

The myth of induction in qualitative nursing research

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Abstract

In nursing today, it remains unclear what constitutes a good foundation for qualitative scientific inquiry. There is a tendency to define qualitative research as a form of inductive inquiry; deductive practice is seldom discussed, and when it is, this usually occurs in the context of data analysis. We will look at how the terms ‘induction’ and ‘deduction’ are used in qualitative nursing science and by qualitative research theorists, and relate these uses to the traditional definitions of these terms by Popper and other philosophers of science. We will also question the assertion that qualitative research is or should be inductive. The position we defend here is that qualitative research should use deductive methods. We also see a need to understand the difference between the creative process needed to create theory and the justification of a theory. Our position is that misunderstandings regarding the philosophy of science and the role of inductive and deductive logic and science are still harming the development of nursing theory and science. The purpose of this article is to discuss and reflect upon inductive and deductive views of science as well as inductive and deductive analyses in qualitative research. We start by describing inductive and deductive methods and logic from a philosophy of science perspective, and we examine how the concepts of induction and deduction are often described and used in qualitative methods and nursing research. Finally, we attempt to provide a theoretical perspective that reconciles the misunderstandings regarding induction and deduction. Our conclusion is that openness towards deductive thinking and testing hypotheses is needed in qualitative nursing research. We must also realize that strict induction will not create theory; to generate theory, a creative leap is needed.

Keywords: philosophy of science, qualitative research, nursing research, nursing theory, philosophy of nursing.

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Introduction

This paper is intended as a starting point for a deeper discussion about the scientific basis of nursing science regarding qualitative methods. In nursing today, it remains unclear what constitutes a good foundation for qualitative scientific inquiry. There is a tendency to define qualitative research as a form of inductive inquiry (Thorne, 2000; Holloway & Weeler, 2010; Morse, 2012; Freshwater & Cahill, 2013); deductive practice is seldom discussed, and when it is, this usually occurs in the context of data analysis (cf. Elo & Kyngäs, 2008, Elo *et al.* 2014).

However, within qualitative nursing research, there is also criticism of reliance on purely inductive descriptions. For example, Bondas (2013) states that:

Inductive descriptions of experiences might become naïve and endless repetitions, and become lost in superficial structures when there are no cumulative connections to a theoretical perspective or sometimes not even previous research. (p. 539)

In this way, so-called inductive qualitative methods can be said to inherit the problems associated with induction as a scientific method, namely, that the theoretical terms used become mere abbreviations of observations and thereby do not say anything profound about how things work (Bendassolli, 2013).

The purpose of this paper is to discuss and reflect upon inductive and deductive views of science and, in particular, challenge the view that qualitative research is and should be inductive.

To do this, we will start by describing inductive and deductive methods and logic from a philosophy of science perspective and how the concepts of induction and deduction are often described and used in qualitative methods and nursing research.

Another problem we will discuss is that some theorists – we use Morse (2012) and other authors advocating concept analysis, as an example – use the term ‘induction’ in such a way that it is almost impossible to understand what it is supposed to mean. Our position is that misunderstandings regarding the philosophy of science and the role of inductive and deductive logic and scientific methods are still harming the

development of nursing theory and science. Finally, we will attempt to provide a theoretical perspective that reconciles the misunderstandings regarding induction and deduction and shows how the hypothetical-deductive method can be used in qualitative research.

Background

In some ways, statements that qualitative research is, and should be, inductive (cf. Morse, 2012) can be seen as an expression of a lack of understanding and knowledge about induction and the developments in the philosophy of science since the demise of positivism in the mid-20th century. Some authors have stated that nursing as a scientific discipline downplays the philosophy of science (Suppe & Jacox, 1985; Di Bartolo, 1998). This critique, which also states that nursing science often adheres to a view of empirical science that could be seen as outdated and misleading, is not new; in 1993, Gortner pointed out that empiricism has been criticized in nursing because it is often misunderstood as being connected to logical positivism. It is reasonable to assume that these misunderstandings, to a large extent, are due to a lack of knowledge about primary sources on empiricism, such as Popper and Quine and the logical positivists themselves, for example, Carnap (cf. Gortner, 1993, Paley, 2005a). We also agree with Gortner (1993) that most of the views of empiricism brought forward in nursing science have been uncritically transferred from critiques of empiricism rendered by hermeneutists, phenomenologists, and critical social theorists. As Gortner (1993) pointed out, inspiration from the positivistic view of science is virtually non-existent, but many views of science put forward by nursing theorists and researchers unknowingly echo some of the core views of logical positivism (cf. Rolfe, 2006, Paley, 2005a). Such misunderstanding, often repeated by the uncritical citing of earlier texts in the discipline, and a lack of knowledge regarding the philosophy of science, can lead nursing researchers to reject sound methodological choices (Di Bartolo, 1998).

