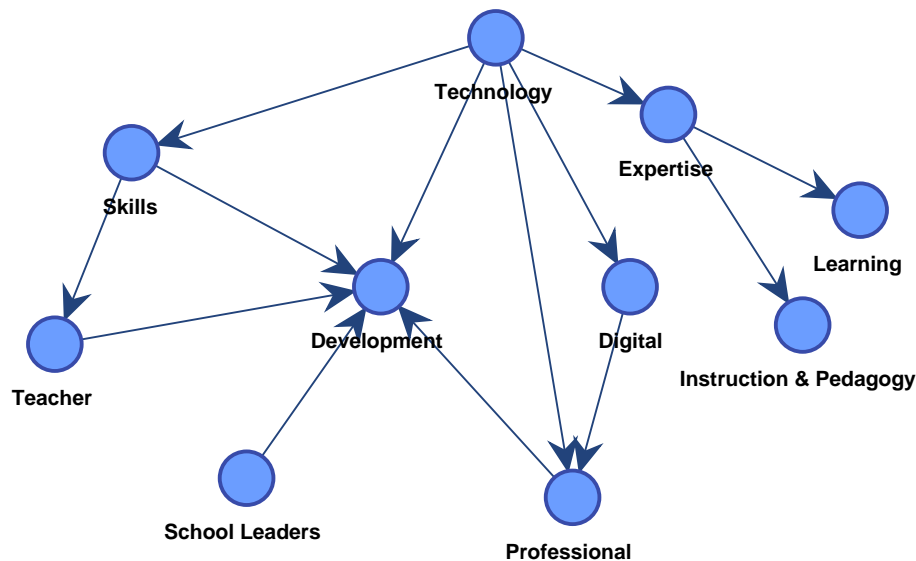

Figure 2. Thematic Graphs of the Problem Statement and the Purposes of the Study

5.1.3 Incorporating Themes Into the Contexts

The authors embedded the concept of professional development into the texts, identifying approximately eight sentences that not only mention these two words but also establish connections with terms like digital, digital skills, and digital competence.

- Teachers were forced to modify their instructional practices and were required to develop technological expertise haphazardly without formal professional development.
- Assessing teachers' digital skills proficiency is an initial step to understanding their professional development.
- identifying teachers' digital self- efficacy is necessary before planning technology-based professional development.
- The school system's lack of a visionary professional development plan.
- Developing technological and pedagogical skills requires differentiated and scaffolded professional development.
- Munthe state requires supporting teachers' digital competence and providing professional development.
- The transition to digital age learning necessitates a different type of professional development
- There is an increasing gap between teachers' digital competency and technology use in the classroom for instructional purposes, which has created a need for professional development for effective teaching in digital-age learning environments.

Collectively, these statements encompass the contexts of the study, the research problem statement, and the purpose of the study. They also highlight the imperative nature of professional development and its correlation with digital skills and digital competence.

Upon incorporating the concept of "Digital" into the texts, the authors identified approximately eleven sentences closely linked to this term. Furthermore, the phrase "Digital Age" also exhibited relatively higher frequencies in the analysis.

- Durak adds that there was an expectation for teachers to use emergent digital technology in their instruction.
- Artacho et al. and Phan et al. stress that preparation for teaching in the digital age requires digital competence and technological and pedagogical content knowledge.
- digital competency refers to the ability to use technology effectively.
- While a teacher may possess digital skills, it will not necessarily result in the effective use.
- Assessing teachers' digital skills proficiency is an initial step to understanding their professional development needs.
- Digital self- efficacy is necessary before planning technology-based professional development.
- Munthe state requires supporting teachers' digital competence.
- The lack of digital learning professional development in school districts.
- while their greatest need is digital literacy and online teaching skills and resources.
- The lack of visionary leadership inadvertently created educators' digital knowledge learning gap.
- this survey research was to identify teachers' digital skills proficiency gaps

5.2 The Quantitative Analysis and Results

The instrument for collecting quantitative data was a questionnaire, consisting of nine aspects: a) Teacher Attitudes Towards Technology, b) Technology Use Practices regarding Teacher Direct Use, c) Technology Use Practices Student Direct Use, d) Self-Confidence in Digital Skills regarding emails, e) Self-Confidence in Digital Skills regarding the internet, f) Self-Confidence in Digital Skills regarding integrated applications, g) Self-Confidence in Digital Skills regarding Teaching with Technology, h) Self-Confidence in Digital Skills regarding Teaching with Emerging Technologies, and i) Self-Confidence in Digital Skills regarding Emerging Technology Skills. All of these aspects effectively address the research problem statement by aligning with the identified themes from the quantitative analysis.

