other terms, such as human kinetics, have recently been renamed using the term *kinesiology*). The main impetus of the name change to kinesiology was a recognition that the field involves more than physical education teacher training. While teacher training remains an important aspect of kinesiology, the name kinesiology itself refers to the *study* of movement; hence research is now more easily recognized as core to the discipline.

Introduction to Research Methods in Kinesiology

The terms *science* and *research* are not new, and certainly not exclusive to the field of kinesiology. However, both terms are commonly used by researchers in kinesiology. In an effort to distinguish between them, Thomas, Nelson, and Silverman (2011) defined science as "a process of careful and systematic inquiry" (p. 10), whereas they described research as "a structured way of solving problems" (p. 17). Others (e.g., Baumgartner & Hensley, 2012) link the term *science* more to the formation of a theory that is developed based on the facts, whereas research refers to the discovery of those facts. Perhaps the easiest way to differentiate between them is to think of **science** as the discovery of knowledge and **research** as a specific method used to discover that knowledge. Regardless of the definitions, it is clear that science and research are intimately tied together.

Creswell (2014) identified three approaches to research: quantitative, qualitative, and mixed methods research designs. These three research approaches represent the majority of research studies conducted in the field of kinesiology to date; however, each research approach differs in underlying assumptions, the types of questions asked, the specific methods used, the type of data that results from the research, and subsequent analysis of the data. All three approaches will be covered in more detail in chapters that follow. As an introduction, each is briefly discussed below, accompanied by some examples of studies conducted by researchers at Canadian universities. This introduction is meant to highlight some of the key characteristics that differentiate among quantitative, qualitative, and mixed methods research approaches.

Quantitative research requires the generation of numerical (i.e., quantitative) data to answer research questions. Hence, quantitative research designs are typically described by researchers (e.g., Creswell, 2014; Thomas, Nelson, & Silverman, 2011) as best suited to questions related to the testing of theory (e.g., links between motivation and behaviour proposed by self-determination theory; Deci & Ryan, 2000), status on variables (e.g., obesity rates in Canada), differences among groups (e.g., physical activity levels in boys compared to girls), and relationships among variables (e.g., research at Acadia University on the relationship between family social influence and physical activity; Shields et al., 2008). As a result, quantitative research designs are fundamentally based on the premise that the data generated be as precise as possible. This precision, or validity (a term you will read much more about in later chapters), is necessary so that any conclusions that are made based on the research are accurate and can be applied to populations beyond the study sample. For instance, researchers at the University of British Columbia (i.e., Masse et al., 2016) recently found that the physical activity parenting practices most often employed by parents in Canada and the United States are not the practices

emphasized in current research measures. As such, they argue that the predictive validity of such measures requires further examination. Researchers conducting quantitative studies attempt to be as objective as possible, typically use large sample sizes, focus heavily on the measurement of variables, and use statistics for their data analysis.

The Canadian Health Measures Survey (CHMS) is an example of a large-scale quantitative approach to research (Tremblay & Gorber, 2007). The CHMS, conducted between the years 2007 and 2009 was designed to study the health and wellness of Canadians. The researchers' goal was to produce baseline data for a variety of health indicators. Measurement of variables ranged from physical activity; to blood pressure; to muscular strength, endurance, and flexibility. A method used to enhance objectivity was the assessment of physical activity via the use of accelerometers, which participants wore for seven days. One published study based on the CHMS data presented the physical activity levels of 2832 Canadian adults between the ages of 20 to 79 years (Colley et al., 2011). Data were shown in the form of average daily minutes of activity at various levels of intensity and by the number of step counts per day. Results showed that only 15% of adults were meeting physical activity recommendations and that a large number of people spent the majority of their waking hours being sedentary.

Although quantitative research studies typically have large sample sizes, they do not always *require* large sample sizes. Experimental studies in particular can require a great deal of time and resources to test the effectiveness of treatments, programs, or interventions; as a result, experimental studies often rely on much smaller sample sizes. For example, Moreside and McGill (2012) recruited students at the University of Waterloo for their hip joint range of motion intervention study. Twenty-four participants were randomly assigned to four separate experimental groups, with interventions (e.g., stretching or core endurance exercises) occurring over a 6-week period. They found that hip rotation range of motion could be improved by a variety of intervention methods. Objectivity was attained through randomization of participants to groups, as well as by having the measurements of key variables conducted by a research assistant who did not share the results with the primary researcher who was present. These strategies helped to reduce the probability that their findings were simply a result of researcher bias and expectations. Even though the specific study design and sample size differed substantially between the Moreside and McGill study and the CHMS, both represent quantitative approaches to research because data collection methods resulted in numerical data that were then analyzed through the use of statistics to answer their research questions.

