Content Analysis in Mixed Methods Research

4

Kristina Mikkonen and Helvi Kyngäs

4.1 Philosophical Background of Mixed Methods in Nursing Science

The philosophical foundation of nursing science emphasises questioning the truth and exploring the nature of being and reality. As such, nursing science researchers apply scientific theory and take into account the limits of knowledge when performing their research [1]. Two prevalent, and distinct, philosophical schools of thought are the received and perceived views of science. The philosophical principles underlying qualitative research methods are based on a perceived view of science. This view includes components of reality that are studied through subjective and inductive approaches. As such, qualitative research methods aim to describe and understand a phenomenon rather than predict and control the topic under study. Multiple truths can be unearthed during the research process. The discipline of nursing is described as a human science; hence, the field of nursing science focuses on humans as a whole and considers nurses as advocates to their patients [2]. Qualitative methods are used to study human phenomena so that researchers can understand relationships, values, experiences and issues, all of which are outside the scope of quantitative methods. On the other hand, the received view emphasises the empirical measurement of facts, with a possibility to implement, test and evaluate the outcomes. Empirical approaches, which were first developed in the nineteenth century, cannot be used to study human behaviour. Nursing science has combined these two schools of thought to provide the strongest possible interpretation of human behaviours. For example, researchers have built knowledge by translating inductive methodological approaches into deductive measurable entities, as well as provided scientifically proven models by developing and testing theoretical frameworks.

K. Mikkonen (✉) · H. Kyngäs
Research Unit of Nursing Science and Health Management, Oulu University, Oulu, Finland
e-mail: kristina.mikkonen@oulu.fi; helvi.kyngas@oulu.fi

H. Kyngäs et al. (eds.), *The Application of Content Analysis in Nursing Science Research*, https://doi.org/10.1007/978-3-030-30199-6_4

The philosophy underlying nursing science includes three components: epistemology; ontology and methodology. Epistemology encompasses the study of knowledge whereas ontology examines the theory of being or, in other words, what exists or what is [3, 4]. Methodology is concerned with which tools should be used to obtain, organise and analyse knowledge. From the epistemological point of view, the nature, extent and justification of gained knowledge about participants' experiences are all important parts of research. Furthermore, epistemology places great significance on the identification of essential concepts from the collected data and the further examination of that knowledge, for example, the development of an instrument that can be used to examine the identified concepts with empirical methods. An ontological perspective stresses that qualitative methods are used to examine participants' experiences in their own context, how participants understand the reality of their own experiences and what relationships underlie how these experiences influence the participants. The methodology applied in qualitative studies is characterised by a humanistic philosophy, which considers personal meaning, understanding that meaning, subjectivity and the adoption of a holistic view of the human as valuable to the creation of knowledge [5]. However, interpretive approaches, subjectivity and inductive techniques include an inherent risk of bias [6]. Therefore, objectivity is essential when analysing research data and drawing conclusions. The inclusion of quantitative techniques is a beneficial way to increase the objectivity of a study.

Critical realism is the most common philosophical approach that combines qualitative (constructivist in that there is the underlying assumption of the existence of multiple realities) and quantitative (positivist in that there is the underlying assumption of a single objective reality) approaches [7, 8]. Mixed methods can be supported with a philosophical understanding of critical realism, which can be described by knowledge that is medicated by one's beliefs and perspectives [9]. Researchers who leverage this philosophy can gain a deeper understanding of topics that have attracted limited research attention by using inductive approaches to capture human experiences, and then translate these experiences into clearly defined concepts [10]. These concepts can be examined further to clarify their meaning and inter-relatedness, as well as develop theoretical models that can be tested and integrated into evidence-based practices.

Content analysis can be integrated into mixed methods approaches in at least three distinct ways. The following section provides some examples of how content analysis can be used in mixed methods research. The first example describes an instance in which qualitative and quantitative methods are used in the same study, while the subsequent example demonstrates how qualitative and quantitative methods can be separately applied in different stages of the research process.

