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# Examining the Utility of the DESCARTE Model for Case Study Research

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## ABSTRACT

The DESCARTE model aims to guide health care researchers on the design, conduct, and reporting of case studies. The current article critically appraises the utility of the model and provides an example of its application to a multiple case study that examined the effect of MARIO, a social robot, on the resilience of people with dementia. The DESCARTE model is explained, and its strengths and the challenges encountered during its application are discussed. DESCARTE provides a structured framework that promotes quality in case study research by requiring the researcher to articulate philosophical cohesiveness, ethical considerations, reflexivity, and the strategies used during data integration and throughout data analysis. However, the model does not prompt the development of research questions or methods to promote rigor and reflexivity throughout the case study. A task list and additional guiding questions are provided to address these deficits and to improve the utility of the DESCARTE model. [*Research in Gerontological Nursing*, 14(2), 60-68.]

*Case studies* are intensive, holistic descriptions and analysis of contemporary phenomena (Merriam, 1988) within their real-life context (Yin, 2009). Case study research (CSR) is particularly useful for examining processes and interventions in health care settings (Brogan, 2019). CSR has been used in gerontological research to investigate resilience in older adult caregivers (Ewen et al., 2015), aging with mobility impairment (Harrison et al., 2013), and palliative care delivery (Sussman et al., 2012). Previous reviews have found that researchers need guidance to design quality case studies (Brogan, 2019; Hyett et al., 2014). The

DESIGN of CAse Research in healThcarE (DESCARTE) model aims to guide health care researchers on the design, conduct, and reporting of case studies (Carolan et al., 2016). DESCARTE particularly aims to provide guidance on the integration of quantitative and qualitative data in CSR that uses mixed methods. To date, a detailed account of DESCARTE's application to health care research (Žulec et al., 2019) has not been reported, and DESCARTE's development followed a relatively small rapid review of case studies ( $N = 20$ ) (Carolan et al., 2016). Therefore, a critical appraisal is needed to inform future users of the model.

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The current article critically appraises the utility of DESCARTE. It provides an example of DESCARTE's application to the design and conduct of a case study that investigated the effect of MARIO, a social robot, on the resilience of people with dementia. This study was part of a wider research project that developed MARIO to increase the social connectedness of people with dementia (access <http://www.mario-project.eu>). Herein, the DESCARTE model is described and applied to the exemplar case study, the strengths of DESCARTE and the challenges experienced during the model's application are discussed, and recommendations are also made to improve the utility of the model.

## DESCRIPTION OF DESCARTE

The DESCARTE model has three stages that are applied in sequence: (1) situating the research and the researcher; (2) determining the components of the case study; and (3) data analysis, adopting the three stances. Design decisions made during Stage 1 concern all aspects of the study because Stages 2 and 3 are embedded in Stage 1 (Carolan et al., 2016; for original figure, access [https://www.researchgate.net/profile/Liz\\_Forbat/publication/281541336\\_Developing\\_the\\_DESCARTE\\_Model\\_The\\_Design\\_of\\_Case\\_Study\\_Research\\_in\\_Health\\_Care/links/55fb737b08aeba1d9f3a11d3/Developing-the-DESCARTE-Model-The-Design-of-Case-Study-Research-in-Health-Care.pdf](https://www.researchgate.net/profile/Liz_Forbat/publication/281541336_Developing_the_DESCARTE_Model_The_Design_of_Case_Study_Research_in_Health_Care/links/55fb737b08aeba1d9f3a11d3/Developing-the-DESCARTE-Model-The-Design-of-Case-Study-Research-in-Health-Care.pdf)). **Table 1** provides an overview of DESCARTE, summarizing the tasks researchers are required to undertake when applying DESCARTE. **Table 1** also lists 12 questions provided by Carolan et al. (2016) to guide and structure DESCARTE's application. During Stage 1, the researcher uses critical reflection to identify the research paradigm and considers how their assumptions, preferences, and clinical, educational, or management roles may potentially bias the research. The researcher also considers and plans how to address the study's ethical dimensions.

During DESCARTE Stage 2, the researcher designs the interdependent components of the case study including: the case in its context, research purpose, and the study's conceptual/theoretical framework. The case-purpose dyad is centrally important. Research questions are derived from this dyad, mediated by the study's conceptual theoretical framework (Carolan et al., 2016). Defining the case includes determining if the case is a phenomenon or an entity, and temporal dimensions of the case context should be considered to determine if the case study should be longitudinal, retrospective, or cross-sectional (Carolan

et al., 2016). Then, the researcher selects the sampling approach and data collection methods in relation to the case-purpose dyad and conceptual framework.

In Stage 3, the researcher concurrently considers three overlapping stances concerning the data analysis: philosophical, strategic, and integrative. The researcher must justify how their positioning of self impacts the analysis, when specific strategies will be applied, and the timing and purpose of data integration. The model will now be applied to the exemplar case study using Carolan et al.'s (2016) 12 guiding questions.

## APPLICATION OF DESCARTE

### What Is My Philosophical Approach?

The constructivist paradigm underpinned the MARIO case study. Constructivism supports the existence of multiple realities, focusing on the production of shared meanings and the meaning placed on knowledge (Kelly et al., 2018). These characteristics were pertinent because the resilience of people with dementia is impacted by meaning created from life experiences (Kitwood, 1993), and technology use is influenced by what the technology means to individuals (Chang et al., 2013). Merriam's (1988, 1998) qualitative approach to CSR is compatible with constructivism; therefore, this approach underpinned the deployment of methods in this case study.

### How Do I Situate My "Self" in This Research?

The lead author (S.W.; herein referred to as the author) used journaling (Johns, 2017) to identify that she held views consistent with constructivism. The author believed that people with dementia had a right to participate in research that involved technologies and that technologies should supplement rather than replace contact with people. The author realized that using person-centered principles (Kitwood, 1993) and the CORTE framework (Murphy et al., 2015) would facilitate participation of people with dementia in the research.

The author identified her training needs, guided by a researcher experienced in dementia research, and she received supervisory support and training in conducting questionnaires with people with dementia and dementia care mapping (DCM; Bradford Dementia Group, 2016). The author is a nurse experienced in the care of people with dementia and is familiar with nursing home environments. These factors might facilitate developing rapport with participants, but she needed awareness of alternative perspectives about the care context. In addition, as an immigrant, the author identified herself as an "outsider"

**TABLE 1**  
**Overview of the DESCARTE Model**

<b>Model Stage</b>	<b>Researcher Tasks When Applying DESCARTE</b>	<b>Guiding Questions</b>
1. Situating the research and the researcher	<p>Articulate the paradigm that guides the study and consider what this means for other components of the study.</p> <p>Identify how the researcher positions “self” and the impact that their views, attitudes, and role will have on the study.</p> <p>Identify the study’s ethical dimensions and plan how they will be addressed.</p>	<p>1. What is my philosophical approach?</p> <p>2. What are the ethical dimensions of this research?</p> <p>3. How do I situate my “self” in this research?</p> <p>Questions 1-3 are not addressed in any prescriptive order.</p>
2. Determining the components of the case study design	<p>Define the case.</p> <p>Determine if the case is a phenomenon or an entity.</p> <p>Identify the context and consider the temporal dimensions.</p> <p>Identify the study’s purpose and if a deductive, inductive, or abductive approach is appropriate.</p> <p>Identify the theoretical framework.</p> <p>Identify a sampling approach.</p> <p>Determine data sources and provide a rationale for these.</p>	<p>4. How is the case defined?</p> <p>5. How is the context defined?</p> <p>6. What is the purpose of the case study?</p> <p>7. What is the conceptual/theoretical framework for the case study?</p> <p>8. What is my sampling approach?</p> <p>9. What is the rationale for my choice of data sources?</p> <p>Questions 4-7 are addressed in an order that is appropriate for study. Questions 8 and 9 are addressed in relation to the previous questions.</p>
3. Data analysis—adopting the three stances	<p>Articulate how the data analysis method is congruent with the adopted philosophical approach.</p> <p>Plan how the researcher will work reflexively during analysis.</p> <p>Articulate and justify the strategic approaches to data analysis.</p> <p>Consider the implications of using these strategies.</p> <p>State in detail how data will be integrated, including the timing and purpose of data integration.</p> <p>Consider if the types of data are transformed and the implications of any transformation.</p>	<p>10. Is data analysis congruent with the philosophical approach?</p> <p>11. Is my analysis adopting a case-based or a variable analysis-based approach?</p> <p>12. How and why are data integrated during data analysis and interpretation?</p> <p>Questions 10-12 are addressed concurrently.</p>