Qualitative research, in contrast to quantitative research, is based on the generation and interpretation of non-numerical (i.e., qualitative) data. Patton (2002) identified three main sources of qualitative data, including open-ended interviews, direct observation, and written documents. In addition to these traditional sources, there is also an increased use of arts-based research methods (Sullivan, 2005) as a form of data collection. Because the resulting data are non-numerical, qualitative research is particularly well-suited to understanding peoples' meanings of experience (e.g., the wheelchair dance experiences of children with spina bifida; Goodwin, Krohn, & Kuhnle, 2004). Qualitative research differs from a quantitative approach in that the design of the studies is often emergent and flexible, the data are typically collected in the participants' natural setting, themes are generated from the data collected, and the researcher is acknowledged as being an integral part of the research process (Creswell, 2014).

While the results of qualitative research can certainly be written up in journal articles, as are quantitative research results, they can also be represented in other ways, such as poems, theatre, and musical performance, to name just a few options (Sparkes & Smith, 2014). And because of the focus on understanding the complexity of peoples' experience, sample sizes in qualitative research tend to be much smaller than in quantitative research.

An example of a qualitative approach is a study conducted by researchers at the University of Alberta that explored the physical activity experiences of young adolescent girls (Clark, Spence, & Holt, 2011). To answer their research questions, they interviewed eight participants (aged 10 to 11 years) twice each in the girls' school setting. The two interviews occurred approximately one year apart. As part of developing trusting relationships with the girls prior to the interviews, the lead researcher also participated in a number of the girls' activities (e.g., art and physical education classes) during the weeks prior to data collection. Participants also completed either collage or drawing exercises prior to the first interview as a way to facilitate depth and richness within the subsequent interviews. Once collected, the interview data were then transcribed verbatim (i.e., typed out word for word) and analyzed using a thematic analysis that resulted in two main themes: (a) "Physical activity lets girls shine" and (b) "Taking care of myself, inside and out." In taking a qualitative approach to their research, Clark et al. were able to provide a rich, in-depth understanding of girls' physical activity experiences.

Another example of a study using a qualitative approach was conducted by Mosewich and colleagues (2009) on women track and field athletes' meanings of muscularity. They conducted focus groups followed by one-on-one interviews with four adult and four adolescent athletes from a variety of track and field events. A somewhat unique aspect of their work was that they had each of the participants complete a photography project between the focus group and one-on-one interviews as a way for the athletes to visually represent their muscularity experiences. The photographs were also used to facilitate discussion in the one-on-one interviews. A thematic analysis resulted in four main themes, including (a) "Many faces of muscularity," (b) "A blurred line between appearance and performance," (c) "A culture of comparison," and (d) "A journey towards self-acceptance." A qualitative study was particularly useful in showing the complexity of women athletes' experiences of muscularity. In both the Clark et al. (2011) study and the Mosewich et al. study, understanding of the participants' experiences was facilitated by presenting direct quotations from the interviews throughout the results, which is a strategy often used by qualitative researchers to facilitate a reader's entry into the participants' world of experience.

Mixed methods research is becoming increasingly common within kinesiology. As might be expected, a mixed methods research approach combines quantitative and qualitative research methods. This combination can take many forms, including research designs that prioritize either one or both of quantitative and qualitative methods, research designs in which quantitative and qualitative methods are conducted either simultaneously or one following the other, and programs of research in which both quantitative and qualitative studies are conducted over a longer period of time, all aimed at answering a broader research question (Creswell & Plano Clark, 2011). In essence, a mixed methods approach is used by researchers who see value in using *both* quantitative and qualitative data to answer their research question(s).

