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A theoretical framework is a theory that can be applied to interpret and understand data in your research study. A useful working definition comes from Connaway and Radford (2021): "…a theoretical framework utilizes theory/theories and their constituent elements as the presumed 'working model' that drives the investigation and analysis of a social phenomenon." (Connaway & Radford, 2021) There are a range of theories that each look at the world through different lenses. Each will shape how we look at and interpret our data. For example: Feminists look at the world through the lens of power and oppression of women. Functionalists look at the world and see how the concepts and ideas in our societies have a role in maintaining social order. Behaviorists look at the world and see how incentives – rewards and punishments – shape human behavior. Postmodernists look at the world and see how language and discourse shape belief systems. When selecting a theoretical framework, we're making a conscious decision about our approach and focus. For example, 'feminism' and 'critical theory' are theoretical frameworks that will focus on how power functions in society. This might be useful in a sociological or cultural studies analysis. But they won't be so useful in a study of classroom learning, which might best be served by 'behaviorism' or 'constructivism' as your theoretical frames. Scholarly Fields: Psychology, Education Constructivism is a theory in educational psychology about how people think and learn. It states that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. When new information challenges past beliefs, cognitive dissonance occurs, which is overcome through processes of assimilation and accommodation until we develop a new understanding of what we observe, which is ideally a closer approximation of the truth. It challenges the previously dominant concept in psychology, behaviorism, that states we learn best through rewards, punishments, and forming associations between concepts. Example of Constructivism in the Classroom A researcher examines how students learn about the concept of gravity in a physics classroom. The study would observe the process as the students first encounter basic information, then explore related concepts through hands-on experiments and classroom discussions. The focus of the study would be on how students construct their understanding utilizing prior knowledge and evolving their understanding through experience and reflection. Scholarly Fields: Psychology, Education Behaviorism is a learning theory in behavioral psychology that holds that behaviors are learned through association, trial and error. This theory takes a principled stance that learning needs to be measurable. Inner cognitive states are not taken into account because thoughts are, to behaviorists, not possible to be measured. Therefore, the theory suggests that behavior must be studied in a systematic and observable manner with no consideration of internal mental states. A famous behaviorist study is Pavlov's study of how his dog learned to salivate when he heard a bell ringing, because the dog associated the bell with food. This is now known as a Pavlovian response. Similarly, B.F. Skinner found that rewarding and punishing rats can lead them into learning how to navigate mazes at faster and faster speeds, demonstrating the observable effects of rewards and punishments in learning. If you were to use Behaviorism as your theoretical framework, it would likely inform both your research question – where you may want to focus on a situation where you will measure changes in behaviors through rewards and punishments – as well as your research methods, where you'll likely employ a quantitative research method that measures changes in behaviors, such as application of pre-tests and post-tests in an educational environment. Example of a Study Using a Behaviorist Theoretical Framework In a study using a behaviorist framework, a psychologist might investigate the effects of positive reinforcement on the classroom behavior of elementary school children. The experiment could involve implementing a rewards system for a selected behavior, such as raising a hand before speaking, and observing any changes in the frequency of this behavior. The behaviorist theoretical framework would guide the researcher's expectation that the reinforcement (reward) would increase the occurrence of the desired behavior. Scholarly Fields: Psychology, Social Work Psychoanalytic and psychodynamic theories, originally proposed by Sigmund Freud, posit that human behavior is the result of the interactions among three component parts of the mind: the id, ego, and superego. This theory might be used by a psychology student in their research project where they test patients' behaviors, comparing them to Freud's (or, for that matter, Carl Jung's) theoretical ideas about stages of development, interaction between id, ego, and superego, or the power of the subconscious to affect thoughts and behavior. This theoretical frame is rarely used today, although it acts as a foundation to subsequent theories that are held in higher esteem, such as psychosocial theory, explained next. Example of a Study Using a Psychoanalytic Theoretical Framework A researcher using a psychoanalytic framework might study the influence of early childhood experiences on adult relationship patterns. Through in-depth interviews, the study would examine participants' recollections of their early relationships with their parents and the unconscious conflicts and defenses that may have arisen from these experiences. The study would then look for patterns in the participants' current relationships that might reflect these early experiences and defense mechanisms. Scholarly Fields: Psychology, Social Work Psychosocial theory builds upon (and, in some ways, rejects) Freud's psychoanalytic theory. This theory maintains that subconscious thoughts affect behavior, but focuses on how early social interactions affect outcomes later in life. Erik Erikson, a central figure in the history of psychosocial theory, theorized that humans go through roughly set-in-stone stages of life, where in each stage, we must overcome challenges like industry vs inferiority (where we need to learn to embrace an industrious and creative personality or else risk having an inferiority complex later in life). Psychosocial theory can be applied in the study of how people develop psychological complexes in their lives and helps them overcome them by exploring the origins of these complexes. Example of a Study Using a Psychosocial Theoretical Framework A study based on a psychosocial framework could explore individual patients' core challenges and relate them to Erikson's psychosocial states. The psychosocial theory would guide the interpretation of the results, suggesting that past events, such as being berated by parents, can lead to increased psychological stress. Scholarly Fields: Sociology, Cultural Studies, and more Feminism is a social and political framework that analyzes the status of women and men in