Note. Adapted from Carolan et al. (2016).

to the dominant culture within the research setting. Therefore, her potential to notice cultural nuances increased. However, the author needed to build rapport with participants to avoid assuming she correctly understood the meaning of expressions and behaviors.

### What Are the Ethical Dimensions of This Research?

Experienced dementia researchers led discussions to determine how to address recruitment, consent, participant well-being, confidentiality, and data storage. In addition, before MARIO's arrival, the nursing home manager completed a risk assessment of the environment. A distress protocol was written advising that in the event of a participant becoming distressed, the author would assess the situation and react to address the source of the distress, seeking caregiver advice and ceasing research activity if necessary. Computer-based data were encrypted and pseudonyms provided participants with anonymity. The National University of Ireland Galway Research Ethics Committee granted ethical approval.

### What Is the Purpose of the Case Study?

The current study investigated MARIO's capacity to support resilience and built upon resilience theory and knowledge about robot use, requiring deductive and abductive approaches, as explained below.

### What Is the Conceptual/Theoretical Framework for the Case Study?

Windle (2011) identified that *resilience* is a process of adapting to stress that operates at multiple interacting levels that are reflective of the human ecology framework described in ecological systems theory (Bronfenbrenner, 1994). A resilience framework drawing on this theory has conceptualized resilience in people with dementia (Newman et al., 2019) and older adults (Bennett et al., 2016; Thetford et al., 2015). The resilience framework considers that resilience occurs in the presence of adversity, such as living with dementia. Resilience outcomes in dementia

**TABLE 2**  
**Study Inclusion and Exclusion Criteria**

Participants	Inclusion Criteria	Exclusion Criteria
People with dementia	Living in the care setting for at least 1 month before the study. Have either a formal diagnosis of dementia of any severity and/or it was stated that they have dementia in the medical records.	Not likely to continue living in the care setting for the study's duration. No significant sensory impairment or acute illness that care staff considered would impair their ability to participate.
Caregivers	Have provided care to the person with dementia during the preceding month.	Not likely to continue to provide care to the person with dementia.
Relatives	Will be visiting with the person with dementia during the study period.	

include "doing okay" (Harris, 2008, p. 59), positive mood, and quality of life (Sabat, 2018). Outcomes are impacted by resources that interact occurring at the individual, community, and societal levels. Resilience resources include having a sense of purpose, good social relationships, and supportive institutional policies (Harris & Keady, 2008; Williamson & Paslawski, 2016).

### How Is the Case Defined?

The case was the resilience of a person with dementia who used MARIO. To address the case study purpose, the case was bound through ensuring people with dementia met relevant inclusion/exclusion criteria (Table 2). In addition to people with dementia, relatives and caregivers were relevant informants and they contributed to the eco-social factors that impacted resilience and MARIO's usage. Therefore, each case included embedded units involving a person with dementia, two caregivers, and a relative of the person with dementia.

### How Is the Context Defined?

The context was the social-cultural environment within the nursing home investigating how resilience changed due to MARIO using a diachronic pre/during/post intervention design.

### What Is My Sampling Approach?

Ten cases were examined simultaneously, rather than sequentially. The case selection strategy also addressed important ethical considerations concerning the recruitment

**TABLE 3**  
**Recruitment Strategy**

Recruitment Stage	Description of Activity
1	People with dementia who met the inclusion/exclusion criteria were asked by a senior nurse, whom they knew well, if they wanted to meet the researcher. If they agreed, the nurse introduced the lead author (S.W.), who spent considerable time with the person with dementia, building rapport and explaining the study and what being a participant would involve. During the discussions, S.W. read with the person a participant information leaflet (PIL) designed for people with dementia. In addition, if they wished, the person with dementia met MARIO.
2	After 7 days, S.W. returned, reintroduced herself and the study to the person with dementia, and again took time to build rapport and answer questions using the PIL. After these discussions, if the person with dementia wanted to participate, their consent was recorded in writing. In addition, before every episode of their involvement in the study, ongoing consent was obtained (Dewing, 2007).
3	When people with dementia had consented to participate, relatives and caregivers received information about the study. If they fit the inclusion criteria, they received a PIL, and their consent to participate was sought after further discussion 1 week later.

and well-being of participants with cognitive and communication difficulties (Table 3).

Conversations during recruitment took place when people with dementia were ready to process information (Mayo & Wallhagen, 2009), guided by information from caregivers who knew the person with dementia well (Hubbard et al., 2003) and facilitated by reducing distractions, speaking clearly, and giving the person time to think and react. Capacity to consent used the British Psychological Society guidelines (Herbert et al., 2019).

#### What Is the Rationale for My Choice of Data Sources?

Using multiple sources of data is typical in CSR (Merriam & Tisdell, 2016). The current case study used quantitative and qualitative data (Table 4) to facilitate understanding of patterns of resilience that vary between contexts and cultures (Ungar, 2011). Audiotaped, semi-structured interviews used with a supportive, flexible approach guided by the CORTE framework (Murphy et al., 2014) provided rich data (Yin, 2014) about how MARIO was perceived and impacted resilience. Questionnaires were deployed that investigated the capacity for resilience and quality of life as resilience outcomes, and their administration was guided by the authors' questionnaire instruction manuals and the result of pilot testing in the nursing home. DCM (Bradford Dementia Group,

2016) captured data about the social and environmental factors impacting resilience and the impact of MARIO on the mood and engagement of people with dementia. DCM is a semi-structured, non-participant observation technique that involves trained mappers quantitatively recording the activities, mood, and engagement levels of people with dementia at 5-minute intervals and recording notes describing social interactions and contextual details. The Observational Measure of Engagement (OME; Cohen-Mansfield et al., 2009) captured participants' engagement and ac-

tivity levels while they used MARIO. MARIO was offered to participants, facilitated by a researcher, three times per week for 12 sessions, in which they engaged with MARIO and used the robot's personalized applications. Applications included photographs to support reminiscence-based conversations, favorite music, calendars, news, and games. Data were collected before MARIO's introduction (pre-MARIO), during sessions with the robot, and after their completion (post-MARIO). In addition, each questionnaire and interview were administered on different days to minimize participants' fatigue.

#### Is Data Analysis Congruent With the Philosophical Approach?

Consistent with Merriam's case study approach, data analysis aimed to provide a holistic understanding of the cases using robust, theoretically endorsed procedures (Merriam & Tisdell, 2016). Through reflective journaling, the author identified that the data analysis strategy needed to mitigate aspects of her personality according to the Enneagram (i.e., model of the human psyche and its nine interconnected personality types) (Riso & Hudson, 1999) that emphasized creative synthesis. Therefore, the analysis was conducted being aware of how meaning within the data was being interpreted, and with the intention to keep ideas tentative and consider alternative meanings until the

**TABLE 4**  
**Data Collection Methods**

Study Stage	Demographic Data <sup>a</sup>	DCM	Questionnaires <sup>b</sup>	OME	Semi-Structured Interviews
Pre MARIO	✓	✓	✓		People with dementia
During MARIO				✓	
Post MARIO	✓	✓	✓		People with dementia, caregivers, and relatives

Note. DCM = dementia care mapping; OME = Observational Measure of Engagement.

<sup>a</sup> Collected using the Mini-Mental State Examination (Folstein et al., 1975) and Cornell Scale for Depression in Dementia (Alexopoulos et al., 1988).

<sup>b</sup> Resilience Scale (Wagnild & Young, 1993); Quality of Life in Alzheimer's Disease Scale (Logsdon et al., 1999).

ideas were corroborated by the data. It was also beneficial to guide the analysis using a theoretically informed, structured approach because the author was a researcher conducting case study analysis for the first time. Therefore, framework analysis using a qualitative content analysis approach (Hseih & Shannon, 2005) was deployed using eight iterative steps (Gale et al., 2013) (Table 5).

**Is My Analysis Adopting a Case-Based or Variable-Based Approach?**

The analysis used case-based rather than variable-based strategies. Within-case analysis started by analyzing the quantitative DCM data according to the DCM procedures (Bradford Dementia Group, 2016), and the OME and questionnaire data were analyzed using SPSS version 24. On the advice of a researcher experienced in quantitative methods, the cross-case analysis used descriptive statistics, and the Wilcoxon signed-rank test ( $\alpha = 0.05$ ) was used to assess mean rank differences between the group questionnaire results. All qualitative data were imported into NVivo 12 and reviewed to “revisit the phenomenon” (Timmermans & Tavory, 2012, p. 175) that was under investigation. The constant comparative method (Lincoln & Guba, 1985) was used while reading the transcripts of four cases, line by line, to code segments of data according to their meaning. This coding involved abductive reasoning and creative inference, examining the interplay between the data and existing theory (Timmermans & Tavory, 2012). Following this, a formal coding framework was developed using the codes already created and deductive reasoning to deduce statements derived from the theory (Bergdahl & Berterö, 2015) on robot acceptability and resilience in dementia. This framework was then used to code data from

**TABLE 5**  
**Stages of Data Analysis<sup>a</sup>**

Stage	Summary of Activity
1	Transcription (interview data were professionally transcribed)
2	Familiarization with data
3	Coding of data from four cases in NVivo 12
4	Developing a coding framework
5	Framework implemented, coding the remaining data
6	Charting data into a matrix
7	Interpreting and abstracting the data into themes
8	Themes were finalized in a written report

<sup>a</sup> Derived from Gale et al. (2013).

the remaining six cases and additional codes were added if new ideas presented in the data. Qualitative and quantitative data were entered into a matrix, created with codes in columns, cases in rows, and data in the matrix cells. The data in the cells were summarized in memos (Bonello & Meehan, 2019). The summaries were then systematically reviewed, and case summaries were written. Cross-case analysis was conducted, comparing similarities and differences in the data across all cases to identify themes and deviant cases. These themes were reviewed and developed by writing analytical memos (Bonello & Meehan, 2019) that facilitated building abstractions and an in-depth understanding of what was important in the data (Merriam & Tisdell, 2016). Then, using critical thinking, the analytical memos were synthesized to define the final themes.



### **How and Why Are Data Integrated During Data Analysis and Interpretation?**

The integration strategy involved concurrent analysis of the quantitative and qualitative data, separately, and then both types of data were integrated before developing the themes. Quantitative data were placed in the matrix according to where they were most meaningful in relation to the codes and categories derived from the qualitative data. For example, the quantitative OME results that concerned participants' attitudes toward MARIO were integrated with qualitative data in the matrix under codes that concerned participants' willingness to use MARIO. Using these integration techniques meant that the numbers and words within the data types were preserved (Sandelowski, 2000) and they corroborated the thematic findings (Yin, 2014).