An example of a mixed methods approach is a study conducted by Ferguson and colleagues (2014), who used both quantitative and qualitative research methods to better understand the role of self-compassion in young women athletes' psychological well-being. In their study, a quantitative phase preceded a qualitative phase. The quantitative phase specifically focused on

Research Highlight

Research led by Nick Holt, a Professor of Physical Education and Recreation at the University of Alberta, is focused on the psychosocial dimensions of youth sport, physical activity, and physical education. He and his colleagues have numerous peer-reviewed publications and have utilized a wide range of research methodologies to help us better understand various study areas in kinesiology. Two of his studies with more unique methodologies are worth particular mention as a way to highlight some of the diversity found in kinesiology research. In a first example, Holt and colleagues (2008) conducted a study on children's perceptions on places to play and be physically active. To answer their research question, they used a "mental mapping technique" to assess perceptions of urban environment among 168 students from grades K to 6. The children created the mental maps by drawing images of the places they could play and be physically active in their neighbourhood. While the children were drawing, the researchers asked clarification questions about the children's images to further enhance their understanding. Some of the mental maps created by the children are presented in the published article, and they exemplify the benefits of artistic practice in answering research questions. In a second example, Holt et al. (2013) were interested in implementing and evaluating sport-based after-school programs for children in low-income areas in Edmonton. Their study took place over a three-year period and included a wide range of activities including initial work to identify the research questions and build relationships within the community, delivery of sport camps in partnership with the school board, the development of after-school programs with principals and teachers, and interviews with adult stakeholders including coaches, school board members, and others. A number of the children participating in the program were also interviewed. The combination of spending a great deal of time working with the community and use of multiple research strategies greatly enhanced the research team's ability to develop an effective and enjoyable physical activity program for low-income students. Taken together, Dr Holt's research is an example of how researchers often use a variety of research approaches to answer different types of research questions in their particular area of interest.

Further Readings

Holt, N. L., McHugh, T.-L. F., Tink, L. N., Kingsley, B. C., Coppola, A. M., Neely, K. C., & McDonald, R. (2013). Developing sport-based after-school programmes using a participatory action research approach. *Qualitative Research in Sport, Exercise and Health, 5,* 332–55. doi:10.1080/2159676X.2013.809377

Holt, N. L., Spence, J. C., Sehn, Z. L., & Cutumisu, N. (2008). Neighborhood and developmental differences in children's perceptions of opportunities for play and physical activity. *Health & Place, 14,* 2–14. doi:10.1016/j.healthplace.2007.03.002

presenting statistical relationships among measured variables, whereas the qualitative phase focused on athletes' experiences of self-compassion and psychological well-being. There were a few distinguishing features between the quantitative and qualitative phases, including the sample sizes (i.e., 83 in the quantitative phase, 11 in the qualitative phase), the methods of data collection (i.e., questionnaires in the quantitative phase, interviews in the qualitative phase), and analysis of data (statistics in the quantitative phase, a thematic analysis in the qualitative phase). Despite these differences between the phases, the quantitative and qualitative approaches each informed the general research question in a unique way. Across the two studies, a complex picture of possible ways that self-compassion might work to enhance psychological well-being for women athletes was presented.

An example of a mixed methods approach across a series of studies is the work on positive youth development in sport by Leisha Strachan (University of Manitoba), Jean Côté (Queen's University), and Janice Deakin (University of Western Ontario). In a qualitative study exploring positive youth development in elite sport contexts, Strachan, Côté, and Deakin (2011) used both interviews and observations as data collection sources with their sample of five elite youth sport coaches. Perhaps most interestingly, 123 athletes of these same coaches had participated in a previous quantitative study on personal and contextual outcomes associated with youth sports (Strachen, Côté, & Deakin, 2009). Their research showed that it is important to focus on positive identity, empowerment, and support in youth sport programs as ways to help prevent burnout and enhance enjoyment from the athletes' perspectives (based on the quantitative study). However, it also showed that coaches can play an important role in creating an appropriate environment in which to promote positivity for their athletes (based on the qualitative study). It is only when *both* studies are considered that a more complete picture emerges of ways to positively impact youth sport development. Across his program of research, Dr Côté in particular has used a variety of quantitative and qualitative methodologies, including different types of interview approaches, observation, video-task analysis, and questionnaires, to answer research questions focused on sport and physical activity performance and participation.

Components of a Research Design

The sources that are used to collect data in a research study, whether the measurement of physiological variables, one-on-one interviews, or arts-based methods, are informed by the specific research approach that is taken (i.e., quantitative, qualitative, or mixed methods). In short, the research approach and methods employed in a study are inherently linked. A researcher taking a qualitative approach is not going to rely on objective numerical data to gain a rich understanding of breast cancer survivors' body image experiences, just as a researcher conducting a quantitative study on the effects of a dynamic stretching program on endurance athletes' training recovery will likely have little need for poetic transcriptions (i.e., participants' words transformed into poems). As discussed in the previous section, the quantitative approach to research requires the application of appropriate quantitative methods, while the qualitative approach requires appropriate qualitative methods. Further, the mixed methods approach will utilize a variety of methods that are appropriate to either quantitative or qualitative research at different stages of the research.

