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Abductive Reasoning Tendencies of Graduate Students in the Context of Qualitative Research: A Q Methodology Study

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Abstract

The aim of this research is to reveal the tendencies of graduate students towards abductive reasoning in the context of qualitative research. To this end, the study is designed within the Q methodology pattern, which is one of the mixed research methods. Q methodology is a research method aimed at systematically analyzing the views of participants on the research question. The study group of the research consists of 11 graduate students determined by criterion sampling. As a data collection tool, 14 sentences related to three themes measuring abductive reasoning tendency were used. The data collection process was carried out using a structured Q sorting. As a result of the research, it has been observed that the tendencies of graduate students towards abductive reasoning in the context of qualitative research are grouped under four factors. These four factors consist of the harmonious creative group, which has a high tendency towards creative abductive reasoning and excessively coded abductive reasoning; the preferring group, which has a high tendency towards under coded abductive reasoning; the descriptive group, which has a high tendency towards excessively coded abductive reasoning; and the exploratory creative group, which has a high tendency towards under coded abductive reasoning and creative abductive reasoning.

Keywords: Abductive reasoning, qualitative data analysis, graduate student.

Lisansüstü Öğrencilerin Nitel Araştırmalar Bağlamında Abdüktif Akıl Yürütme Eğilimleri: Bir Q Metodoloji Çalışması

Öz

Bu araştırmanın amacı, lisansüstü öğrencilerin nitel araştırmalar bağlamında abdüktif akıl yürütme eğilimlerini ortaya koymaktır. Bu amaç doğrultusunda, çalışma karma araştırma yöntemlerinden Q metodoloji deseninde tasarlanmıştır. Q metodoloji, katılımcıların araştırma sorusuna ilişkin görüşlerini sistematik şekilde analiz etmeyi amaçlayan bir araştırma yöntemidir. Araştırmanın çalışma grubunu, ölçüt örnekleme ile belirlenmiş 11 lisansüstü öğrenci oluşturmaktadır. Veri toplama aracı olarak, abdüktif akıl yürütme eğilimini ölçen üç temaya ilişkin 14 cümle kullanılmıştır. Yapılandırılmış Q dizgisi kullanılarak veri toplama işlemi gerçekleştirilmiştir. Araştırma sonucunda, lisansüstü öğrencilerin nitel araştırmalar bağlamında abdüktif akıl yürütme eğilimlerinin dört faktör altında toplandığı görülmüştür. Yaratıcı abdüktif akıl yürütme ile aşırı kodlanmış abdüktif akıl yürütmeye ilişkin eğilimin yüksek olduğu uyumlu yaratıcı grubu; yetersiz kodlanmış abdüktif akıl yürütmeye ilişkin eğilimin yüksek olduğu tercih eden grubu; aşırı kodlanmış abdüktif akıl yürütme eğiliminin yüksek olduğu betimsel grubu; yetersiz kodlanmış abdüktif akıl yürütme ile yaratıcı abdüktif akıl yürütme eğiliminin yüksek olduğu keşfedici yaratıcı grubu söz konusu dört faktörü oluşturmaktadır.

Anahtar kelimeler: Abdüktif akıl yürütme, nitel veri analizi, lisansüstü öğrenci

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INTRODUCTION

Qualitative research, like all other research, begins with the identification of a research problem and continues with a cyclical process involving data collection, analysis, and interpretation. The nature of this process, based on interpreting the subjective meanings of participants, especially necessitates deeper examination during the data analysis stage. Various researchers (Marecek & Magnusson 2020; Wertz, 2011; Wertz, 2014) highlight that qualitative studies once seen as a deviant discipline under the influence of quantitative research for many years, began to gain acceptance in the 1970s. Simultaneously, the data analysis stage, considered the darkest area of the qualitative research process, started to emerge as a field of study.

Qualitative data analysis, viewed as an interpretative process by which a researcher makes sense of and imbues meaning to a data set (Rinehart, 2021), relies on synthesizing data into meaningful information and reconstituting it in a form that is meaningful to the reader (Miles & Huberman, 1994; Morse & Field, 1995). This process requires both data collection and analysis, as well as the establishment of solid and repetitive connections between theory and data. These connections are established through scientific reasoning processes (Kennedy & Thornberg, 2018). Accordingly, it can be said that reasoning processes are one of the fundamental elements of the qualitative data analysis process.