Induction and deduction in the philosophy of science and how they are described in qualitative research and nursing science

In literature concerning qualitative research methods, induction is often loosely defined as going from particular, or singular, statements to universal, general ones. Deduction, if it is defined, is the other way around; it moves from the general, or theory, to the particular. A study is called deductive if the research question is based on, or deduced from, a theory (Thorne, 2000, Suppe & Jacox, 1985, Patton, 2002, Yin, 2008, Elo & Kyngäs, 2008, Chinn & Kramer, 1999, Upshur, 2001, Holloway & Weeler, 2010). In our view, these loose definitions are part of the problem. One should call a method inductive only if it moves from direct observation or experiment to an inferred generalization. With the same reasoning, we argue that a method should be called deductive only if it aims to deduce testable observation statements, called singular statements, inferred from a general theory. A hypothetical deductive method aims to test critically, or to falsify, a theory by empirically and logically testing a hypothesis derived from the theory (Popper, 2001); how the theory is created is of less concern – it could be formulated on the basis of a single observation. In modern science, the term ‘deduction’ is not reserved for inferences from true premises, statements; instead, it is often used to make implications from premises, statements, which are empirical and therefore not necessarily true (Schank, 2008). However, if the premises are true, the deductively inferred statement is necessarily true, which means that if an observation does not confirm the inference, then one or all of the premises are false, and the theory can be said to be falsified (Popper, 2001). The validity of the deduction is a matter of logic; the observation determines if the deduced statement is corroborated or falsified. In the case of induction, the premises, statements, can be true, but the inductively inferred statement can still be false.

Induction as scientific method has a history dating back to Francis Bacon in the 17th century. In the 18th century, Hume formulated ‘the problem of induction’

(Suppe & Jacox, 1985; Popper, 2001; Bendassolli, 2013), which concerns the problem of using inductive inferences as a method to justify knowledge. Inductive inference is problematic because we can never be certain that recurring, observed events will continue to occur (Popper, 2001; Bendassolli, 2013); making that assumption is to transcend the observational data.

In the early 20th century, the logical positivists attempted to justify induction by using probability. If there are many existing observations of something, it is more probable that future observations will yield the same result. This was important for the development of modern quantitative methods of statistics and probability studies (Schwandt, 2007). The general view among empiricists, particularly the logical positivists, was that the demarcation between science and pseudo-science was the use of some principle of induction. However, Popper states that induction plays no role at all in science:

Induction, i.e. inference based on many observations, is a myth. It is neither a psychological fact, nor a fact of ordinary life, nor one of scientific procedure. (Popper, 2002a, p. 52)

Just as the positivists tried to find a point where further observation would not yield a stronger justification, there is a similar thought in grounded theory. The point where it is not probable that a new observation would yield a different result is called ‘the point of saturation’ (Glaser & Strauss, 1967, p. 11). An objection brought up by Suppe & Jacox (1985) is that there are no clear criteria of when that point of saturation is reached or even that it can be reached.

Another, related problem with induction formulated by Popper (2001) is that it is not possible to create theory by only using strict inductive practice. As stated above, induction is of no use in science according to Popper. Since inductive inference cannot justify knowledge, it cannot and has never been used in formulating theories and hypothesis. For example, naming categories based on the data is not using inductive logic; it is merely naming a phenomenon. In fact, a qualitative study is even more obviously not inductive since there can be no generalization based on many observations.