But how do researchers choose both their approach and the corresponding methods? As will be shown throughout this book, there are several decisions to make and steps to take when planning and designing a research study. However, playing a fundamental role in the type of approach and choice of subsequent methods is a researcher's **philosophical worldview**, which represents a set of beliefs related to her or his general orientation of the world and the nature of research (Creswell, 2014). More specifically, a philosophical worldview dictates what a researcher believes (or does not believe) counts as knowledge. For example, a researcher might believe that the stories children tell about their experiences in physical education class are or are not important and valuable as knowledge. This belief permeates the entire research process from beginning to end.

Two concepts that align closely with a philosophical worldview are ontology and epistemology. Whaley and Krane (2011) provide a "primer on ontologies, epistemologies, and methodologies" (pp. 395–7) that we find quite useful. In essence, **ontology** refers to someone's belief in the nature of truth and reality. For example, if we accept that there is an objective physical reality separate from our own personal existence, that belief reflects a particular ontological stance. Alternatively, **epistemology** refers to someone's belief about how we acquire knowledge about that truth and reality (and even whether we can or should go about acquiring that knowledge). For example, valuing personal experience in the quest for knowledge reflects a particular epistemological stance. As Whaley and Krane describe, the ability for researchers to understand and appreciate various types of research depends largely on their epistemology, rather than simply not understanding a particular method (e.g., questionnaires, interviews, observations). If we look at the definition of philosophical worldview provided in the previous paragraph, it essentially represents an integration of both ontology (i.e., "general orientation to the world") and epistemology (i.e., "nature of research"). Hence our choice is to use the term *philosophical worldview* throughout this book to encompass a researcher's set of beliefs that guide her or his orientation to science and research (see Figure 1.1).
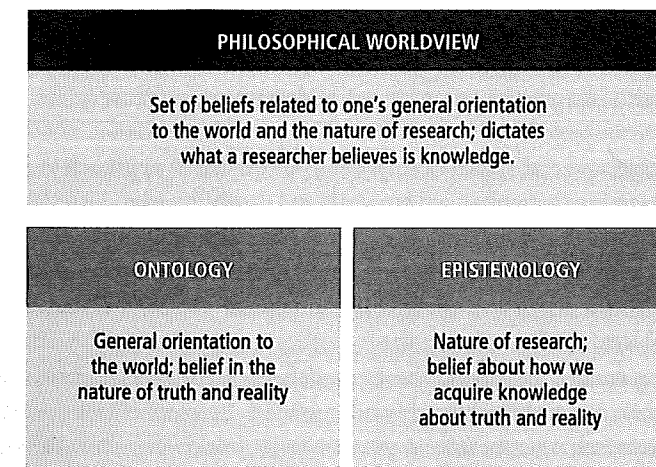
PHILOSOPHICAL WORLDVIEW

Set of beliefs related to one's general orientation to the world and the nature of research; dictates what a researcher believes is knowledge.

ONTOLOGY

General orientation to the world; belief in the nature of truth and reality

EPISTEMOLOGY

Nature of research; belief about how we acquire knowledge about truth and reality

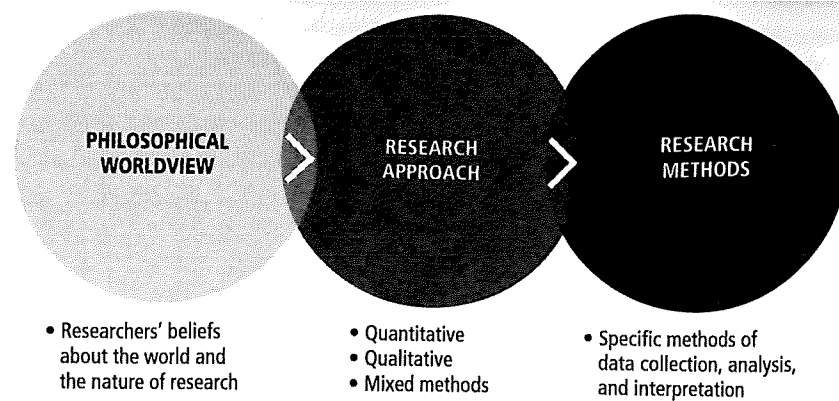**Figure 1.1** The relationship between philosophical worldview, ontology, and epistemology.

Figure 1.2 Three components of research designs.