4.2 Examples of How Mixed Methods Are Used in Nursing Science

The application of mixed methods approaches in nursing science can facilitate rich data collection through clearly defined research questions, an intricately designed research design and rigorous data analysis [11]. However, a researcher needs to

have experience and various competences to successfully conduct both research methods. Mixed methods approaches are used to gain a deeper understanding of measurable concepts, develop instruments, validate theoretical models, interpret the outcomes of quantitative research, combine different groups of participants in action research and examine the conclusions from a study's dissemination phase [11]. It is important for researchers to understand that the purpose of their research should guide study design and methodological choices. Mixed methods approaches can be used in nonparallel stages of research, for example, a researcher may begin a large-scale research project by loosely formulating the study goals (quantitative approach), but then later carefully conduct a literature review to find prior evidence of the topic (qualitative approach). It is sometimes clearly evident that the topic under study has not received sufficient research attention and requires a deeper analysis. In a recent study by Wiens [12], the researcher interviewed 13- to 16-year-old girls living in Lapland, Finland, about their experiences of well-being. The research applied qualitative methods as participant experiences were described based on diary entries along with individual and focus-group interviews. The results of the long data collection process were used to develop a hypothetical model based on inductive content analysis, which is an example of a qualitative method. In the next step of the study, the researcher used the conceptual definitions of the hypothetical model to operationalise the definitions into empirically measurable units (items). The items can then be combined into a scale that quantitatively measures the studied phenomenon and can be psychometrically tested [13]. In this example of a nonparallel research approach, the researcher initially builds strong evidence and then leverages the versatility of different research methodologies at distinct research stages (see also Chap. 7). Another example of mixed methods is research that combines qualitative data collection and quantitative content analysis. Anguera et al. [14] provide researchers with comprehensive guidelines for how to apply quantitative methods to data that were collected using qualitative approaches. The objective of this type of research could be identifying behavioural patterns based on the conditional probabilities that were calculated for participants. This type of data analysis is commonly used in neuroscience and psychology, but seldom in nursing science.

In another study, Kyngäs et al. [15] investigated how well adolescents with Type I Diabetes Mellitus (type1 DM) adhere to health regimens. The researchers performed an inductive content analysis with the objective of developing a hypothetical model (Chap. 2, Fig. 2.6 provides an illustration of the analysis path). The data collection phase encompassed open observations, interviews and drawings of adolescents' type1 DM experiences. A hypothetical model was developed based on the results. In the next step of qualitative data analysis, the researchers developed—and psychometrically validated—an instrument to test the hypothetical model. Once the Chronic Disease Compliance Instrument (CDCI)—which includes 72 items and 13 background questions—was validated, data were collected from 346 adolescents [15]. A linear structural relations (LISREL) analysis was performed to test the hypothetical model while a multiple indicators and multi causes (MIMC) approach was applied when building the model (see Chap. 7). LISREL—an example of structural equations modelling (SEM)—is a multivariate method that can be used to

conduct confirmatory factor analyses, multiple linear regression analyses and path analyses [16]. The MIMIC model is a structural equation that can be used to explain a single latent variable based on observed variables [17]. This method was applied to the research by Kyngäs et al. [15] to confirm that the structure and definitions of adherence concepts were in line with the factors measuring adolescents' adherence to health regimens. For example, the MIMIC model showed that *Support* and *Encouragement* did not explain adolescent adherence to health regimens. This disagrees with the initial quantitative findings, as the earlier analysis showed that adolescent participants often shared experiences of *Support* and *Encouragement*. The researcher continued the analytical process by returning back to the qualitative data and quantifying the sub-concepts identified in the content analysis (see Chap. 2, Figs. 2.3 and 2.6). There are two main approaches for the quantification of qualitative data. One approach is the calculation of the frequencies of defined concepts (for example, the *Support of Parents* toward adolescents) within participant experiences. In the study presented in this section, the support of parents was mentioned 51 times by the 51 interviewed adolescents (Fig. 4.1). As in the previous sentence, the results of the quantification can be reported in numerical format.