In the so-called inductive qualitative method, theories are usually seen as generated or constructed from and confirmed and verified by observation (Morse, 2001; Meleis, 2011). Both theory construction and theory justification can be seen as parts of a single method. Interestingly, most philosophers of science since the 20th century – such as Popper, a postpositivist; Carnap, a positivist/empiricist; and James, a pragmatist – separate the creation of theory from theory justification (Putnam, 1992). In some ways, the notion that theory development is an exclusive product of research is embedded in pre-20th century inductive views of science. Meleis (2011) exemplifies this as the ‘research–theory’ approach to theory development and sees it as an inductive practice of science. However, she incorrectly attributes this strategy to 20th century empiricism:

In fact, for empiricists, post-empiricists, and post-positivists, theory development is considered exclusively as a product of research. (Meleis, 2011, p. 398)

As mentioned above, both positivists/empiricists and postpositivists, such as Popper, clearly distinguish theory justification from the creative discovery of theory:

Accordingly I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically. (Popper, 2001, p. 31)

This can serve as an example of the problems that Gortner (1993) brought up, the short shrift given to empiricism based on a lack of knowledge of first-hand sources. The consequence is that many qualitative researchers still think that results and a theory can be justified by following a specific procedure, like a phenomenological method or a principle for concept clarification. All these attempts to establish validity or trustworthiness by following a method or principles inherit all the problems of the principles of induction. Most criticisms that Popper and other postpositivists had against induction as a means to justify knowledge are also valid against all other similar methods or principles that try to justify knowledge through methodological principles that do not include critical tests.

Theory and its place in qualitative research

In qualitative research, there is said to be theoretical plurality. Qualitative researchers draw theories from different disciplines, such as nursing, sociology, and philosophy, but they also develop theories particular to qualitative research and can develop their own theories based on their own research.

Theory is sometimes seen as an organized, coherent, and systematic arrangement of concepts to define and explain some phenomenon or part of reality (Silverman, 2005). A theory could also be described as consisting, ‘... of plausible relationships produced among concepts and sets of concepts’ (Strauss & Corbin, 1994, p. 278). According to a positivist view of science, the credibility of a theory depends on its ability to explain the evidence obtained by our senses. There has been some influential criticism of a type of positivistic empiricism, pointing out that there is no clear borderline between the evidence of our senses and theory (Quine, 1951; Popper, 2001). There is also a paradox: Qualitative researchers seem to understand theory in a similar way to logical positivists, namely, as a set of statements that depend on empirical content for their validity (Bendassolli, 2013). In fact, as Paley (2005a) points out, many nursing researchers and theorists would find that they were in agreement with many of the views of logical positivists if they took the time to read them.

It is important to remember that all results from empirical studies, whether the study is called inductive or deductive, implicitly or explicitly involve the development of certain theories that have been considered meaningful to the research question or used as a guide when conducting the research (Avis, 2005). This means that, in some respects, no study is purely inductive in the sense that it only uses the data and does not have a theoretical foundation. The research question, interpretation of the data, data collection, and analytical strategy are always influenced or even deduced from the theoretical framework and context in which the research is performed.

Today, most empirical researchers and philosophers of science acknowledge that all scientific evidence is dependent upon theory (Avis, 2005). Popper

also stands in strong contrast to many theorists within nursing and qualitative research by stating that the social sciences in particular are deductive (Popper, 2002b):

[I]n the social sciences it is even more obvious than in the natural sciences that we cannot see and observe our objects before we have thought about them. For most of the objects in of social science, if not all of them, are abstract objects; they are *theoretical* constructions. (p. 125)

According to this view, all concepts in nursing science are theoretical constructions, and analyses of these concepts actually have a theory as the point of departure. Within the literature on qualitative methods, Silverman (2005) makes a statement about the role of theory in social science that is very similar to Popper's view:

Theories arrange sets of concepts to define and explain some phenomena . . . Without a theory, such phenomena such as 'gender', 'personality', 'talk' or 'space' cannot be understood by social science. In this sense, without a theory there is nothing to research. (p. 14)

One has to remember that the 'theory' from which the statements are derived does not need to be based on scientific observation. In Popper's (2001) view of the scientific method, theories can also be based on experience, derived from other theories, and formulated in a creative process. However, the *statements* deductively derived from a theory do need to be testable in order for the theory to be regarded as scientific, according to Popper (2001). As mentioned earlier, Popper saw the formulation and creation of theory as belonging to a creative psychological process, while the justification of theory involves the logic of science. We believe that nursing science should similarly accept that theory creation is a creative endeavour that can use any tool that helps the theorist to arrive at a theory, including deductive and inductive inference.

The problem of induction in qualitative research

Despite these apparent problems with induction as a scientific ideal, several authors claim that qualitative

research is, and should be, inductive; one statement that can serve as an example was made by Morse (2012):

Qualitative health research is an inductive research approach used for exploring health and illness. (p. 147)

Qualitative research is also said to be characterized by using methods that are interpretive and focus on meaning and understanding (Morse & Richards, 2002).