### **CRITICAL APPRAISAL OF DESCARTE**

#### **Strengths**

DESCARTE focused the researcher's attention on the selection and application of a research paradigm. This focus ensured the case study was cohesively, theoretically underpinned. Through prioritizing the positioning of self and ethical considerations, the model improved the research quality by facilitating the researcher to mitigate her impact on reflexivity and ensuring that potential ethical problems were proactively addressed.

DESCARTE guides the case study researcher to critically consider data analysis and integration strategies. This guidance addresses an underdeveloped area in the case study literature (Yin, 2009). This guidance enables multiple data sources to be deployed using theoretically robust strategies.

Using DESCARTE avoided the necessity to pigeon-hole the exemplar study into a case study taxonomy (Carolan et al., 2016). Instead, the researcher had to identify whether the study required deductive, inductive, or abductive approaches. Doing so was more useful because it facilitated the selection of strategies for data collection and analysis. In comparison, determining whether the exemplar study was exploratory and/or evaluative, as outlined by Yin (2014), seemed to have little practical value.

The model is logically structured, generic, and flexible. Through these factors DESCARTE guides the researcher to accomplish tasks required in the design and conduct of CSR in the most appropriate way for the individual study. For example, although embedded units were not considered helpful by Carolan et al. (2016), they were used because they were meaningful in the exemplar study.

#### **Challenges**

Traditionally during case study design, components are derived from the research questions (Merriam & Tisdell, 2016; Stake, 1995; Yin, 2014). Indeed, having "how" and "why" questions are reasons for choosing CSR (Yin, 2014). Using the case-purpose dyad and not prompting researchers to identify the research questions, did not prevent DESCARTE being applied to the exemplar case study. But consideration of research questions might have more quickly determined the study's strategic direction and its specific objectives. Furthermore, not focusing on research questions might be more problematic to post-positivist case studies. In case studies using this paradigm, researchers are required to identify propositions from the research questions and data are linked to these propositions during data analysis (Yin, 2014).

The promotion of rigor is inherent when using DESCARTE. However, the researcher is not prompted to identify specific methods to address rigor and demonstrate the trustworthiness of findings. For example, the exemplar used strategies that align with constructivism: credibility, confirmability, data dependability, and transferability, and the plausibility of the findings were reaffirmed using member checking (Merriam & Tisdell, 2016).

The model assumes that the researcher has prior knowledge of research philosophy and CSR. This means that some steps commonly taken in case study design are not highlighted in the model's guidance provided by Carolan et al. (2016). The guidance is particularly limited when the researcher is directed to identify if the case is a phenomenon or a person (Carolan et al., 2016). This limited categorization of a case does not acknowledge complexities that a case is a "bounded system" (i.e., what is being studied has a boundary around it) (Merriam, 1998; Stake, 1995; Yin, 2014) and that the case is important because of what it represents or can reveal about a phenomenon (Merriam, 1998; Stake, 1995); or, indeed, that the case is required to be "something of" a phenomenon, which could be an aspect of a person (Thomas, 2015). The current guidance on DESCARTE also understates the need to deploy specific methods for reflective practice to enhance reflexivity throughout the study.

#### **RECOMMENDED DEVELOPMENT TO DESCARTE**

For reasons stated above, two additional prompt questions are proposed to facilitate future applications of DESCARTE: (1) What are the research question(s)/aims? and (2) What strategies and methods are used to address rigor in this research? Ideally, the research question(s)/



aims should be addressed after determining the case study purpose and its conceptual framework. Consideration of methods to promote rigor can take place after determining the data sources. In addition, DESCARTE users should identify methods to facilitate reflection and incorporate reflexive practice throughout the study, and the requirement to determine if the case is a phenomenon or an entity should be removed.

## CONCLUSION

The DESCARTE model provides a useful framework to enhance case study quality by requiring the researcher to focus on philosophical cohesiveness, ethical considerations, reflexivity, and data analysis. However, its use requires knowledge of research philosophy and CSR and it does not prompt the identification of research questions or specific methods to promote rigor and reflexive practices throughout the research. Additional guidance and guiding questions were recommended to improve the model's utility.

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