Another way that researchers can quantify the results of content analysis is to calculate the frequencies at which concepts are mentioned in all of the data, i.e., within the diverse sub-categories and categories. For example, in the study of adolescent adherence to health regimens, support from parents was mentioned over 300 times in the analysed data. Hence, various quantification methods can lead to noticeably different outcomes. For this reason, the purpose of quantification should be clearly defined to reach the required outcome of quantification. It is often the case that the sample used in the qualitative analysis is too small for any reliable statistical

Fig. 4.1 The frequencies at which several participant experiences appeared in the results of a content analysis

- Conflicts (n = 47)
- Pain (n = 36)
- Guilt (n = 38)
- Dependence (n = 51)
- Control (n = 51)
- Support from parents (n = 51)
- Difference (n = 46)
- Fears (n = 51)
- Variations of blood glucose level (n = 25)
- Worries (n = 43)
- Hypoglycaemia (n = 38)
- Sadness (n = 28)
- Complications (n = 51)
- Encouragement from friends (n=51)
- Dishonest

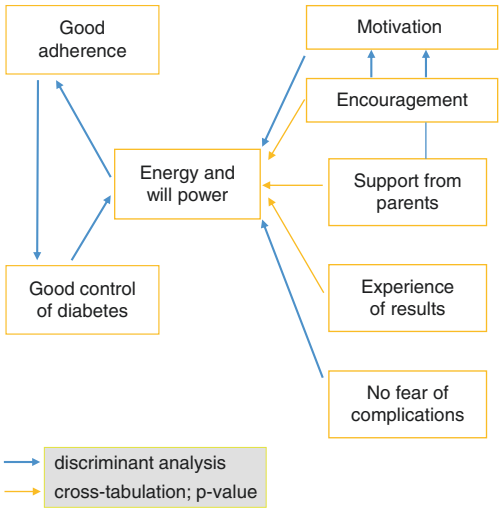

Fig. 4.2 Results from a discriminant analysis of a model of good adherence to health regimens

analyses. However, the percentages and frequencies can be reported. The study presented in this section included 51 interviewees, which enabled the researcher to perform a discriminant analysis that included the calculation of *p*-values. These analyses supported the creation of a model that describes good adherence to health regimens among adolescents with type1 DM (Fig. 4.2). The model indicates that support from parents and the encouragement of health care providers and friends did not directly explain adherence, but explained the participants' motivation, energy and will power, all of which influenced adherence (see Chap. 7). A hypothetical model—which will be further discussed in Chap. 7—was created based on these outcomes.

An alternative approach for mixed methods studies is parallel data collection that combines qualitative and quantitative research methods. This approach can be used to gain a deeper understanding of quantitative data outcomes by considering how the collected qualitative data influence decision-making, and is commonly applied to interventional studies or action research in the field of nursing science. The example provided in this chapter is a Finnish study of doctoral students by Isohätälä et al. [18]. During the data collection phase, 1645 candidates from a university in northern Finland were invited to participate in a cross-sectional survey. A total of 375 doctoral candidates participated. The researchers aimed to explore and describe doctoral candidate perceptions of their doctoral degree and future career at the university. The survey included questions relating to doctoral study conditions, factors contributing to the progress of doctoral studies and perceptions of future career. These three areas of concern were measured using items that could be quantified statistically. For the *factors contributing to the progress of doctoral studies* area, candidates were given the additional option of sharing their personal experiences through an open question. These responses yielded qualitative data, which was

analysed with content analysis. During the analysis, prior to which one researcher had read through the data several times, the identified open codes (n = 300) were grouped under two tables: (1) presenting positive factors (298 answers); and (2) presenting negative factors (312 answers). The open codes were organised in Microsoft Excel, with each open code in a separate row. Table 4.1 presents an example of the data distribution. The most frequently mentioned factors were initially grouped under ten categories, and these categories could include both positive and negative factors. The ten categories were *Funding and position, Supervision, Community, Studies, Research and academic work, Practices, Infrastructure, Other work-related responsibilities, Motivation and one's own abilities* and *Personal life*. This phase included two researchers independently creating categories based on the collected data, after which the researchers organised the data into the identified categories. The data distribution among the ten categories is presented in Table 4.2.