A rather common view in qualitative research is that, as a result of the so-called inductive process, certain themes and patterns will start to emerge from the data: They will inductively 'reveal' themselves to the researchers (Bendassolli, 2013). This view of qualitative research can be exemplified by other authors such as Denzin & Lincoln (1994), who state that qualitative research draws on an interpretive orientation that focuses on the complex and nuanced process of the creation and maintenance of meaning. An article by Toloie-Eshlaghy *et al.* (2011) points to what the authors regard as characteristics of qualitative research epistemologies, namely, that they are 'non-oriented proof' and are intended to 'interpret and reveal concepts and meaning' rather than to generalize accidental relationships. The authors also state that 'qualitative research techniques cannot fall into numbers' (p. 107). We agree that qualitative research should be interpretive and concerned with a person's subjective experience and their creation of meaning, but we object to the notions that this implies inductive practice, that meaning can be 'revealed', that proof is 'non-oriented', and that qualitative research 'cannot fall into numbers'. We are also critical of the vague language used by, among others, Toloie-Eshlaghy *et al.* (2011). It risks becoming jargon that impedes the discussion of how qualitative research should be conducted. It seems that a part of the problem is trying to see social sciences and qualitative research as fundamentally different from all other types of research and, in particular, very different from quantitative research.

The process often described as 'inductive' in qualitative research is the process of *generating* theory, not the process of scientific *testing* or justification of theory. The problem here is related to the fact that

most so-called inductive qualitative methods only describe ways of generating or constructing theory, namely, the psychology of science, not methods of scientific testing of theory, i.e. the logic of science (Popper, 2001). In literature on qualitative nursing research, much has been written about theory generation or construction, but little emphasis has been placed on testing theory. When theory evaluation or validation is discussed, mainly quantitative or inductive verification is mentioned, as in Morse & Richards (2002) and Morse (2001, 2012). In the 'research-theory strategy' (Meleis, 2011) that is often used in qualitative nursing theory development, unnecessary restraints are placed on the generation of theory, and the prevailing view is that theory can only come from research. We believe that this view is a major problem for theory development in nursing science. There needs to be more room for creative theory formulation by both nursing practitioners and nursing scientists/theorists. Qualitative research, like all research, has both inductive and deductive phases, meaning that qualitative researchers can aim to both develop a hypothesis and test it deductively using qualitative methods (Creswell 2003, Elo & Kyngäs 2008, Elo *et al.* 2014, Schwandt 2007, King *et al.* (1994).

Examples of so-called induction in qualitative nursing research

One area in theories concerning methods for nursing research where induction is seen as something of a virtue is concept analysis.

The approach advocated by Morse (2012) and a few others such as Rodgers (2000) starts with defining concepts from observation, and then, statements and theories are constructed from the concepts that are referred to as 'building blocks' of theory. This so-called inductive practice and the building block notion point to some of the problems of induction. The naming of concepts may well become naïve and repetitious (Bondas, 2013), and the concept names can become mere abbreviations (Bendassolli, 2013) without theoretical elevation of the content. Morse (2012) then assumes that these concepts, building blocks, can form 'statements' together with other

'mature' concepts. However, the practice of creating statements from clarified concepts has nothing to do with inductive inference, and it is not clear how it is supposed to be done. The building block approach is an idea that originated in 17th century philosophy. Some body of base knowledge was postulated, examples of which are Descartes's clear and distinct ideas, the sense data phenomenalism of the logical positivists, space time coordinates, or the concepts of Morse, Rodgers, Walker and Avant, and these building blocks were then assumed to form the basis of all theory (Suppe, 1977). So, while not using proper induction, the concept theorists are trying to define something along the lines of 'principles of induction' (cf. Morse, 2012, p 154).