Scientific reasoning can be defined as a systematic thinking process that includes forming hypotheses, designing experiments to test hypotheses, distinguishing definitive evidence from uncertain evidence, and interpreting results as evidence that supports or refutes hypotheses (Chen, 2020). Traditionally, this process has been addressed in terms of deduction and induction. In inductive reasoning, which is on one side of this axis, a researcher starts with empirical data and tries to develop a theory based on this data. Conversely, in deductive reasoning, a researcher starts with a theory and makes explanations about a specific case. However, the path followed in qualitative data analysis cannot always be explained solely by deduction and induction, and researchers often need to transcend these boundaries, particularly in the discovery of new understandings. Deduction or induction alone is not sufficient for the discovery of new insights (Ezzy, 2002). Within these limitations, philosopher Charles Sander Peirce has stepped outside this binary axis, stating that the logic of scientific research advances on three types of reasoning processes. The additional path of reasoning, although originally attributed to Aristotle, is most commonly associated with Peirce and is known as abductive reasoning (Halpin & Richard, 2021; Raholm, 2010).

Abductive reasoning refers to a thought process that involves making predictions about the current situation by considering signs (existing or observed), which is a way of thinking that entails creating an explanatory hypothesis to propose a new idea (Kapitan, 1990). This process starts with an observation requiring explanation and leads to the hypothesis that best explains the gathered data. With this structure, it can be seen as both data-focused and domain-bound, representing a falsifiable act of insight (Peirce, 1958, cited in Hidayah et al., 2020). Consequently, it can be said that the new hypotheses generated as a result of abductive thinking are the most plausible predictions that need to be validated with new data (Tavory & Timmermans, 2014; Walton, 2014).

To better understand abductive reasoning, it is useful to compare it with other forms of reasoning. In such a comparison, deductive reasoning starts with a rule and progresses through a case to reach an observed conclusion that either proves or disproves the rule. In contrast, inductive reasoning begins with a set of circumstances and develops an inference about some universal rules based on the outcomes indicated by these circumstances. Abductive reasoning, however, starts the process with conclusions and then constructs causes (Timmermans & Tavory, 2012). Therefore, while deductive inferences are certain as long as their premises are true, and inductive inferences are probable, abductive inferences are only characterized as plausible (Shank, 2008). The goal of the abductive process is to discover data, find a pattern, and propose plausible hypotheses using appropriate categories. In summary, it can be said that deduction focuses on explanation, induction on verification, and abduction on creation (Yu, 1994).

Within the specified framework, it can be said that the significance of abductive reasoning stems from it being the point where innovation and creativity enter the scientific method. This is because with deduction, conclusions are derived from premises, but their origins cannot be fully explained. Induction leads to conclusions from observations, but the significance of these conclusions cannot be proven. However, abductive reasoning provides the possibility of explanation and new knowledge (Mingers, 2012). In this context, it would not be incorrect to say that abductive reasoning stands out as the only logical process in the scientific research process that introduces

new ideas (Hidayah et al., 2020; Raholm, 2010; Timmermans & Tavory, 2014). Nevertheless, it is observed that much of the literature focuses more on induction and deduction, and does not adequately address abductive reasoning (Lipscomb, 2012; Moscoso, 2019; Thagard, 2007). In a sense, it is stated that responses to calls for action to make the abductive reasoning process more concrete have not been received (Vila-Henninger et al., 2022).

At this point, it can be said that there is a need for research related to the aspect of abductive reasoning in the process of qualitative data analysis. No studies in the national literature focusing primarily on abductive reasoning in qualitative data analysis have been encountered. This study addresses this need by centering on the abductive reasoning process. The research focuses on the tendencies of graduate students in abductive reasoning processes within the context of qualitative research. This is because the applicability of the abductive reasoning process is contingent upon qualitative researchers utilizing this process.

Kuczynski and Daly (2003) emphasize the challenging nature of the interpretative process in qualitative data analysis, underscoring the need to focus on training especially young researchers in this process. Li and Seale (2007) highlight the necessity of examining students' approaches to the data analysis process within this challenging context. Studies in the literature support these views. It is indicated that graduate students find it very difficult to construct a theoretical framework within the qualitative research process (Sölpük & Karadağ, 2019), experience uncertainties about where to start coding in qualitative data analysis (Li & Seale, 2007), have negative emotions in deciding on data analysis and research type (Çepni et al., 2019), and struggle with identifying and analyzing codes and themes (Blank, 2004; Wang, 2013). At this point, it is thought that the abductive reasoning process, due to its contribution to creating hypotheses by reading signs and generating new ideas in qualitative research, has the potential to offer a solution to the difficulties experienced in the qualitative analysis process. It can be said that the emerging picture indicates the need for research to determine the tendencies of graduate students regarding the abductive reasoning process.

Considering these reasons, this research aims to investigate the tendencies of graduate students who have experienced the qualitative research process towards the abductive reasoning process, seeking answers to the following sub-problems:

- Do graduate students show similarities in their tendencies towards abductive reasoning in the context of qualitative research?
- What sub-dimensions emerge as prominent in the tendencies of graduate students towards abductive reasoning in the context of qualitative research?

METHOD

Research Design

In this study, the Q methodology pattern from mixed research methods was employed. Q methodology is a mixed research method used to uncover and define different views and thoughts on a subject. It consists of a series of qualitative and quantitative stages intertwined, designed to bring out and define the different opinions and consensus on a subject (Ramlo, 2015). Q methodology facilitates the examination of human subjectivity. Participants are presented with a series of statements related to the topic and are asked to rank them. Each ranking represents the participant's viewpoints. When participants arrange these statements in a manner such as agreeing, disagreeing, or neutral, they interpret events, objects, or people related to their personal experience world. The data obtained this way are related to the participants' personal experiences and thoughts, and while expressing their thoughts on a specific subject, they convey their subjective interpretations. Q methodology systematically collects these subjective interpretations, and by identifying the commonalities and differences in these interpretations, it provides researchers with a broad spectrum of views on the subject. Therefore, Q methodology is particularly used to gain a deeper understanding of human behaviors, attitudes, and beliefs. The ranking done by participants according to their perspectives forms the qualitative part of the methodology (Brown, 1993). The analysis of data collected with the Q sorting using a statistical program, and the determination of which group the participants belong to through principal component analysis, constitute the quantitative part of the methodology (Çakmak et al., 2022).

Participants and Procedure

In Q methodology, it is recommended that the number of participants in the study group be less than the number of Q statements (Aydoğan et al., 2022). In this context, as 14 sentences related to abductive thinking were developed for this study, the research group consists of 11 graduate students selected through criterion sampling. Criterion sampling ensures the formation of the study group according to predetermined criteria to provide in-depth cases rich in knowledge related to the research question (Merkens, 2004). In the study, since the tendencies of graduate students towards abductive reasoning in the context of qualitative research are to be examined, one of the criteria for the participants forming the study group was that they must have conducted at least one qualitative research.

Participants were coded using their gender, educational level, number of qualitative research conducted, and sequence number. For example, a male doctoral student who has conducted one qualitative study and is the first in the sequence was coded as "MD11". The personal characteristics of the participants forming the study group are shown in Table 1.

Table 1. Personal Characteristics of Participants

Participant Code	Gender	Graduate Level	Number of Qualitative Research Conducted
MD11	Male	Doctorate	1
FD12	Female	Doctorate	1
FD33	Female	Doctorate	3
FD34	Female	Doctorate	3
FD35	Female	Doctorate	3
FD16	Female	Doctorate	1
MM17	Male	Master's Degree	1
FD28	Female	Doctorate	2
FD19	Female	Doctorate	1
MM110	Male	Master's Degree	1
FD411	Female	Doctorate	4

Upon examining Table 1, it is observed that among the participants, three are male and eight are female. Two of the participants are master's degree students, and nine are doctoral students. The number of qualitative research studies conducted by them varies between 1 and 4.

Instruments

In this study, a pool of judgment sentences related to abductive reasoning in the context of qualitative research was created by reviewing the literature. While constructing the sentence pool, a structural design was employed. Structural design refers to the process of forming the sentence pool by considering predetermined themes (Yıldırım, 2017). In this regard, the study used a structural design and considered themes identified in the literature related to abductive reasoning (Eco, 1983; Magnani, 2009).

In the literature, abductive reasoning is examined under two themes: creative and selective abductive reasoning. Creative abductive reasoning is the situation where a new assumption is made instead of making a choice based on previously acquired knowledge and experiences. Selective abductive reasoning refers to selecting the hypothesis that provides the best explanation among the generated hypotheses. Within selective abductive reasoning, there are subcategories of over-coded and under-coded abductive reasoning. Over-coded abductive reasoning includes choices related to judgments that are naturally accepted within the culture or without conscious effort in daily life practices, whereas under-coded abductive reasoning involves choosing an assumption when there are two or more rules to choose from (Eco, 1983; Magnani, 2009). Therefore, in the study, the tendencies of abductive reasoning in the context of qualitative research were examined under three themes: creative abductive thinking, over-coded abductive reasoning, and under-coded abductive reasoning, and judgment sentences were formed under these three themes.

In Q methodology, ensuring diversity of opinions under maximum variety (Webler et al., 2009) is recommended, and for this purpose, writing both positive and negative judgment sentences for each theme is suggested (Yıldırım, 2017). However, since the subthemes of abductive reasoning can be defined as opposing tendencies, a total of 14 sentences have been written, including four positive sentences for over-coded abductive reasoning and five positive sentences each for under-coded abductive reasoning and creative abductive reasoning. The created sentence pool was presented to two experts who have conducted research on qualitative research, and

the sentences were structured and semantically adjusted according to expert recommendations. Subsequently, a pilot application was conducted with two graduate students, and feedback was obtained from the students regarding the understandability of the sentences. The randomly numbered items are shown in Table 2.

Table 2. Q Sentences

Dimensions	Questions
Over-Coded Abductive Reasoning	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.
	11. I code the data I collected under the headings of the questions I asked.
	8. When analyzing the data, I utilize frequently repeated expressions.
	5. When analyzing the data I collected, I attempt to validate the theory on which the study is based.
Under-Coded Abductive Reasoning	2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.
	9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.
	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.
	13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.
Creative Abductive Reasoning	3. When I collect data and find surprising information outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.
	6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.
	10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.
	14. In data analysis, I code without basing it on any theory.
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.

The Q sort technique allows participants to arrange items in a way that reflects their personal perspectives, placing the items they find most significant at the extreme ends and the items they consider neutral in the center. Participants define each item within a sorting order, but this order is different from the ranking in a Likert scale survey. In the Q sort technique, each item is evaluated in comparison with the others, requiring participants to internalize each item before placing it in the grid. This demands a reflective process (Stephenson, 1936). The data were collected using a symmetric Q-sort that fits a normal distribution in the range of ±2. Table 3 shows the Q sort.

Table 3. Q-sorting

DISAGREE		NEUTRAL	AGREE	
-2	-1	0	+1	+2

The Q sorting presented in Table 3 was used for participants to place the Q statements. Participants were given a form with randomly ordered Q statements and small papers with the Q statements, designed according to the Q sort. Additionally, a second paper with the Q sort grid was prepared, and below this, a table was included for participants to mark the items they agreed with, disagreed with, and found neutral. Participants were asked to note down the items they agreed with (5 items), disagreed with (5 items), and found neutral (4 items) in the table before placing them in the Q sort grid. They then compared the items in their tables and pasted them onto the Q sort grid presented in Table 3. This process is important as it allows participants to reflect on their thoughts. Furthermore, two open-ended questions were asked regarding the reasons for choosing the items they most agreed and least agreed with, to collect participant views.

As there are sequential steps to be followed in the Q sort technique, and to explain the process to participants, all data for the study were collected in a face-to-face setting. Before filling out the data collection tool, participants were informed about the topic and explained how to fill out the form.

Validity and Reliability

Q methodology is a research method used for understanding subjective evaluations and different perspectives among individuals. This methodology is typically utilized to identify and rank various viewpoints of individuals who are relevant to the subject. Q methodology is based on individuals making evaluations according to their own perspectives, thereby representing a relatively subjective approach. Consequently, Q methodology differs from standard scaling practices, as it focuses on allowing individuals to make their own evaluations and express these evaluations through rankings. The assessments made by individuals are aligned with their own subjectivity and cannot be compared with an external standard. Therefore, this approach does not rely on traditional psychometric issues of validity and reliability (McKeown & Thomas, 2013). Hence, it is argued that validity and reliability should not be considered in relation to problems resolved through Q methodology (Stephenson, 1936).

Data Analysis

In the scope of the research, the data collected were analyzed using the PQMethod 2.35 software. Principal component analysis was used to evaluate the opinions of the participants. Factor load values were calculated using the formula proposed by McKeown and Thomas (1988), "Standard error = 2.58 x (1/√(number of Q statements))". In this context, the significance value for the 14 Q statements used in the study was determined to be 0.67. To compare the views of the participants, the averages of the Z scores were calculated. Since the sentences forming each sub-dimension consist of positive sentences that define the sub-dimension, the averages related to the factors were calculated by dividing the total of the Z scores by the number of sentences. For the weighted average related to the sub-dimensions, the factor averages were multiplied by the number of participants in the factor, and these products were summed across all factors and then divided by the total number of participants.

The explanations given by participants regarding the statements they agreed with most and least were subjected to content analysis, allowing for an in-depth evaluation of the factors.

Research Ethics

The ethical approval for the research was granted by Mimar Sinan Fine Arts University with protocol number E-15207191-050.06.01-134755.

FINDINGS

A principal component analysis was conducted to examine whether there is a common tendency in the abductive reasoning abilities of graduate students in the context of qualitative research. The analysis revealed that the factor loads related to the participants were grouped under four factors. Rotations of 10 degrees in the negative direction between Factor 1 and Factor 3, and 14 degrees in the positive direction between Factor 3 and Factor 4, were made to observe the distributions of the factors. The findings related to the factor loads are presented in Table 4.

Table 4. Participant Factor Loads

Participant	Factor 1	Factor 2	Factor 3	Factor 4
MD11	**0.76X**	0.34	0.30	-0.09
FD12	0.25	-0.36	**0.83X**	0.03
FD33	**0.75X**	-0.50	0.12	-0.05
FD34	**0.83X**	-0.19	-0.33	-0.00
FD35	-0.13	**0.73X**	0.06	0.37
FD16	0.00	**0.86X**	-0.11	0.04
MY17	0.45	**0.72X**	0.09	-0.23
FD28	**0.75X**	-0.21	-0.46	0.04
FD19	0.44	-0.11	-0.21	**0.70X**
MY110	**0.70X**	0.42	0.25	0.25
FD411	0.17	0.25	-0.17	**-0.69X**
Explained Variance	31%	24%	11%	11%

Upon examining Table 4, it is observed that participants with factor loads above the significance value are grouped under four factors. Of the 11 graduate students who participated in the research, five are grouped under Factor 1, three under Factor 2, one under Factor 3, and two under Factor 4. The total variance is explained by Factor 1 at 31%, Factor 2 at 24%, Factor 3 at 11%, and Factor 4 at 11%. The Q statements, according to the rankings of the participants, the priority order of the statements, and their Z scores, are presented in Table 5.

Table 5. Z Scores and Importance Rankings in Factors for Q Statements

Q Statements	Harmonious Creative		Preferring		Descriptive		Exploratory Creative	
	Z	Rank*	Z	Rank*	Z	Rank*	Z	Rank*
1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	0.16	7	0.70	4	0.77	5	-1.02	12
2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.	-1.03	12	0.71	3	-1.54	14	1.54	2
3. When collecting data, if I find surprising data outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.	0.75	5	-0.73	10	0.00	9	0.02	5
4. Before analyzing the data, I decide which theoretical perspective could better explain	0.06	8	1.86	1	-0.77	12	-1.54	14

the research and conduct the analysis according to this framework.								
5. When analyzing the data I collected, I attempt to validate the theory on which the study is based.	-1.80	14	-0.93	11	0.00	9	-0.52	11
6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.	1.51	1	0.23	6	1.54	2	2.04	1
7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	-1.03	12	1.63	2	-0.77	12	-0.22	8
8. When analyzing the data, I utilize frequently repeated expressions.	0.79	4	-0.00	8	0.77	5	1.00	3
9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.	-0.68	10	-1.18	13	0.00	9	-1.04	13
10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.	0.70	6	-0.93	12	0.77	5	0.00	7
11. I code the data I collected under the headings of the questions I asked.	0.93	2	0.22	7	0.00	9	-0.48	10
12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	0.86	3	0.25	5	-1.54	14	-0.48	10
13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.	-1.26	13	-0.45	9	1.54	2	0.00	7
14. In data analysis, I code without basing it on any theory.	0.02	9	-1.38	14	-0.77	12	0.50	4

* It shows the participants' order of importance for the item.

In naming the factors, the rankings of Q statements by the participants forming the factors were considered. For participants grouped under Factor 1, the statements they agreed with most were: (1) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (2) I code the data I collected under the headings of the questions I asked, (3) When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research, (4) When analyzing the data, I utilize frequently repeated expressions.

Examining these statements, it is seen that while participants have a high tendency towards creative abductive reasoning, they also show a tendency towards some statements related to over-coded abductive reasoning. Therefore, this factor has been named "Harmonious Creative."

For participants grouped under Factor 2, the highest agreed upon statements were: (1) Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework, (2) To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework, (3) When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory, (4) I try to code the data I collected for the research in accordance with the theoretical framework of the study. These statements indicate a tendency towards under-coded abductive reasoning. Hence, this factor is named "Preferring."

For participants grouped under Factor 3, the highest agreed upon statements were: (1) Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses, (2) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (3) I try to code the data I collected for the research in accordance with the theoretical framework of the study, (4) When analyzing the data, I utilize frequently repeated expressions. These statements indicate a tendency towards over-coded abductive reasoning. Therefore, this factor is named "Descriptive." For participants grouped under Factor 4, the highest agreed upon statements were: (1) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (2) When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory, (3) When analyzing the data, I utilize frequently repeated expressions, (4) In data analysis, I code without basing it on any theory. These statements indicate a tendency towards under-coded and creative abductive reasoning. Thus, this factor is named "Exploratory Creative."

To interpret holistically the abductive reasoning tendencies of participants named Harmonious Creative, Preferring, Descriptive, and Exploratory Creative, and to understand which sub-theme of abductive reasoning is prominent in each group, the average Z scores for each sub-theme and overall, for the groups have been calculated. The relevant findings are presented in Table 6.

Table 6. Average Z Values Related to Abductive Reasoning Tendencies

Factor / Theme	Harmonious Creative (5 People)	Preferring (3 People)	Descriptive (1 People)	Exploratory Creative (2 People)	Weighted Average
Over-Coded	0.02	-0.0025	0.385	-0.255	-0.003
Under-Coded	-0.258	0.514	-0.308	-0.252	0.005
Creative	0.768	-1.456	0	0.416	0.028

Upon examining Table 6, it can be seen that all participants exhibit the highest tendency towards creative abductive reasoning, followed by under-coded abductive reasoning, and finally, over-coded abductive reasoning. When considering the participant groups, it is observed that those in the Harmonious Creative and Exploratory Creative groups show a high tendency towards creative abductive reasoning; participants in the Preferring group have a high tendency towards under-coded abductive reasoning; and those in the Descriptive group show a high tendency towards over-coded abductive reasoning.

Pairwise comparisons have been made to see the distinctions between the groups, and the statements with the highest difference (Z scores above 1) are presented in Table 7.

Table 7**.** Divergences Between Factors

Factors	Sentence	Difference in Z scores
Harmonious Creative vs Preferring	10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.	1.635
	3. When collecting data, if I find surprising information outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.	1.469
	14. In data analysis, I code without basing it on any theory.	1.396

	6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.	1.286
Harmonious Creative vs Descriptive	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	2.398
Harmonious Creative vs Exploratory Creative	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	1.602
	11. I code the data I collected under the headings of the questions I asked.	1.405
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	1.337
	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.181
Preferring vs Descriptive	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	2.625
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	2.398
	2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.	2.244
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	1.787
Preferring vs Exploratory Creative	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	3.397
	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.721
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	1.651
Descriptive vs Exploratory Creative	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.788
	13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.	1.537
	9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.	1.042

Upon examining Table 7, it is observed that participants in the Harmonious Creative group differ from those in the Exploratory Creative group in terms of statements related to over-coded abductive reasoning. Meanwhile, participants in the Preferring and Descriptive groups differ in statements related to creative abductive reasoning. When examining the statements where participants in the Preferring group differ most from those in the Descriptive group, it is found that they diverge in statements related to under-coded abductive reasoning. However, participants in the referring group also differ from those in the Exploratory Creative group in statements related to over-coded abductive reasoning. Lastly, it is noted that participants in the Descriptive group differ from those in the Exploratory Creative group in statements related to over-coded abductive reasoning.

The findings related to the explanations given by participants for the statements they agreed with most and least are presented below, based on the factors.

Harmonious Creative

The Harmonious Creative factor is comprised of five participants (MD11, FD33, FD34, FD28, MM110). Participants identified as Harmonious Creatives indicate that data analysis in qualitative research assists in creating new perspectives and hypotheses, therefore, surprising data with the potential to illuminate different aspects of the research problem are important for achieving original results and should not be excluded. Some opinions from participants on this topic are as follows:

When coding, the different codes we obtain can reveal aspects of the research problem that we hadn't noticed before. This can lead to richer results. Therefore, I think we should not immediately exclude these codes (MD11).

Participants under this factor also note that in the data analysis process, identifying frequently occurring expressions is essential, and contributing to the literature by basing on a specific theory is important.

I believe that the most crucial dimension in qualitative research is towards data analysis. Repeated data and determined question headings are significant for a meaningful and consistent data set (MD34).

Therefore, the surprising nature of the data, examining the implicit and deeper meanings beneath it, can be seen as valuable for providing a new perspective to the research topic, contributing differently to the literature, and potentially charting alternative paths for subsequent similar research (MM110).

Preferring

The Preferring factor includes three participants (FD35, FD16, MM17). Participants in this factor believe that basing data analysis on a theoretical foundation will solidify the scientific basis of the research, enhance the clarity of the data, and create awareness about the focus of the data collection process. Some opinions from participants on this topic are as follows:

I think that conducting the analysis according to a specific theoretical framework will simplify the process and better serve the problem and sub-problems of the research. Additionally, analyzing according to the theoretical framework also enables a more meaningful, consistent, and systematic interpretation of the data (FD16).

Because conducting analysis within a certain framework will prevent the research from straying off focus. Also, the narrow space that this framework creates for me both guides me in what to do and imposes a positive limitation on my codes. This makes it easier to establish relationships between the created codes (MM17).

Descriptive

The Descriptive factor consists of one participant (FD12). The participant under this factor emphasizes that in order to achieve the objectives of qualitative research, it is necessary to not deviate from the scope of the research and that the research boundaries should be predetermined and not exceeded. The participant's opinion is presented below:

Although qualitative research types vary, the framework of scientific research to be conducted by the researcher should be predefined and its boundaries established. Otherwise, bias can occur. If the scope of the study expands too much, it will not be possible to achieve the necessary depth to explain the 'how' (FD12).

Exploratory Creative

The Exploratory Creative factor includes two participants (FD19, FD411). Participants in this factor state that associating the obtained data with a selected theoretical framework will make the results more meaningful. However, they also highlight the importance of codes that fall outside the theoretical framework of the research, as they provide opportunities to present different perspectives on the research problem and expand the research question. They also point out that adhering strictly to a single theory during data analysis can lead to overlooking potential new findings. Therefore, they focus on the presence of different expressions that will diversify the research findings, rather than repeatedly used expressions. The participants' views on the topic are as follows:

I take note of the codes that emerge, thinking that they will contribute to the study from a different angle (FD411).

Conducting data analysis in research based only on predetermined assumptions can lead to the neglect of potential new findings (FD19).

DISCUSSION AND CONCLUSION

Abductive reasoning is the outcome of a process of forming insights related to observed situations or events. Considering this in the context of qualitative research, it would not be incorrect to say that science is not only about observed phenomena but also significantly involves the human mind and logic (Plutynski, 2011). Although assumptions made with such insight may not definitively explain the research problem, they are important for the development of scientific knowledge. Therefore, researching the tendencies of graduate students toward abductive reasoning in qualitative data analysis is considered significant in understanding the needs of these new researchers

to gaining new perspectives and foster creative and innovative thinking within the context of qualitative data analysis.

The results of the study show that graduate students have high tendencies towards creative abductive reasoning and low tendencies towards over-coded abductive reasoning in the context of qualitative research. The high tendency for creative abductive reasoning in qualitative data analysis may imply that the researcher has a heightened awareness in discerning relationships and connections that are not obvious or apparent. Indeed, Meyer and Lunnay (2012) note that such reasoning allows the researcher to think about something in a different context, create new ideas, and present unexpected relationships. In addition, in the context of qualitative research, graduate students have been categorized under four factors based on their abductive reasoning characteristics. Given the direction of students' qualitative research as well as sub-themes of abductive reasoning, these factors have been called Harmonious Creative, Preferring, Descriptive and Exploratory Creative.

The groups that score high in tendencies to engage in creative abductive reasoning are the Harmonious Creatives and Exploratory Creatives. Participants in the Harmonious Creative factor score highly in tendencies towards creative abduction, but also show a tendency towards over-coded abduction when faced with qualitative data. In qualitative data analysis, they are used to focus on surprising or novel data for new and creative results. But in the end, after all this is done, their findings tend to be based on existing theories. The trends of the researchers in this group called Harmonious Creative reflect the attributes of adaptable creatives described by Kim and Pierce (2020). In this section, these authors define adaptable creative thinkers as those more capable of producing original ideas yet seen against existing paradigms and with the ability to take an existing technique or solution and modify it for a new scenario. Looking at it from this angle, Harmonious Creative researchers are probably going to come up with new findings that fit contemporary paradigms.

There are also in the Exploratory Creative factor people with high tendencies towards creative abductive reasoning. However, participants in this group also exhibit tendencies towards under coded abductive reasoning. This indicates that participants identified as Exploratory Creative relate data to a chosen theoretical framework yet tend to use codes that go beyond the theoretical limits of the research to present different perspectives and broaden the research problem. Exploratory Creatives, defined as such, can be said to approach problems from an unusual perspective and are more flexible in basing data on a theory compared to Harmonious Creatives. They tend to base their findings on one of the theories they can substantiate. Kim and Pierce (2020) mention that individuals they defined as innovative creatives put forward innovative solutions and tend to do things differently. Thus, it is possible to say that Exploratory Creative researchers exhibit characteristics similar to innovative creative thinkers.

Creative abductive reasoning is used in qualitative data analysis to understand and explain unexpected findings. In this context, it is important for a researcher to be open to surprising data rather than strictly adhering to a specific theoretical framework (Timmermans & Tavory, 2022). This approach enables the researcher to develop a more creative and in-depth understanding that transcends existing theoretical structures. However, it is quite natural for graduate students, who are new to the research process and have conducted a limited number of qualitative studies, to show a tendency to adhere to a certain theory during data analysis. Ertugay (2019) states that competence in qualitative research develops as one continues to conduct qualitative studies, describing it as a dynamic process that allows for continual improvement. In this context, it is possible to say that Harmonious Creative and Exploratory Creative researchers conduct data analysis with a certain degree of flexibility. Timmermans and Tavory (2022) describe this as 'controlled flexibility.' They define this term as based on a theoretical framework while also being receptive to unexpected findings emerging from the data. Thus, the researcher can develop a richer and more detailed understanding. A fundamental criticism in qualitative data analysis is the tendency of the researcher to evaluate data only within the theoretical framework in which the research is structured and to neglect data that is not directly connected to the phenomena or events (Coryn et al., 2011). Kuhn (2021) emphasizes that innovative creativity in science is rare and that most scientists are fundamentally traditional. He points out that scientific research is framed within the assumptions of an existing paradigm and is more a type of repetitive work aimed at deepening the existing paradigm rather than laying the groundwork for an innovation. Therefore, it is plausible to say that Exploratory Creative researchers might have the potential to discover unusual, exceptional, or strange findings that could facilitate a paradigm shift.

In the Descriptive factor, participants exhibit a high tendency towards over-coded abductive reasoning. In over-coded abductive reasoning, there is an automatic acceptance based on common sense (Eco, 1983). The researcher quickly infers a conclusion based on existing knowledge and experience. In the context of qualitative data analysis,

Descriptive researchers with a high tendency towards over-coded abductive reasoning will search for codes in the data set based on themes they have developed related to the research question. It might be thought that sticking to a theory during qualitative data analysis does not lead to abductive reasoning. However, Coffey and Atkinson (1996) argue that theories should be considered as heuristic tools, and the regularities created by theories in form or content can be associated with ideas that go beyond these data. Therefore, conducting the analysis process while adhering to a theory can also enable the expansion of scientific knowledge. In this context, the importance of researchers' knowledge about theories or models becomes evident. Fundamentally, abductive reasoning aims to present new information by relying on existing knowledge and following clues (Patakorpi, 2006). From this perspective, it is important for Descriptive researchers to utilize their knowledge of theoretical information and models and integrate this knowledge into the analysis process.

The Preferring factor consists of participants showing a tendency towards under-coded abductive reasoning. In under-coded abductive reasoning, there is also a choice based on previous knowledge and experience. However, new interpretive connections are made to approach the event or phenomenon. Therefore, this type of abductive reasoning is not a mechanical or automatic process. It involves the researcher using previous knowledge and inferences to make a new interpretation. However, since it includes a choice process based on previous inferences, it offers a limited range of options (Bertilsson, 2004). In the context of qualitative data analysis, Preferring researchers will carry out data analysis by choosing the most reasonable theoretical framework. Here, theories are used as tools that provide reference points for learning and give meaning to experiences, as Gustavsen (1996) pointed out. Lipscomb (2012) states that conducting sequential interviews in the data collection process of a qualitative study or observing a participant in sequential situations plays a significant role in validating hypotheses proposed through abductive reasoning. Thus, such sequential analysis can be used to check the validity of the selected most reasonable hypothesis.

In the qualitative data analysis process, considering the similar tendencies of participants grouped into four categories based on their abductive reasoning tendencies, it can be said that they could be further categorized into two groups in terms of reasoning methods. Harmonious Creative researchers and Exploratory Creative researchers with high tendencies towards creative abductive reasoning use similar reasoning methods in the process of qualitative data analysis, while Descriptive researchers and Preferring researchers also have similar reasoning methods. Magnani (2009) states that abductive reasoning is conducted in a theory-based and/or guided manner. He defines theory-based reasoning as forming hypotheses that explain an observation or phenomenon, and guided reasoning as a non-theoretical reasoning method aiming to create meaning between past and new experiences. From this perspective, it can be said that Harmonious Creative and Exploratory Creative researchers employ guided abductive reasoning methods, while Descriptive and Preferring researchers use theory-based reasoning.

In conclusion, encouraging graduate students to use abductive reasoning in qualitative data analysis will contribute to the production of creative and innovative thinking. Acting with a tendency towards abductive reasoning in qualitative data analysis will increase the questionable evidence about reality, and this will likely enhance the confidence of graduate students, who are new researchers, in their pursuit of truth. Although the results of the research are limited to graduate students, they provide an important perspective in identifying different abductive reasoning tendencies in qualitative data analysis processes. Based on these results, the following recommendations can be offered.

Implications, and Suggestions for the Future Research

Abductive reasoning can enhance the capacity for exploratory and creative thinking, and thereby the likelihood of identifying surprising data in qualitative data analysis, facilitating the development of scientific knowledge. Therefore, it is important to develop these skills in graduate students. In this context, to enhance graduate students' tendencies towards abductive reasoning and increase their competencies in qualitative data analysis, it is advisable to conduct qualitative research courses in graduate programs in a practical manner.

The study employed Q methodology, which enables an in-depth examination of subjective opinions. Therefore, conducting new studies using Q methodology to determine tendencies towards the qualitative research process is thought to be significant in illuminating the qualitative research process.

It can be said that there is a need for new research to better understand the abductive reasoning process. Replicating this research with different study groups, comparing the results emerging from different study groups, and discussing the similarities or differences are seen as important.

Conducting studies to develop inventories related to the abductive reasoning process can more clearly reveal researchers' tendencies towards this type of reasoning. It would also contribute to determining the relationship of this reasoning type with different variables attributed to scientific researchers.

Limitations

In this study, the tendencies of graduate students towards abductive reasoning in the context of qualitative research were identified using Q methodology. To ensure reliability in Q methodology, studies should be conducted to assess how consistent the Q statements are across different samples. Obtaining empirical evidence is critically important for establishing confidence in the reliability and consequently the validity of Q methodology. This represents a limitation of the study.

Statements of Publication Ethics

The ethical approval for the research was granted by the …….

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1's name	☒	☒	☒	☒	☒	☒
Author2's name	☒	☒	☒	☒	☒	☒
Author 3's name	☒	☒	☒	☒	☒	☒

Conflict of Interest

There are no conflicts of interest.

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