Once both researchers had completed their categorisation of the raw data, the results were combined into one data set. All of the disagreements were marked in a different colour, after which the researchers discussed the reasons for their choices. In each of the disagreements, the researchers came to agreement based on the strongest theoretical support for categorisation. An example of the similarities and differences between the data analyses of the two researchers is presented in Table 4.3.

The frequencies at which each open code appeared among the ten categories were statistically calculated. Interrater reliability was assessed to strengthen the trustworthiness of the data analysis. Cohen's kappa, which measures inter-rater agreement in qualitative data analysis, was chosen for evaluating interrater reliability, and was calculated for each category [19]. Cohen's kappa can be calculated through several software programs, for example, SPSS, Microsoft Excel, and various online calculators, with a value >0.80 demonstrating sufficient reliability.

In the study presented in this section, six of the 10 categories demonstrated sufficient Cohen's kappa values. The four categories *Research and academic work, Other work-related responsibilities*, *Motivation and own abilities* and *Personal life* resulted in low Cohen's kappa values, varying from 0.10 to 0.60, which are insufficient for ensuring reliability. As a result, the researchers returned to the data

Table 4.1 Raw data distribution of positive factors identified through content analysis, shown in a Microsoft Excel document

Interviews
To be a member of research group. Supervision. That I had an opportunity to work full time for 1 year
Great supervisors and great infrastructure. Curriculum and structure of degree program is good
Interesting topic, research community, support from friends in the same situation, encouraging supervisor
Research visit abroad
Research seminars and feedback there. Fellow PhD researchers and discussion with them. Conferences and conference paper presentations and feedback + connections made there
Support from my family
Freedom and independence, interesting industrial research projects

Table 4.2 Data distribution among the categories identified through content analysis

Negative factors			
Category	Funding	Supervision	Community
Lack of full-time funding	1		
Lack of knowledge in my field. Lack of cooperation with other researchers			1
Guidance of students, project management, project applications			1
Demotivated post-graduate students, who use doctoral studies for temporary employment			1

Table 4.3 Similarities and differences in the content analysis results of two researchers who had worked independently

Negative factors		
	Funding and position	Funding and position
Category	Researcher 1	Researcher 2
Lack of full-time funding	1.00	0.00
Lack of knowledge in my field		
Project management, project applications		
Demotivated post-graduate students, who use doctoral studies for temporary employment	1.00	1.00

analysis and examined the categories in which the most disagreements were observed. They noticed that a majority of the disagreements concerned whether an open code should be categorised under Research and academic work or Other work-related responsibilities, as well as under Motivation and own abilities or Personal life. A re-evaluation of these categories showed that there was a fair amount of overlap in the meanings and descriptions of the concepts defining these categories. For this reason, the *Research and academic work* and *Other work-related responsibilities* categories were merged into one category, while *Motivation and own abilities* and *Personal life* were merged into the *Personal factors* category. After these changes, as well as independent re-evaluations of the merged categories by both researchers, these two new categories showed Cohen's kappa values >0.80, and thus, reflected sufficient interrater reliability.

The frequencies at which open codes appeared in each category were calculated and presented as factors that either promote or hinder doctoral candidates' research and training (Figs. 4.3 and 4.4). These results were compared to the findings of the quantitative analysis to strengthen the reliability of the data analysis and the interpretation of results. The factors structure, recourses and supervision showed similar results in both the qualitative and quantitative analyses (Fig. 4.5). For example, the quantitative analysis showed that doctoral candidates in their twenties and thirties were 90% faster in their studies than older students. Among all of the participants, those employed by the university progressed 0.56 times faster than doctoral candidates who were employed outside the educational institution. Supervisory