While many philosophical worldviews exist, each uniquely providing a framework to guide the research process, Creswell (2014) identified four worldviews that are common in the literature: (a) postpositivism, (b) constructivism, (c) pragmatism, and (d) transformative. Another philosophical worldview that is becoming increasingly visible in Indigenous health research in Canada is two-eyed seeing. These five philosophical worldviews are common to the multidisciplinary field of kinesiology research in Canada and will be discussed in turn. Philosophical worldviews have inherent assumptions about knowledge that drive the research approach and distinct methods or procedures used in research, as shown in Figure 1.2.

Philosophical Worldviews as Guiding Frameworks of Research

Postpositivism is a common philosophical worldview in kinesiology research that is premised on the notion that there is a single reality or objective truth to be discovered through research. Inherent to postpositivism are the assumptions of determinism (causes determine effects) and reductionism (ideas can be reduced to small testable research questions), as well as a reliance on theory to uncover objective reality. An example of a postpositivist approach to research would be reflected in a study testing that enhanced strength and flexibility (the causes) result in increased parallel bar performance in gymnastics (the effect). Researchers with postpositivist worldviews are guided by the scientific method as a rigorous way to answer research questions. One popular approach to the scientific method described by Thomas et al. (2011) consists of four steps: (a) developing the problem, (b) formulating the hypothesis, (c) gathering the data, and (d) analyzing and interpreting results. Following these pre-defined steps aids in uncovering truth in the research process while remaining objective and unbiased. Researchers who adopt a quantitative approach to their research operate from a postpositivist worldview, since the characteristics of the quantitative approach (e.g., numerical data, measurement of variables, large samples, and statistical analyses) align with the philosophy of objectivity and finding one single truth in research.

Constructivism is another philosophical worldview that guides many kinesiology research programs. Constructivism is based on the notion that multiple realities exist and that meaning is varied and complex. For example, researchers with a constructivist philosophical worldview would likely adopt a stance that there is no distinct set of emotions that are similarly experienced by all people; instead they might view the experience of emotions as unique to each individual (e.g., what you experience as competitive anxiety might be very different from what someone else experiences as competitive anxiety). Therefore, in contrast to postpositivism, which is guided by the philosophy that there is one objective reality to be discovered, researchers with a constructivist philosophical worldview operate from the position that meanings of experience are subjective and socially constructed. That is, individuals engage with their world and make sense of it based on their own personal, social, cultural, and historical perspectives. Researchers with a constructivist worldview seek complexity of views rather than reducing or narrowing ideas down to a single testable idea. True to the belief that meanings are varied and multiple, researchers with a constructivist worldview recognize that their own realities and views shape the research process; they are not objective scientists but rather are closely connected in constructing and interpreting their findings. Kinesiology researchers with a constructivist worldview take a qualitative approach to exploring and understanding human movement, often incorporating open-ended discussions and interactions with other people to understand their personal, social, cultural, and historical worlds.

While postpositivist and constructivist philosophical worldviews include strong beliefs on the status of reality (i.e., single and objective or multiple and varied), a pragmatic worldview is somewhat different. **Pragmatism** is premised on the idea that researchers need to be concerned with solutions to problems; therefore, there is no commitment to any single notion of reality. Rather, truth and knowledge are viewed as what works at the time to address the research problem or question. Researchers with a pragmatic worldview are concerned about application, or doing what works. They recognize that questions related to the nature of reality are indeed important but are willing to set aside those types of questions temporarily (or permanently) in their research. Thus, rather than commit to one type of research approach and corresponding method over another, pragmatists incorporate all approaches that are appropriate and necessary to understand their research problem. Specifically, pragmatists adopt a pluralistic approach to their research, engaging in mixed methods research to incorporate both quantitative and qualitative approaches into their programs of research. A mixed methods approach works best for researchers with a pragmatic worldview because aspects from both quantitative and qualitative methods will provide the best understanding in their research, and ultimately the best solution to their research problem.

A **transformative** philosophical worldview is based on the notion that research needs to be closely connected with politics and have an action agenda to advocate for marginalized peoples, such as those who experience inequity based on gender, race, ethnicity, disability, sexual orientation, and socioeconomic status. Researchers with a transformative worldview focus on reform and change through their research, and they have the underlying objective to better the lives of the participants involved in their research. In order for action to take place, transformative research is inherently collaborative whereby researchers and study participants work together throughout the research process in order for change to occur and to be meaningful to the

participants. The collaboration can be seen at all stages of the research process, including the development of research questions, data collection and analysis, and experiencing the reform and change as an outcome of the research. Researchers with a transformative worldview often adopt a qualitative approach to their research when working directly with study participants, though a quantitative approach can also add important elements, as is often seen through the use of numerical data to justify reform and change (e.g., statistics showing low participation or high risk). Researchers with a transformative worldview often focus on research topics of particular relevance to racial and ethnic minorities; persons with disabilities; members of the lesbian, gay, bisexual, transgender, and queer communities; and Indigenous peoples.