The various, vague, definitions of concepts also echo the phenomenalism of early logical positivism. Concepts are said to be 'complex cognitive representation of perceptible realities formed by direct or indirect experience' (Morse *et al.*, 1996) or as Rodgers (2000) puts it:

There is a consensus that concepts are cognitive in nature and that they are comprised of attributes abstracted from reality, expressed in some form and utilized for some common purpose. (p. 33)

As stated above, philosophers of science, such as Popper (2001), differentiate between creatively formulating a theory and scientifically testing a theory. However, the conceptual analyses referenced here run the risk of doing neither. The underlying assumption seems to be that one can discover the meaning or essence of a concept; from that point of view, inductive analysis of the usage of a concept is understandable. However, the assumption of a concept's 'core' meaning or essence rests on an outdated view of language that has little support in the modern philosophy of language and science (cf. Quine, 1951). The accepted view is that knowledge builds on ideas that are systematically tested by scientific methods.

The underlying assumption behind concept analysis as an important tool for theory development is a hierarchical view of theory. In order to construct theory, it is assumed that one must start with concept development and then proceed to construction of statements that would then form a theory. Maybe this

hierarchical view is what Morse (2012) refers to as 'inductive'. However, the view of theories as constructed and verified from concepts and statements is hard to justify, and Popper has a directly opposite view; theory cannot be built by arguing from statements, and truth can never be verified:

I never assume that we can argue from the truth of singular statements to the truth of theories. I never assume that by force of 'verified' conclusions theories can be established as 'true'. (Popper, 2001, p. 33)

One reason that Popper emphasizes that all science is deductive is that theories have a universal character. It is only through deductively forming observational statements from theoretical statements that we can discover the weaknesses of theories and thereby understand how to develop them further. Another leading philosopher of science, Quine (1978, 1998), states that concepts acquire meaning in the theoretical context to which they belong. Since the types of concepts that are used in social science and nursing are usually defined on a theoretical level, inductive inference and so-called inductive methods are of little help for concept explication and clarification.

The assumed dichotomy between qualitative and quantitative research and its connection to beliefs about induction and deduction

The adherence to so-called induction can be seen as connected to the view that there is a dichotomy between qualitative and quantitative research. When reading Morse (2012) and Morse (2001), qualitative methods are described as inductive steps that eventually lead to theory formulation, and the theory can then be verified by quantitative methods. According to Sandelowski *et al.* (2009), qualitative and quantitative data are not different kinds of data as both represent experiences that can be formed into words or figures. Sandelowski *et al.* (2009) also state that a qualitative study can be used to test a hypothesis and that 'quantitizing' qualitative data could be a way of extracting more meaning from qualitative data.

However, in our view, qualitative inquiry is the core of theory development and the advancement of new

theory in nursing science. In discovering or formulating new theory, purely quantitative methods have a limited value. In the creation of a theory, one must allow usage of both deductive and inductive inferences; the most important feature of the methods used is that they stimulate the researchers' ability to create and formulate theory. Usually, labelling the methods of theory creation as inductive or deductive is misleading. In fact, we believe that theories can, and often should, be formulated without any empirical scientific studies but that scientific studies can offer useful tools to formulate and develop theory. However, deductive testing is required in order to justify theory and to weed out what works from what does not (Popper, 2001), and our opinion is that qualitative methods can be used to distinguish 'how it seems' from 'how it really is' (Paley, 2005a)

Qualitative inductive and deductive analyses

Qualitative analysis is often called inductive if the researcher names the categories or themes that are the result of an analysis without using concepts from an existing theory; one starts with the data and infers categories and theory from the data. If one uses categories, themes, or concepts from an existing theory, the analysis is often called deductive (Elo & Kyngäs, 2008, Schwandt, 2007, Yin, 2008, Bendassolli, 2013). As we see it, and in the light of the definitions of deduction and induction, solely attempting to verify a system of categorization or themes is not deductive practice, even if it is often described as deductive by qualitative researchers. An analysis should not be called deductive if it does not use deductive inference. If a study has the purpose of verifying the theory by adding observation (cf Morse, 2001), attempting to verify theory by more observations and/or quantitative methods is in line with positivistic theory verification and could be seen as inductive. However, Elo & Kyngäs (2008) also state that deductive analysis should include hypothetical theory testing, even if they not use the term 'falsification'.