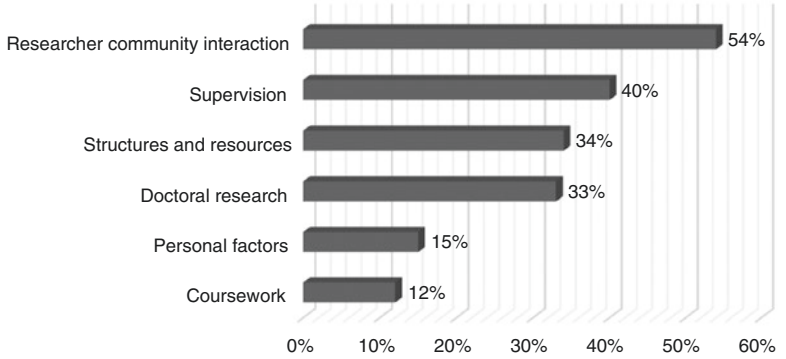

Fig. 4.3 The frequencies at which responses presented as promoting factors appeared in the data

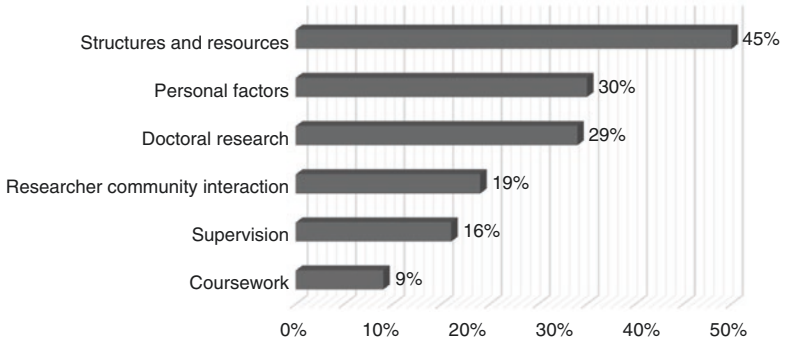

Fig. 4.4 The frequencies at which responses presented as hindering factors appeared in the data

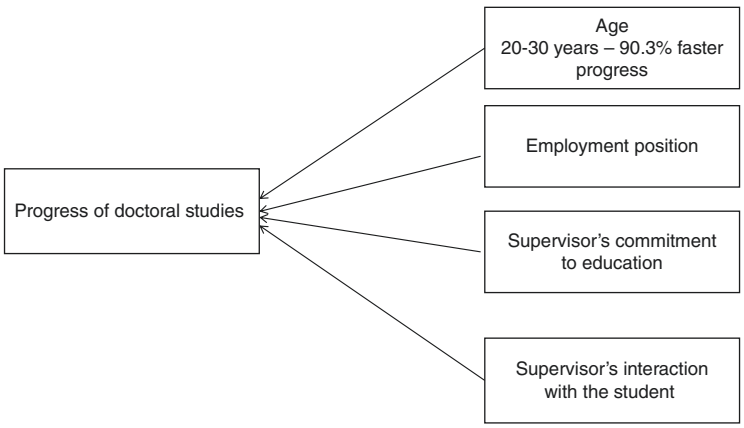

Fig. 4.5 Quantitative analysis results of which factors are linked to the progress of doctoral studies, quantitative study outcome

commitment to a candidate's education promoted their progress, as students who only had supervisory meetings a few times a year or less (10%) showed 25% slower progression than students who met with their supervisors more often. The qualitative data analysis offered new insights into how personal factors and coursework influence education progression that could not be unearthed by solely applying quantitative methods [18].

The results of the qualitative analysis were reported as the frequencies at which the most common open codes appeared in the collected data. The results section also included descriptions of each identified category, the frequency at which open codes appeared in each of the 10 categories and direct quotations from participants [18]. The quotations were presented to support the researchers' interpretations of the results and provide further confirmation for the trustworthiness of the research.

4.3 Conclusion

Nursing science that adopts the received view focuses on objective reality by gathering and analysing empirical evidence with the overarching goal of generalising results into evidence-based practice and education. On the other hand, nursing science that is based on the perceived view will investigate multiple realities which are not fixed to a single entity. Researchers use qualitative methods to understand human experiences based on the analysis of subjective and narrative data. The outcomes of qualitative data need to be further tested using larger samples so that the findings can be deemed reliable before they are applied as a solution.

Mixed methods approaches allow researchers to study phenomena with distinct approaches that are based on different philosophical backgrounds. Furthermore, mixed methods approaches enable researchers to better understand the topic under study by providing further evidence of the phenomenon and helping the researcher identify possible research gaps.

However, when incorrectly applied, mixed methods approaches can compromise the validity and reliability of the study. Researchers need to have competence and experience in using both of the research approaches. Furthermore, they must follow both the qualitative and quantitative research processes, as well as determine how the distinct methods can be combined in a way that benefits the research. This requires the research to be carefully planned, and it may sometimes be useful to include expert panels and/or collaborate with other groups of researchers. The study design needs to be transparently and meticulously described, including any potential limitations, so that readers and decision makers are able to evaluate the validity of the results.

References

1. McEwen M, Wills EM. Theoretical basis for nursing. Philadelphia: Lippincott Williams & Wilkins; 2002.
2. Meleis AI. Theoretical nursing: development and progress. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2005.

3. Allmark P, Machaczek K. Realism and Pragmatism in a mixed methods study. J Adv Nurs. 2018;74:1301–9. https://doi.org/10.1111/jan.13523.
4. Edwards SD. What is philosophy of nursing? J Adv Nurs. 1997;25:1089–93.
5. Playle JF. Humanism and positivism in nursing: contradictions and conflicts. J Adv Nurs. 1995;22:979–83.
6. Giuliano KK. Expending the use of empiricism in nursing: can we bridge the gap between knowledge and clinical practice? Nurs Philos. 2003;4(3):44–52.
7. David S. Critical realism and empirical research methods in education. J Philos Educ. 2005;39(4):633–46. https://doi.org/10.1111/j.1467–9752.2005.00460.x.
8. Maxwell J, Mittapalli K. Realism as a stance for mixed methods research. In: Tashakkori A, Teddlie C, editors. SAGE handbook of mixed methods in social and behavioral research. Thousand Oaks: SAGE Publications; 2010. p. 145–68. https://doi.org/10.4135/9781506335193.
9. Tong A, Flemming K, McInnes E, Oliver S, Craig J. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Med Res Methodol. 2012;12:181.
10. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs. 2008;62:107–15.
11. Regnault A, Willgoss T, Barbic S, International Society for Quality of Life Research (ISOQOL) Mixed Methods Special Interest Group (SIG). Towards the use of mixed methods inquiry as best practice in health outcomes research. J Patient Rep Outcomes. 2017;2:19. https://doi.org/10.1186/s41687-018-0043-8.
12. Wiens V. Well-being of the adolescent girls in Northern Finland—a hypothetical model. Acta Univ. Oul. D 1498. University of Oulu; 2018. http://urn.fi/urn:isbn:9789.
13. DeVellis R. Scale development. Theory and applications. 3rd ed. Newbury Park: Sage; 2012.
14. Anguera MT, Portell M, Chacon-Moscoso S, Sanduvete-Chaves S. Indirect observation in everyday contexts: concepts and methodological guidelines within a mixed methods framework. Front Psychol. 2018;9:13. https://doi.org/10.3389/fpsyg.2018.00013.
15. Kyngäs H, Skaar-Chandler C, Duffy M. The development of an instrument to measure the compliance of adolescents with chronic disease (CDCI). J Adv Nurs. 2000;32:1499–506.
16. Loehlin JC, Beaujean AA. Latent variable models: an introduction to factor, path, and structural equation analysis. 5th ed. New York: Routledge; 2016. https://doi.org/10.4324/9781315643199.
17. Carmen DT, Roger SZ, Fuller WB, Guoyao W, Raymond JC. Functional multiple indicators, multiple causes measurement error models. Biometrics. 2017;74:127–34.
18. Isohätälä J, Louis JN, Mikkonen K, Pyhältö K. Towards a doctoral degree and future career: perceptions of doctoral students at the University of Oulu. Acta Univ. Oul. F 12, Scripta Academica; University of Oulu; 2017. http://jultika.oulu.fi/Record/isbn978-952-62-1675-1.
19. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977;33:159–74.