For instance, one example of the analysis can be observed in Table 1, which presents a comparison of self-confidence scores based on years of experience. This analysis directly relates to the research problem and adds valuable insights to the study.

Table 1. Self-Confidence Creating a Database by Years of Experience

Pairwise Comparisons of Self-Confidence Creating a Database by Years of Experience

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
11-15 years-More than 20years	-20.682	18.141	-1.140	.254	1.000
11-15 years-16-20 years	-38.834	18.141	-2.141	.032	.323
11-15 years-0-5 years	57.364	17.948	3.196	.001	.014
11-15 years-6-10 years	73.963	18.614	3.974	<.001	.001
More than 20 years-16-20 years	18.153	14.673	1.237	.216	1.000
More than 20 years-0-5 years	36.682	14.433	2.542	.011	.110
More than 20 years-6-10years	53.282	15.253	3.493	<.001	.005
16-20 years-0-5 years	18.529	14.433	1.284	.199	1.000

16-20 years-6-10 years	35.129	15.253	2.303	.021	.213
0-5 years-6-10 years	-16.599	15.023	-1.105	.269	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

6. Discussion and Conclusions

This study employed a mixed methods design to explore an innovative approach for evaluating the quality and consistency of critical components in doctoral dissertations. Specifically, the researchers utilized a convergent parallel model, integrating quantitative and qualitative elements within the same research phase. For data analysis, three analytical techniques and software tools were utilized. The quantitative analysis phase made use of SPSS (2023), while the qualitative analysis phase leveraged two software applications: TATs and Semantic Network Analysis (Segev, 2022), in conjunction with BayesiaLab (Conrady & Jouffe, 2015).

This pioneering approach initially centers on qualitative data extracted from the context, research problem statement, and study purpose within a doctoral dissertation. To exemplify the incorporation of quantitative data, the study delves into self-confidence by creating a database based on years of experience through a questionnaire. The qualitative analysis employs semantic and thematic analysis techniques, unveiling a clear alignment between the identified themes and the quantitative evidence. These findings underscore the efficacy of the mixed methods approach in providing a comprehensive evaluation of the quality of doctoral dissertations.

7. Scholarly Significance of the Study

Assessing the quality of a doctoral dissertation involves ensuring coherence and consistency among its various components. This process entails a deliberate effort to establish objective evaluation procedures rather than relying on subjective judgment.

Rationality in argumentation is crucial, encompassing key components such as the research problem statement, the study's purpose, and its contextual relevance. A well-anchored research problem statement within the study's context piques the interest and understanding of stakeholders and readers. The study's purpose serves as a rational guide for developing research questions and hypotheses, ensuring focused and evidence-supported objectives while striking a balance between generality and excessive detail. Detailed discussions related to the purpose often emerge in the data analysis and discussion sections.

Semantic analysis is another unique technique that involves scrutinizing the meaning and interpretation of the dissertation's text. It ensures that the terminology, concepts, and definitions used in the dissertation are both precise and aligned with the research context.

Thematic analysis assists in identifying and assessing recurring themes and patterns within the dissertation. It sheds light on the depth of the researcher's engagement with the subject matter and how well these themes align with the research problem and purpose.

Quantitative data analysis, as an example, was included in this study to illustrate the coherence and logical flow between the research problem statement, the purposes of the study, and the data analysis components. It serves as confirmation that the chosen data analysis methods are appropriate for the study's objectives (Zhang & Garcia, 2023).

The assessment of a doctoral dissertation constitutes a comprehensive evaluation process that encompasses content clarity, argumentative rationality, and component alignment. This study focuses solely on the latter. We hope this critical aspect of dissertation quality evaluation provides a thorough understanding of the study's significance and effectiveness.

8. Limitations

The utilization of the mixed methods model for conducting a dissertation quality analysis is a bold endeavor. However, there may be different perspectives regarding this study, and thus, the choice of research methods for assessing quality is still a subject of debate.

In the quantitative analysis phase, the authors provide only a demonstration to examine the alignment between the research problem statement sets and the quantitative analysis. The quantitative analysis results are insufficient. To enhance the sufficiency of the dissertation's qualitative analysis, additional components such as

hypotheses, research designs, and various quantitative analyses may be incorporated.

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