We believe that the tendencies to limit qualitative analysis to methods that are called 'inductive' and to banish quantifying as a qualitative analytical tech-

nique are harmful and misleading. They limit the tools available to use when we create and develop theories. We agree with Sandelowski *et al.* (2009) that all qualitative analysis that classifies data into categories or themes is in fact choosing when to *count* something as belonging or not belonging to a specific category. The first set of categories is often established directly based on the data, a process that is sometimes called 'inductive', but when researchers check the consistency of a category for coherence, they are performing a deductive test of the consistency. In our view, a good qualitative analysis always consists of steps involving inference from the data and steps using deductive inference, even if some authors choose to call the process inductive since the overall direction is towards a higher level of generalization. Again, it is not necessary to label the steps leading up to a theory either as inductive or deductive; as long as researchers can present a testable theory, they can use any means they feel comfortable with. Today, the problem is that most categorization is so vague that it is hard to base further studies on the results; the categories become '... naïve and endless repetitions ...' (Bondas, 2013) of little use or reference to proper theory. We believe that more emphasis should be put on finding possible sources of error in the analytical process so that the qualitative research constitutes a complete cycle in itself (Allmark 2003).

When Glaser & Strauss (1967) developed a grounded theory, they suggested that the phenomenon be approached without predetermined ideas of what the researcher was looking for, seeking to generate theory. When the data analysis is complete, then the researcher should decide if there are any existing theories that are applicable to the new theory generated. It could always be questioned whether a researcher ever approaches a phenomenon without any predetermined ideas. The particular phenomenon is chosen because of the researcher's interest and motivation to learn more about it. The use of the term 'induction', in this context, seems to point more to approaching the phenomenon with an open mind, rather than basing the research on inductive logic. An often forgotten feature of grounded theory is that it includes a form of falsification so that errors can be excluded from a theory (Paley, 2005a).

Can qualitative research use the hypothetical-deductive method?

At this stage, we have identified two problematic beliefs that exist in qualitative nursing research: one is the belief that theory can only come from structured inductive scientific studies and, second, that theories should then be verified via more studies or quantitative studies (Morse, 2001). In our view, there is a lack of theory testing, and more seriously, creative theoretical ideas based on, for example, professional experience are not regarded as theory. By not rigorously testing theory, we have no way of discerning between good (usable) and bad (unusable) theory. There seems to be a commonly held view that one needs to be quantitative to test a theory that has been developed by qualitative inductive studies. However, we would like to argue that this is incorrect. For example, Yin (2008) states that case studies and other qualitative methods are to be seen as experiments much like in physics or chemistry and that such experiments can test the validity of theoretical constructs. In fact, one qualitative observation can falsify a hypothesis, while inductive reasoning leads to quantification as the only means of theory and hypothesis validation. The qualitative method is often described as incompatible with the hypothetical-deductive method. We believe this is mostly due to misconceptions regarding the hypothetical-deductive method. For example, there is a belief that since the conclusion that can be inferred from deductive reasoning is true if the premises are true, there is a problem with deductive reasoning when it is applied to science. This argument suggests that deductive thinking requires a view that truths are absolute and sure (Upshar, 2001). In fact, the reason Popper (2001) and others state that science is deductive is that deduction is a good way to test or attempt to falsify a theory. If the conclusion is falsified, by some sort of empirical observation, one also knows that at least one of the statements that form the premises is false, and the theory from which the statements are derived is in need of revision. Popper (2001, pp. 32–33) describes that logic is used to deduce testable statements from theories. If these statements are scientific, testable by observation, or experiment, they are subjected to tests in an attempt to falsify them,

which would also falsify the theory that the statements are derived from. If the statements are not falsified, the theory is corroborated, and it is still preliminarily accepted. In this way, a positive result will only temporarily support the theory. A milder, pragmatic form of theory testing is to investigate a theory's practical utility.

An example that shows a sort of falsification in what could have been a deductive approach to theory testing is from Wiman & Wikblad (2004). They attempted to use the so-called theory of caring and uncaring of Halldorsdottir (1990). A problem is that the so-called theory is more of a flat description of qualitative data. When using Halldorsdottir's aspects as observation categories, they found that most of the data classified as 'uncaring' did not fit the aspects of Halldorsdottir's theory. However, instead of seeing this as a falsification of the theory, they invented a new uncaring aspect to cater for the data not fitting with the original theory and chose to see the theory as verified. By trying to verify the categories they reduced and the value of their approach and by adding categories ad hoc, they made the so-called theory less specific and more general instead of, as Popper (2001) suggests, more specific and less general. We agree with Paley (2005b) who states that it is welcome for a theory to be tested in this way; however, Wiman and Wikblad's reaction to Paley's critique also shows some serious misconceptions regarding Popper's philosophy of science that might explain why they chose the approach they did. Wiman & Wikblad (2005) state,