Two-eyed seeing is rooted in the belief that there are many ways of understanding the world, some represented by various Indigenous knowledge systems and others by European-derived sciences. Introduced to the research world by Mi'kmaw Elders Albert and Murdena Marshall, two-eyed seeing reflects the "bringing together" of knowledge by using the analogy of two eyes, with one eye seeing from the strengths of Indigenous ways of knowing and the other eye seeing from the strengths of Western ways of knowing (Bartlett, Marshall, & Marshall, 2012). Researchers with a two-eyed seeing worldview suspend judgment on the various ways of knowing, recognize that all knowledge systems are equitable, and embrace sharing knowledge from both Indigenous and Western knowledge systems. Two-eyed seeing draws upon Indigenous and Western knowledge in a way that addresses the needs of the individuals and/or community with whom researchers are working, without pitting one knowledge source against the other or favouring one perspective over the other. As such, this worldview is premised on respect, reflection, and co-learning. A two-eyed seeing philosophical worldview is particularly valuable in allowing for diversity of perspectives and valuing that all views contribute something unique and important.

It is important to gain an appreciation for philosophical worldviews, such as those presented in Table 1.1, as they are foundational to any research design. The philosophical orientation that researchers adopt about the world and the nature of knowledge will dictate the type of research that they do and the types of research that they value. For instance, researchers who believe that both Indigenous teachings about the land and Western physical activity adherence theory offer value (i.e., two-eyed seeing) when implementing a physical activity program for Indigenous youth will develop a very different study from researchers who want to determine which of three training programs provides the greatest strength gains for athletes (i.e., postpositivism). As another example, researchers who embrace the notion that our lives are socially constructed and that meanings are varied (i.e., constructivism) will adopt a qualitative approach and corresponding methods of data collection when exploring the lived experiences of adults with spina bifida. Alternatively, other researchers might be less interested in philosophical debates regarding the status of knowledge, truth, and reality and instead focus on problem solving (i.e., pragmatism), such as determining the best rehabilitation program for individuals living with multiple sclerosis. Finally, researchers who are fundamentally driven by an action agenda and are focused on reform (i.e., transformative) will respond to the removal of bike paths and associated increases in sedentary behaviours in a First Nations community by working collaboratively with community members to initiate change toward improved health. These are just a few examples highlighting the links between philosophical worldviews and the types of research approaches that might follow.

Table 1.1 A summary of the main philosophical worldviews.

WORLDVIEW	MAIN FEATURES	MAIN RESEARCH APPROACH
Postpositivism	• A single reality or objective truth discovered using scientific method • Determinism • Reductionism • Theory testing	• Quantitative
Constructivism	• Multiple realities exist • Meaning is varied and complex • Subjective and socially constructed • Seek complexity of views • Researchers' own realities and views shape the research process	• Qualitative
Pragmatism	• Focused on solutions to problems and consequences of actions • No commitment to any single notion of reality • Application-focused • Pluralistic	• Mixed methods
Transformative	• Closely connected with politics and advocacy • Empowerment-oriented • Focused on reform and change • Collaborative	• Quantitative • Qualitative
Two-eyed seeing	• Mutual strengths of knowledge from Indigenous and Western ways of knowing • Equity in knowledge systems • Premised on respect, reflection, and co-learning	• Quantitative • Qualitative

The bottom line is that what "counts" as knowledge to researchers will influence their entire program of research. Philosophical worldviews provide researchers with a guiding framework that informs their research approach (quantitative, qualitative, or mixed methods), specific strategy of inquiry within that approach, and particular methods used in their research.

Research Abstract Exercise

Although a researcher's philosophical worldview will influence her or his entire research process, many researchers do not explicitly specify a guiding philosophical framework when presenting their research. As such, a researcher's worldview can remain largely hidden from her or his research. Applying your knowledge of postpositivism, constructivism, pragmatism, transformative, and two-eyed seeing worldviews, identify a philosophical worldview that might underlie each of the research studies described in the following research abstracts: