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The Potential of Qualitative Content Analysis for Empirical Educational Research

Michaela Gläser-Zikuda, Gerda Hagenauer & Melanie Stephan

Key words:

qualitative content
analysis; empirical
educational
research; inductive
category
development;
deductive category
application; mixed
methods

Abstract: Researchers carrying out empirical studies in education are faced with complex and multifaceted phenomena that need to be investigated from different perspectives and with various methodological approaches. A suitable, often-applied method in empirical educational research is qualitative content analysis (QCA), developed by Philipp MAYRING (1983, 2015). This method can be used for inductive and deductive strategies of analysis, and is appropriate for combining qualitative and quantitative analyses, especially for research strategies based on mixed methods approaches (CRESWELL, 2015), which have for several years now been extensively discussed in empirical educational research (GLÄSER-ZIKUDA, SEIDEL, ROHLFS, GRÖSCHNER & ZIEGELBAUER, 2012; HAGENAUER & GLÄSER-ZIKUDA, 2019; MAYRING & GLÄSER-ZIKUDA, 2008). In this article, we discuss the potential of QCA for empirical educational research by giving insights into the basics of analysis and by providing research examples. We also briefly address the relevance of digitally supported analysis and describe specific software packages. Finally, we discuss the potential and challenges of applying QCA within mixed methods designs in the field of empirical educational research.

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1. Introduction

Siegfried KRACAUER was the first to discuss the "potentialities of the qualitative approach" (1952, p.637) for content analysis, emphasizing the mutual strengths of qualitative and quantitative content analysis. Today, qualitative content analysis (QCA) is firmly established in the empirical education research literature. This can be traced back to the work of Philipp MAYRING (1983, 2015), who described QCA as a procedure, which we elaborate upon below. In this article, we summarize the general characteristics of QCA and the lines of development in Germany. MAYRING presupposes the consistent implementation of each individual step in the analysis process; as such, we provide an overview of the basic logic and procedures underpinning this method, while presenting examples of research projects using these approaches (Section 2). We also emphasize the

importance of digitally supported data analysis, as the use of data analysis software has become a matter of course nowadays (Section 3). Following this, we aim to clarify the relationship between qualitative and quantitative data analysis, drawing upon the formulations of KRACAUER (1952) and MAYRING (1983, 2015). Here, we present exemplary studies in which QCA was implemented based on mixed method designs (Section 4). We conclude the article with a discussion of the potential of QCA for empirical educational research (Section 5). [1]

2. Qualitative Content Analysis in Empirical Educational Research

Researchers have applied QCA across a broad range of disciplines, including communication science, journalism, sociology, psychology, educational science, medicine and business. Over the last decades, QCA has become increasingly popular (NEUENDORF, 2002). In Germany, QCA was first described by MAYRING (1983) and has subsequently become an established approach for text analysis in sociology and, to a lesser extent, psychology (TITSCHER, WODAK, MEYER & VETTER, 1998). [2]

QCA has been applied to empirical educational research over the course of several years (GLÄSER-ZIKUDA, 2014; MAYRING & GLÄSER-ZIKUDA, 2008). It is a suitable method to analyze interviews with different individuals (e.g., students, teachers, etc.) and groups (e.g., teachers, stakeholders). The method can also be applied for coding documents or observations (including video observations). [3]

In the following section, we describe different trends in empirical educational research based on different methodological approaches (KÖLLER, 2014; TIPPELT, 2002; TIPPELT & SCHMIDT, 2009). In this overview we elucidate general trends in the choice of research topics, as well as research methodologies dominating the German educational research landscape. Please note that we only address selected aspects. [4]

In the 1960s and early 1970s, the educational research landscape was dominated by studies focusing on social selectivity and efforts to improve equality in education. Initial studies showed, for example, that access to education depended strongly on social background (ARTELT, BLOSSFELD, FAUST, ROSSBACH & WEINERT, 2013; PICHT, 1964; SCHNEIDER & PFOST, 2013). In the late 1970s and early 1980s, researchers focused on disparities regarding school education, educational participation, impact factors and consequences. In the 90s, quality and efficiency became the most important topics in education. Studies in this period focused on school effectiveness, large-scale assessments and quality of learning and instruction. The German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) financed many of these studies. From the 1990s onward, researchers increasingly focused on the organization and planning of education, as well as on educational governance and the economic conditions pervading the educational system. In addition, the concept of life-long learning became an increasingly important research topic. From 2000 onward,

studies related to the "Programme for International Student Assessment" (PISA) dominated much of the research literature. For example, educational equity was analyzed based on political debates using QCA (STOJANOV, 2008). As a consequence, numerous educational standards were developed to coincide with the introduction of new competency models, such as the PIRLS/IGLU-studies (BOS et al., 2007). Regional cooperation and networking in schools were other topics of discussion (BERKEMEYER, BOS & KUPER, 2010; BERKEMEYER, MANITIUS, MÜTHING & BOS, 2009). Greater emphasis was also placed on higher education research. From 2010 onward, an increase of funding of research programs by the Federal Ministry of Education and Research can be seen. This period also coincided with the founding of the Centre for International Student Assessment (ZIB), which is responsible for the national organization and reports of PISA. During this period, there was a growth of video analysis in empirical educational research, which represents a specific methodological application of QCA (STIGLER, GALLIMORE & HIEBERT, 2000). In recent years, various methodological and technical guidelines have been published, as well as numerous related studies (JANIK & SEIDEL, 2009). In most comparative or large-scale studies, such as those related to PISA, quantitative methods are applied. When researchers of such studies integrate qualitative approaches in their overall design, they often use QCA for data analysis, as for example KIELBLOCK (2015) in the qualitative component of the StEG-Q study on all-day schools in Germany.¹ [5]

Overall, there has been a boom in empirical educational research since 2000, which has had a strong impact on the research field and subsequent theory development (DITTON, 2009; KÖLLER, 2014; TILLMANN, 2005). As a consequence, interdisciplinary cooperation has increased and numerous new research associations have been founded; for example, the Society for Empirical Educational Research for the German-Speaking Countries (GEBF). In these research associations researchers from different disciplines discuss methodological issues, such as the combination of qualitative and quantitative perspectives and methods in research (Section 4). [6]

The combination of qualitative and quantitative methods with respect to mixed methods approaches (CRESWELL, 2015) are extensively discussed in the empirical educational research literature (GLÄSER-ZIKUDA & JÄRVELÄ, 2008; GLÄSER-ZIKUDA et al., 2012; HAGENAUER & GLÄSER-ZIKUDA, 2019). The use of mixed methods offers significant potential for educational research. We will elaborate on this aspect in more detail in Section 4. [7]

One essential feature of QCA, as described by MAYRING (1983, 2015), concerns possibilities of its connection to quantitative research. The content structuring form of QCA follows a linear-regulated approach. Margrit SCHREIER (2014) contrasts it with the extracting QCA, as described by Jochen GLÄSER and Grit LAUDEL (2009). In the following section we outline the essential characteristics and strategies of QCA according to MAYRING (1983). Essentially, QCA researchers should aim at providing an interpretative analysis of manifest and

¹ The abbreviation "StEG" refers to the study on the development of all-day schools in Germany, see <https://www.projekt-steg.de/> [Accessed: November 26, 2019].

latent structures to elucidate the meaning of data derived from semi-structured interviews, group discussions, semi-structured observations, documents, etc. MAYRING (1983, 2015) supposed that QCA is characterized by

- embedding data in the communication context,
- a rule-guided and systematic procedure of analysis,
- development or application of categories,
- quantifying the categories if theoretically reasonable, and
- quality criteria (e.g., inter-rater reliability). [8]

These characteristics can be regarded as the conceptual background for two strategies of analysis: inductive category development and deductive category application. Both of these strategies of analysis are applied at different stages in QCA. We describe the two techniques and provide examples applying them in empirical educational research using these techniques. [9]

2.1 Category development and application

"How categories are defined [...] is an art. Little is written about it" (KRIPPENDORF, 1980, p.76). Similarly, Udo KUCKARTZ (2018a) observes that great care and attention must be paid to category formation, and the derivation of inductive categories. For the interpretation of qualitative data, categories are considered the smallest objects of meaning, and as such must be conceptualized to be as close to the source material as possible. Inductive category development in QCA is oriented to reductive processes with respect to the psychology of text processing (BALLSTAEDT, MANDL, SCHNOTZ & TERGAN, 1981). With inductive category development, the researcher aims to formulate a criterion of definition, which is derived from the theoretical background and research question, which in turn determines which aspects of the text material will be taken into account during the analysis. Following this criterion, the material is analyzed by reducing and summarizing key information, thus gradually giving rise to the formation of categories. During inductive category development, the macro operator's selection, reduction, generalization, construction, combination and integration are systematically applied by the researcher in a step-by-step procedure. These categories are revised in a final step and combined to form main categories (MAYRING, 2014; MAYRING & GLÄSER-ZIKUDA, 2008). [10]

In deductive category application, the source material is analyzed according to the coding framework—described by MAYRING as a "category system"—based on the theoretical background, which is identified before the analysis begins. With the deductive coding frame, the researcher aims to elucidate explicit definitions, reference examples and coding rules for each deductive category, thus helping to determine the exact criteria by which parts of the data (e.g., text passages) will be coded. These category definitions and rules are described in a coding frame. The qualitative step of deductive analysis involves the methodologically-controlled assignment of categories to a passage of text. Deductive category application may be carried out using different techniques: formal and content structuring,

typifying and scaling structuring (MAYRING, 2014; MAYRING & GLÄSER-ZIKUDA, 2008). [11]

As indicated above, educational researchers frequently develop coding frames that comprise deductive and inductive categories. Such deductive-inductive coding frames take advantage of the strengths of both approaches. In the first step, researchers develop deductive categories based on existing theoretical background, hence underscoring the critical role of theory in the application of QCA. In the second step, researchers develop inductive categories for the analysis and interpretation of additional or new aspects not yet addressed in theory. [12]

Gerda HAGENAUER, Michaela GLÄSER-ZIKUDA and Simone VOLET (2016) used QCA in their cross-cultural interview study on emotion displays by Australian and German university teachers in teaching, and how this influenced the teacher-student relationships. This study was chosen as an example for two reasons: firstly, it illustrates how deductive and inductive steps of data analysis can be meaningfully combined; secondly, there is a growing body of studies in educational empirical research focusing on higher education. Educational policy makers have increasingly prioritized quality improvement in higher education teaching and learning, which necessitates evidence-based identification of the preconditions for quality learning and teaching. Coding was done in several steps, at first deductively. Emotion research is premised on the idea that positive and negative emotions can be readily distinguished and that there are different display rules for the communication of these positive and negative emotions. This gives way to the development of two deductively-developed categories: displays of positive emotions and displays of negative emotions. Interview transcripts were examined for text passages that could be allocated to these categories. The researchers sought to understand how the teachers displayed their emotions to students. Given the paucity of research in this field, the researchers had to develop their own inductive categories to describe the concrete modes of display based on the interview data. Therefore, a coding frame including deductive and inductive categories was used for coding the interview material. With this process, the authors followed the principles of content structuring. Each category and subcategory was defined and illustrated using a reference example. A similar procedure was applied for coding the quality of the teacher-student relationship. Coding rules were not defined in this project as the categories were clearly distinguishable. However, should this not be the case, following QCA it is suggested to use coding rules in order to clarify the allocation of data to appropriate categories. In Table 1 an extract of the coding frame used to code teacher perceptions regarding appropriate displays of positive emotions when teaching and interacting with students is illustrated.

Category	Definition	Reference Example
Display of positive emotions (deductive category)	This category is used when teachers talk about how to display positive emotions.	"So, okay, the positive ones are easy to handle. Just join it, just share the fun" (Interview 1, Australia).
Ways of communicating positive emotions (inductive subcategories)		
Giving positive feedback	The teacher communicates positive emotions neutrally by giving content-focused feedback.	"I give feedback to the students at the end of the session how I perceived the session. How I perceived the progress of the course" (Interview 5, Germany).
Praising students	The teacher communicates positive emotions (e.g., satisfaction) by praising the students. Praise incorporates some kind of emotionality in the feedback.	"Well, from my perspective praising students is very important" (Interview 6, Germany).
Expressing positive emotions intensely (verbally)	The teacher communicates positive emotions intensively verbally. Communication is emotionally more intense compared to Code 2 (praising students).	"I would equally say, 'I am so happy for you.' You know, if somebody gets a job or if somebody gets an award or something else" (Interview 4, Australia).
Hugging students (intense physical reaction)	The teacher hugs the students.	"I would hug students and students would hug me that ... that ... not all the time but I wouldn't hold back from doing that kind of thing" (Interview 4, Australia).
Displaying enthusiasm	The teacher shows enthusiasm evoked by the content / subject.	"I get excited about things. And I'll say: 'Oh, guess what, guys! Look at this! Check this out! Everybody come over!' " (Interview 13, Australia)
Sharing humor	The teacher shares humor in the classroom.	"Having a laugh with the group. That's important" (Interview 15, Australia).

Table 1: Extract of a deductive-inductive coding frame (HAGENAUER et al., 2016, p.53) [13]

2.2 Quality criteria in qualitative content analysis

Scientists conducting empirical educational research must adhere to certain quality standards for data collection and analysis. While in quantitative research objectivity, reliability and validity are defined as the central quality criteria to be met (DIEKMANN, 2003); quality criteria in qualitative research are more heterogeneous (EISEWICHT & GRENZ, 2018). Common criteria used for the critical evaluation of qualitative research include interrater reliability, and communicative and consensual validation (FLICK, 1987, 2017; MAYRING, 2000, 2014). These quality criteria are especially relevant for QCA; how they may be fulfilled in the research process is described in the following. [14]