Karl Popper held that a good scientific theory is one that can never be falsified. Within nursing science few theories fulfil this criterion. Yet the fact that most theories on behaviour are easy to falsify does not necessarily mean that they are useless. On the contrary, they are important as they help us to understand complex situations. Theories in caring can be used as toolboxes that contain concepts and ideas that are useful when analysing complex empirical reality. (p. 124)

Somehow, they consider that good scientific theories should not be falsifiable, which is obviously exactly opposite to Popper's (2001) view, which states that it is necessary for a theory or system to be falsifiable in order to count as scientific. It seems that

when the terms 'inductive' and the 'principles of induction' are used by Morse (2012), Rodgers (2000), and exemplified by Wiman & Wikblad (2005), they are dedicated to avoiding excluding anything and to constantly expanding the theoretical construct so that it becomes less and less specific. This can be seen as an example of over-reliance on vague inductive reasoning; theories can only be verified, and every new observation or theoretical construct is added to the theory, which then encompasses more and more, and eventually becomes impossible to falsify. In this way, concepts and theories may become tautological and thus unusable in both practice and science.

Towards a holistic view of science

The reliance on induction is in line with a primitive positivistic view of science, even if the theorists who advocate induction are not directly inspired by any type of positivism, as Paley (2005a), Bendassolli (2013), and others have already discussed. Rolfe (2006) points out that Morse *et al.* (2002) uses terms such as 'verification' and 'scientific evidence' that are coherent with a primitive logical positivism. This is an example of a problem in nursing science: Owing to misinformation and a lack of knowledge about the philosophy of science, there is a risk that we do not learn from history and instead repeat errors regarding scientific method that have been known and widely discussed by philosophers of science for decades or even centuries. Quine (1951) also discusses the positivistic reliance on induction, verification theory, and reductionism, and states,

The verification theory of meaning, which has been conspicuous in the literature from Peirce onward, is that the meaning of a statement is the method of empirically confirming or infirming it. An analytic statement is that limiting case which is confirmed no matter what. (p. 35)

By this, Quine describes how positivists attempted to find the meaning of a statement by verifying it by some empirical method, as do Morse (Morse, 2001; Morse *et al.*, 2002). Quine calls the idea that statements get their meaning through direct reports by being translatable into immediate experience as 'radical reductionism'. He continues,

More reasonably, and without yet exceeding the limits of what I have called radical reductionism, we may take full statements as our significant units – thus demanding that our statements as wholes be translatable into sense-datum language, but not that they be translatable term by term. (Quine, 1951, p. 36)

We believe that nursing research has much to gain by aligning itself with the insights of postpositivistic philosophy of science. In short, it is time to go from inductive radical reductionism to meaning holism in order to develop theory based on qualitative, and quantitative, research methods using both deductive and inductive approaches. Deductive and holistic views of science can be seen as an alternative to an inductive, reductionist, and arguably outdated view of science.

Conclusions

We should, at least, acknowledge that all science has, and should have, elements of deduction and that qualitative researchers should use deductive methods to test theories. Studies may range from the descriptive and explorative type, which is often called inductive, to the experimental and theory-testing type, where a hypothesis or theory is critically tested, and as a result, the theory is corroborated or rejected. As researchers, we should also feel a responsibility to be up to date on the theory of science and critically review and reflect on the foundations of our discipline and on the quality of information we pass on to future nursing scientists. The dogma that qualitative health research should only be inductive and that theory can only be created from studies that are labelled inductive limits the creativity of researchers and our scientific development. We must also allow nurse researchers, and practitioners, to form theories based on experience, and creative thinking can accelerate theory development; however, this requires that we recognize and acknowledge the separation between theory creation and theory justification. Instead of defining a chasm between inductive and deductive and qualitative and quantitative, we would be better off distinguishing between methods of theory justification and methods of theory creation. We should also accept that all scientific theories must be subject

to deductive tests of some form, either qualitative or quantitative, before we can justify them as corroborated, valid, or usable for nursing practice. We must also realize that strict induction will not create theory. To construct theory, a creative leap is needed; one needs to go beyond mere inductive description, categories, and themes to theories concerning effects, causes, and associations. We also believe that openness towards deductive thinking and hypothesis testing by qualitative methods is in line with the more modern model of science that is essential for the development of nursing science and practice.

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