Intersubjectivity is a function of the stability of applying the coding frame, the replicability of coding by groups of two or more coders, and the accuracy of the coding procedure. Krippendorff's alpha (KRIPPENDORFF, 1980, 2013) or Cohen's Kappa (WIRTZ & CASPAR, 2002) are usually calculated in QCA for the estimation of inter-rater reliability (GLÄSER-ZIKUDA, 2008; MAYRING, 2014). In general, an inter-rater score in excess of $\kappa = .70$ is deemed to be a sufficient indicator of consistency. Furthermore, the validity of results in qualitative research is generally established on the basis of communicative or consensual validation (SCHEELE & GROEBEN, 1984). Communicative validation involves researchers and participants reaching a consensus on the interpretation of the data. Consensual validation, on the other hand, involves the researchers analyzing the qualitative data together, and discussing the development or application of categories. [15]

The rigor of qualitative research is established through the validation of inter-rater reliability and both communicative and consensual validation (FLICK, 2007). These quality criteria are especially relevant for QCA, as they can be used to contribute to a systematic and theory-based understanding of category development. This helps in explaining why such widespread appeal of QCA is seen across so many disciplines, often coexisting in combination with quantitative research methods, especially in the context of empirical educational research (REINDERS, DITTON, GRÄSEL & GNIEWOSZ, 2015). It should be noted that communicative or consensual validation contributes to the quality of QCA studies, especially those relying on interview data, in order to clarify the appropriateness of the researcher's interpretation from the participants' perspective. However, these quality criteria seem to be seldom applied due to a lack of resources (e.g., manpower, budget and time). [16]

3. Possibilities and Challenges of Digitally Supported Qualitative Content Analysis

In the following section, we briefly describe the potential of digitally supported QCA in empirical educational research (see for an overview also EVERS et al, 2011). Different software packages (e.g., [ATLAS.ti](#), [f4analyse](#), [MAXQDA](#), [QCAmap](#)) are available for every stage of the research process (KUCKARTZ, 2010; MAYRING, 2014; RÄDIKER & KUCKARTZ, 2019). In addition to data collection and preparation, software is particularly useful for data analysis. Large amounts of data can be handled and monitored more easily using software. Depending on one's choice of software, one might, for example, take advantage of various search functions or have the ability to quickly trace the context of extracted data with the use of links. Software can be used to facilitate the analysis of either text-based data (e.g., interview transcriptions, diaries, social networking content), or visual data (including photos, maps and drawings), film and sound recordings. The use of digitally supported analysis of multimedia data permits a profound level of content-related analysis from multiple perspectives. [17]

As already indicated, video analysis is a very powerful method in empirical educational research used to ascertain the quality and effectiveness of teacher competencies (JANIK & SEIDEL, 2009). One example of the application of video analysis in QCA is the study by MAYRING, GLÄSER-ZIKUDA and ZIEGELBAUER (2005). In this study, students' learning processes and achievement emotions were analyzed using the software [Videograph](#) (RIMMELE, 2002). Videotaped lessons were analyzed using QCA following MAYRING (1983, 2015). Like other comparable software, the use of Videograph provides a window for the transcription of verbal information and for coding decisions by the researchers. In the mentioned video study, researchers applied a set of theory-based coding procedures (structuring QCA) to code students' positive and negative achievement emotions according to mimics, gestures, and verbal information every five seconds. [18]

With another software package, [Feldpartitur](#), the researcher works with pictographic notes (for example, it is possible to select symbols for the camera setting or fast/slow movements), and it can be used to facilitate qualitative analysis of audio-visual data. The software [Mangold INTERACT](#) can be used to go beyond simply software-supported audio-visual data analysis. The researcher has the opportunity to apply an additional module to analyze behavioral patterns in longitudinal data on the basis of cluster analysis. A human researcher might easily miss such subtle patterns and the identification of such patterns is highly time-consuming. Using software can facilitate the concise and reliable analysis of data, thus supporting the research processes. [19]

Although there are some clear advantages to the use of digitally supported data analysis, it also comes with a number of unique challenges. In the case of video and multimedia data (e.g., sound recordings and film material), the use of software makes it difficult for researchers to guarantee the anonymity of research subjects during analysis. Digitally supported data analysis accelerates the

analysis process. But the ability to process larger volumes of data and cases can result in any time savings being lost. There is also a risk of losing whatever close connection the researcher might have had with the material by having outsourced the analysis to the software. Another controversial issue concerns whether the use of software for QCA leads to the dilution of research methods or opens up the possibility of extending existing research methods (KRUSE, 2015; KUCKARTZ, 2010). In general, however, the methodological approach should not be determined by the QCA software because the software is only a tool. As such, it is up to the researcher to use the software skillfully (KRUSE, 2015; KUCKARTZ, 2010; SILVER & LEWINS, 2014), and hence it is the researchers' responsibility to transfer their methodological knowledge to the functions of the software. For example, [MAXQDA](#) (just like other software solutions, e.g., [ATLAS.ti](#), [NVivo](#) or [QDA Miner](#)) is extensive in functionality and a widely used software in qualitative social research. It can be used for the analysis of qualitative data based on different qualitative methods (e.g., grounded theory methodology), and it is also suitable for the analysis of qualitative data based on QCA according to MAYRING (1983, 2015). It does not offer a specific function for developing a deductive coding frame in the sense of MAYRING; however, it is possible to describe the coding frame (explicit definition of categories, reference examples and coding rules) by using the memo function. Due to its flexibility, software such as MAXQDA is appealing for researchers who analyze their data based on QCA according to MAYRING. [20]

For the step-by-step application of his version of QCA, MAYRING (2014) developed a specific software application: [QCAmapp](#). QCAmapp is suitable for the consistent implementation of QCA. Moreover, having been developed by MAYRING specifically for this purpose, the use of QCAmapp allows researchers to follow the original process models as proposed by MAYRING for inductive category development and deductive category application. Therefore, each of the aforementioned techniques can be easily applied using this program. [21]

There is no right answer to the question of whether and which software should be used for qualitative data analysis in empirical educational research. FLICK (2017), however, offers a list of considerations to facilitate the decision-making process with respect to software, arguing that researchers should focus on the

- type of data that can be processed with the software (text, video, audio),
- scope of functions and whether these enable the implementation of the research design,
- influence of the software on the research process,
- user-friendliness and level of support available (e.g., tutorials, ability to contact technical support),
- technical requirements (operating system, working memory, compatibility with other programs, etc.), and
- financial considerations. [22]

Although software support is very helpful for the research process, one should also consider the disadvantages described earlier, before starting the research process. Therefore, the decision depends on both, methodological considerations, personal competencies and preferences. [23]

Another aspect to consider is the possibility of data exchange. It is becoming increasingly important to make social science data accessible in the long term. The challenge of preparing and providing qualitative data in a way that is comprehensible for the scientific community means there is potential for improving the transparency of qualitative research and consequently the quality of research as a whole (PERRY & RECKER, 2018). An example of how to secure, prepare and provide scientific qualitative data is the [Verbund Forschungsdaten Bildung](#) (Alliance for Research Data in Education). Within this network, the Leibniz Institute for the Social Sciences ([GESIS](#)), Leibniz Institute for Research and Information in Education ([DIPF](#)) and the Institute for Quality in Education ([IQB](#)) ensure the technical, organizational and legally compliant realization of securing and providing data. An example for such a re-analysis is the study of Jochen GLÄSER and Grit LAUDEL (2000) who used a modified form of MAYRING's QCA. The aim of this study was not simply to perform further qualitative analysis to verify an existing analysis, but to offer a re-interpretation of the data (i.e., re-analysis) (MEDJEDOVIĆ, 2014). GLÄSER and LAUDEL used the secondary analysis to train students in research methods. Using such digitally provided data thus extends the possibilities of researchers to examine the same data with different questions or to check the quality of results. Furthermore, as highlighted previously by Beverly SMITH and Sharlene HESSE-BIBER (1996), software helps "to bridge the gap between quantitative and qualitative data analysis" (p.428). How QCA, according to MAYRING (1983, 2015), is related to mixed methods research will be explained in the following section. [24]

4. Qualitative Content Analysis and Mixed Methods

As already mentioned, researchers using QCA can quantify findings if that is what the research question requires; for example, by calculating the frequency of certain categories, by applying categories to text passages based on nominal or ordinal scales, or by relating different categories by means of computing crosstabs and/or correlations (MAYRING, 2014, 2015). Therefore, given its systematic processing of data and openness for quantification, QCA is an appealing option for researchers with a quantitative background who are performing mixed method studies of empirical educational research (GLÄSER-ZIKUDA et al., 2012; HAGENAUER & GLÄSER-ZIKUDA, 2019). According to Nicole BURZAN (2016, pp.26-30), QCA is a hybrid method, combining qualitative and quantitative analysis. Nevertheless, QCA should not be equated with mixed methods research, which typically refers to the combination of quantitative and qualitative methods in a research project. In contrast, Udo KUCKARTZ (2018b) proposes the transfer design as a specific form of mixed method design, describing the transfer of qualitative to quantitative data (i.e., quantification), or the transfer of quantitative to qualitative data (i.e., qualification). MAYRING (2012) explains that QCA is essentially a qualitative method. QCA researchers,

however, may apply not only qualitative but also quantitative forms of analysis. In our article, we refer to this understanding of MAYRING (2012) and BURZAN (2016), who follow a more conservative understanding of mixed method research, and who do not integrate QCA into the mixed method designs. [25]

As a specific technique of analyzing qualitative data, QCA is suitable for different research designs as suggested within the mixed method approach. John CRESWELL distinguishes three main mixed methods designs: 1. convergent parallel design, 2. explanatory sequential design and 3. exploratory sequential design (CRESWELL, 2015; CRESWELL & PLANO-CLARK, 2011). In the following, we describe examples of mixed method studies in educational research in which researchers have used QCA in one of the designs mentioned above. Then we discuss the function of QCA within these research designs. [26]

Convergent (parallel) design: In a convergent design, the qualitative and the quantitative strands are conducted separately, after which the findings are merged, thus resulting in an overall interpretation of the findings in order to obtain a more complete picture of the phenomenon under investigation or to cross-validate findings (CRESWELL, 2015). For instance, Gerda HAGENAUER and Tina HASCHER (2010) investigated the learning enjoyment of students in lower secondary schools by combining a longitudinal survey (i.e., questionnaire) with daily diary entries of a sub-sample of students involved in the study. With this combination, the researchers were able to investigate the relationship between the characteristics of the learning environment and students' learning enjoyment (i.e., quantitative part), and to obtain students' perspectives on why they thought they experienced learning enjoyment in a situation, while their learning enjoyment had been impeded in other situations (i.e., qualitative strand). As the sample in the qualitative strand was large (n=134), and students wrote multiple diary entries, the qualitative results were coded first, thus resulting in a quantifiable set of results (i.e., frequency tables) based on diary entries. In this study, QCA was used to analyze the qualitative data, allowing the large number of diary entries (app. 2,000) to be easily managed (HAGENAUER, 2011). One of the main advantages of QCA is that it can be used to handle large volumes of qualitative data. [27]

Explanatory sequential design: In an explanatory sequential design, researchers conduct the quantitative strand of the study first. After they have analyzed the results of this strand, they plan the qualitative strand of the study, which helps to better understand specific and intentionally chosen aspects of the quantitative findings (e.g., following up on unexpected results). The sample for the qualitative study is typically chosen from the quantitative study according to specific criteria (purposive sampling) (CRESWELL, 2015). For example, Kati TREMPLE, Judith SCHELLENBACH and Cornelia GRÄSEL (2012) investigated whether a science education summer camp for disadvantaged youth would increase students' social skills due to the numerous collaborative elements integrated into summer camp activities. Their quantitative results, based on pre-, post- and follow-up measures, showed an increase in students' social competences if they were from lower socioeconomic groups. No differences were found for students in middle or high

socioeconomic groups. In order to better understand these findings, the authors conducted a follow-up qualitative study with a subsample of twelve students. They conducted semi-structured interviews, which were analyzed with QCA. During these interviews, participating students reported their subjective experiences of the summer camp. The qualitative data was not quantified, but was reported qualitatively by referring to selected interview quotes from the data material (Table 2).

Subject	Construct	Main Category	Subcategory
Effect of <i>Researcher Holidays</i>	Social competence	Willingness to help others	<ul style="list-style-type: none"> • helping others when they ask • helping others when they have forgotten something • demonstrating a sense of fairness (all should have the same chances or be given the same grade)
		Interactions	<ul style="list-style-type: none"> • participation, when friends are participating • meeting friends from elementary school • working together with a partner • getting help from a partner • enjoying working with others • effective work with others

Table 2: Deductive coding scheme for social competences (TREMPLENER et al., 2012, p.99) [28]

TREMPLENER et al. showed that QCA works well for combining quantitative and qualitative methods of data analysis. With their quantitative results they describe and define the theoretical context using deductive categories. With the qualitative results they elaborate and specify the contextual aspects in more detail. QCA can be fruitfully applied within an explanatory sequential design as it contributes to a more profound and in-depth understanding of the relationships between the variables or the trajectories of specific characteristics. [29]

Exploratory sequential design: In an exploratory sequential design, the qualitative part of the mixed method project is conducted first in order to explore a phenomenon. After the exploratory phase, a quantitative study is conducted based upon the findings of the qualitative strand. Researchers might use the qualitative findings to develop a questionnaire and/or an intervention, which is then followed by a quantitative study after pre-tests have been conducted (CRESWELL, 2015). Carolin ENZINGMÜLLER, Claudia NERDEL and Helmut PRECHTL (2012) used an exploratory sequential design in their study on teacher beliefs about the use of technical language in biology instruction. As a pre-study, the researchers conducted semi-structured interviews with biology teachers, and

analyzed these using structuring QCA (MAYRING, 2015). Like in the study of TREMPLE et al. (2012), the interviews were analyzed by differentiating themes that were described qualitatively using interview quotes. In the main study, the authors aimed to investigate the impact of teacher beliefs about technical knowledge on their teaching practice based on a quantitative design. Their use of QCA allowed them to define core dimensions of teacher beliefs that could be used for the development of items for the quantitative study. This allowed for the consideration of respondents' everyday language in the wording of question items, thus helping to ensure that the questionnaire was easily understood by participants. ENZINGMÜLLER et al. conclude:

"With regard to the pre-study, it has to be noted, that it is a first explorative step to conceptualize teacher belief systems [...]. Due to its qualitative nature that comes along with small samples, no representative statements regarding the distribution of the facets of teacher beliefs can be made. Thus, the results can only be interpreted as hints that have to be followed up in the main study" (2012, p.191; our translation). [30]

The reasoning described above is typical of researchers who have their roots in quantitatively-driven educational research, and who apply mixed method designs using QCA in the qualitative part of a study. If we were to inquire about the researcher's priorities, we would likely find that the qualitative part of the study is less important compared to the quantitative part in many cases. Traditionally, the qualitative strand of a study is considered a type of pre-study that precedes the main quantitative part. This combination is feasible within the quantitative worldview as both methods provide accurate and structured procedures for the collection and analysis of data. [31]

While many mixed method studies in empirical educational research emphasize the quantitative part, the use of QCA makes a significant contribution to our understanding of the research phenomenon well beyond what is possible using quantitative data alone. In the study by HAGENAUER and HASCHER (2010), the use of inductively developed categories facilitated a broader understanding of the antecedents of students' learning enjoyment. The QCA by TREMPLE et al. (2012) elucidated a new understanding of the correlations between variables found in the quantitative study by providing additional context through rich descriptions of students' experiences of the summer camp. Finally, ENZINGMÜLLER et al. (2012) profited from QCA as the authentic responses of interviewees supported the development of a subsequent questionnaire in a hitherto under-researched field. [32]

5. Discussion and Conclusion

To sum up, using QCA provides a number of advantages, allowing large volumes of textual and other types of qualitative data to be analyzed quickly and comprehensively. Moreover, QCA as a rule-guided and systematic analytical procedure can be used for corroborating evidence. QCA is a research method in which several criteria are used for the assessment of research quality. Due to its rule-guided procedures and techniques, the use of QCA allows researchers to document the various analytical steps taken in the research process and to verify inter-rater reliability during and after the analysis. [33]

QCA in MAYRING's version is not an appropriate method if the research questions are explorative and not theory-oriented (MAYRING, 2015). A further limitation is that the researcher extracts the data material from the overall context when the material is allocated to respective categories. This is particularly true in the case of content structuring. The strengths of QCA become most apparent with qualitative data based on theoretical considerations to analyze specific aspects of the data, as well as on larger volumes of data. QCA is usually not used for in-depth case analysis, although this is possible if the research aim and question requires that (for a discussion on QCA and case analysis see JANSSEN, STAMANN, KRUG & NEGELE, 2017; KUCKARTZ, 2018a). Finally, an excessive interpretation during the coding process, as for example in grounded theory methodology (KELLE, 2005) is not provided by researchers using QCA, and is rather seen as having a negative impact on the quality of coding (MAYRING, 2015). [34]

For several years now, QCA has been successfully applied to the multifaceted phenomena of educational research. QCA is a powerful method for analysis of qualitative data with a number of advantages for this research field. Firstly, application of inductive category development and deductive category application procedures allow researchers the possibility of analyzing individual and contextual conditions, processes and outcomes in a theoretically guided, adaptive, rule-guided and interpretative way. Secondly, based on these aforementioned procedures, researchers using QCA have a variety of analytical techniques for inductive category development, such as the techniques of summarizing, and different forms of structuring in the case of deductive category application. Depending on the specific research question, an appropriate technique may be used for the analysis with QCA. Thirdly, various forms of quantifications are possible based on the aforementioned QCA procedures and techniques. The results of QCA may be enlightening with respect to frequencies and rankings of specific aspects of learning and instruction, or as correlations of these aspects with further variables. Nevertheless, further statistical analyses are possible, thus QCA is a method of analysis that is well aligned with mixed method approaches and one that might be regarded as a hybrid research method (BURZAN, 2016). [35]

With regard to mixed method studies, educational researchers should go beyond simply applying QCA according to MAYRING (2015) in the qualitative part of mixed method studies. Research questions might be extended with the inclusion

of more reconstructive and interpretative approaches to qualitative research. Moreover, efforts should be made to foster a spirit of cooperation amongst qualitative and quantitative researchers. Such efforts might lead to the analysis of qualitative data from different perspectives, for example, by using QCA, grounded theory methodology (MEY & MRUCK, 2011) or the documentary method (BOHNSACK, NENTWIG-GESEMANN & NOHL, 2013). By combining these different qualitative research and data analysis approaches, researchers might not only complement quantitative with qualitative research methods, but also take advantage of the complementarity of methods within the qualitative approaches as discussed in multi-methods research (HESSE-BIBER & JOHNSON, 2015). [36]

Both QCA and mixed method studies can be supported by the use of appropriate software. The use of software packages for this purpose has to be well considered by the researchers. The individual selection of appropriate software entails a complex decision-making process, and the choice of software influences the data analysis process. In the case of mixed method studies, the various pros and cons of different software packages should be discussed to ensure that the steps of analysis and combination of data remain objective, reliable and valid. Researchers would benefit from a comprehensive overview of how they can use currently available software packages for the analysis of qualitative data, and how these tools might influence the results. In times of increasing digitalization, qualitative researchers also face questions of how to best organize and store growing amounts of data and how best to ensure the anonymity of research participants. In addition to legal, organizational, financial and technical issues, methodical considerations cannot be neglected when selecting suitable software². The development of research methods and software should take place in a close mutual process. QCAmapp is an example of software developed specifically for QCA according to MAYRING to ensure the correct application of summarizing and the different strategies of structuring in his QCA version. In addition, when considering the methodological developments, it is important to take into account the possibilities of software (such as the possibility to automatically recognize patterns in data). [37]

Finally, researchers using QCA in empirical educational research benefit from descriptive and interpretative knowledge and, in combination with quantitative methods, predictive knowledge. Studies in which "causal" knowledge may be obtained, have significantly increased (e.g., by applying extensive longitudinal designs); notwithstanding, additional research is needed. In particular, the variety of research designs should be extended by considering different ways of integrating quantitative and qualitative research methods. In doing so, researchers can take advantage of the possibilities that mixed method research provides for the exploration of complex educational phenomena. For example, in future studies researchers should explore the interplay of various factors on the macro-, meso- and micro-level in order to explain student outcomes (HELMKE, 2015). In addition, teacher competencies have increasingly become the focus of attention in empirical educational research (BAUMERT & KUNTER, 2006). The

² This also is the case for quantitative research.

development of teacher professionalism is a highly complex endeavor requiring a meaningful combination of qualitative and quantitative approaches in order to track these changing processes. These research questions pertain not only to pre-school, primary and secondary education but also to higher education. [38]

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Wirtz, Markus & Caspar, Franz (2002). *Beurteilerübereinstimmung und Beurteilerreliabilität*. Göttingen: Hogrefe.

Authors

Michaela GLÄSER-ZIKUDA is a full professor at the Institute for Educational Science, Research and Teaching Unit School Education and Instructional Research at the University of Erlangen-Nuremberg. Her main research interests are emotions and self-regulation in school and higher education, instructional quality, and teacher education. She is also interested in qualitative research methods and mixed methods research.

Contact:

Prof. Dr. Michaela Gläser-Zikuda
University of Erlangen-Nuremberg
Faculty of Humanities, Social Sciences, and
Theology
Research and Teaching Unit School Education
and Instructional Research
Regensburger Straße 160
90478 Nürnberg, Germany

Tel.: +49 911-5302-586

E-Mail: michaela.glaeser-zikuda@fau.de

URL: <http://www.spaed.ewf.uni-erlangen.de/der-lehrstuhl/lehrstuhlinhaberin/>

Gerda HAGENAUER is a full professor in the School of Education at the University of Salzburg. Her main research interests are emotions, motivation and social relationships in teaching and learning at school, in teacher education and in higher education. She is also interested in mixed methods research.

Contact:

Prof. Dr. Gerda Hagenauer

University of Salzburg
School of Education
Department of Educational Science, School
Research and School Practice
Erzabt-Klotz-Straße 1
5020 Salzburg, Austria

Tel: +43 662 8044 7389

E-Mail: gerda.hagenauer@sbg.ac.at

URL: <https://www.uni-salzburg.at/index.php?id=211331>

Melanie STEPHAN is a PhD student at the Institute for Educational Science, Research Unit for Media Education at the University of Erlangen-Nuremberg. In her PhD she focuses on technology-based teacher education. Her research interests are emotions in learning and instruction, media education, and teacher education.

Contact:

Melanie Stephan, M.A.

University of Erlangen-Nuremberg
Faculty of Humanities, Social Sciences, and
Theology
Research Unit for Media Education
Regensburger Straße 160

90478 Nürnberg, Germany

Tel.: +49 911-5302-96511

E-Mail: melanie.stephan@fau.de

URL:
<https://www.medpaed.phil.fau.de/lehrstuhl/person/melanie-stephan-m-a/>

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