society with the purpose of using that knowledge to promote women's rights and interests. Generally, a person applying a feminist framework would have at the core of their research question an interest in how women are positioned in society in relation to men, and how their lives and personal agency is shaped and structured by a manufactured gender hirearchy. Of course, within Feminism, there are a range of conflicting views and perspectives. The intersectional feminists are highly concerned with how black, working-class, and other marginalized women face compounding disadvantages; whereas other feminists might focus exclusively on gender in the workforce, or even how women's rights intersect with, and are possibly impacted by, trans* rights. Example of a Study Using a Feminist Theoretical Framework A researcher could use a feminist theoretical framework to investigate gender bias in workplace promotions within a large corporation. The study might involve collecting and analyzing qualitative data and quantitative data on promotion rates, gender ratios in upper management, and employee experiences related to promotion opportunities. From a feminist perspective, the study would aim to identify any potential systemic inequalities and their impact on women's career trajectories. Scholarly Fields: Sociology, Cultural Studies Conflict theory is a framework derived from Marxism's teachings about the operation of power through economic and cultural apparatuses in a society. It generally works to highlight the role of coercion and power, particularly as it relates to social class and possession of economic capital. Generally, this approach will involve an examination of the ways the economy, policy documents, media, and so forth, distribute power in a capitalist context. Other conflict theorists might examine non-capitalist contexts, such as workers' cooperatives with the intention of exploring possibilities for economic and cultural life in a post-capitalist society. Example of a Study Using a Conflict Theory Framework A sociologist might utilize conflict theory to study wealth and income disparities within a specific urban community. This study might involve the analysis of economic data, alongside a consideration of social and political structures in the community. The conflict theory would guide an understanding of how wealth and power disparities contribute to social tensions and conflict. Scholarly Fields: Sociology (see the separate concept: Functionalism in Psychology) Functionalism, based on the works of Durkheim. Merton and their contemporaries, is an approach to sociology that assumes each aspect of society is interdependent and contributes to society's functioning as a whole. Functionalism often leans on the analogy of the human body to describe society. Just as the human body has organs which each have a purpose (i.e. a function), each social institution also serves a function to support the whole. So, a functionalist theoretical framework aims to examine social institutions and social structures (e.g. economic conditions, family relationships, religious practices, media outlets, etc.) to explore how they do or do not fulfill their purposes. Building on Merton's work in functionalism, many functionalist studies in sociology also explore how institutions have both manifest functions (intended purposes and consequences) and latent functions (unintended purposes and functions). Key social institutions explored in functionalism in sociology include: the education system, hospitals, workplaces, factories, religion, and families. Example of a Study Using a Functionalist Theoretical Framework A key question in functionalism is: "What is the role of this institution in upholding society, the status quo, and social hierarchies?" Following this approach, an educational researcher using a functionalist framework might study the role of schools in preparing students for various roles in society. They might collect data on curriculum, teaching methods, student performance, and post-graduation outcomes. Using a functionalist lens, the researcher would be interested in how each aspect of the education system contributes to the socialization process and preparation of individuals for adulthood and societal roles. Scholarly Fields: Sociology (see: symbolic interactionism in sociology) The symbolic interaction theory states that the meaning we ascribe to objects, processes, ideas, concepts, and systems are subjective. They are constructed through language, words, and communication, and differ from context to context and culture to culture. Symbolic interactionism is very common in qualitative research in the social sciences, especially work that involves interviews as a research method. Symbolic interaction is a theoretical frame that challenges that of functionalism by focusing on microsociology rather than macrosociology. Whereas functionalists are generally concerned with how social structures, institutions, and concepts have meaning on a social level, symbolic interactionists are concerned with how people make their own meanings of things in their surroundings. For example, symbolic interactionism argues that people derive their understanding of their world through social interactions and personal experiences and interpretations. Example of a Study Using a Symbolic Interactionist Framework A researcher applying symbolic interactionist theory might investigate how medical patients and doctors negotiate understandings of illness during medical consultations. The study would likely involve observations and perhaps recordings of consultations, focusing on the language and symbols used by both parties. A symbolic interactionist approach would highlight how shared meanings and interpretations are built in these interactions, impacting the patient-doctor relationship and treatment decisions. Scholarly Fields: Sociology, Cultural Studies, Media Studies Postmodern theory critiques social narratives, beliefs, and definitions, arguing that they're historically, culturally and socially situated. A key concept in postmodernism is discourse, which refers to how knowledge is constructed through language. The ways people talk about something constructs normative ideas about it (i.e. ideas, like gender, a socially constructed). Postmodernists are therefore skeptical of truth-claims made about anything. Their research aims to demonstrate how truth-claims, such as "men are natural-born leaders" emerge through language and social narratives that normalize such as belief. Postmodernism's role, therefore. Is to highlight the relativity of truths and social narratives propagated by media and culture. Example of a Study Using a Postmodern Theoretical Framework A researcher using a postmodernist framework might conduct a study analyzing the portrayal of reality in contemporary television news. They might examine the selection and presentation of stories, the use of imagery and language, and the underlying assumptions about truth and objectivity. From a postmodernist perspective, the study would not be looking for an objective reality represented in the news but would explore how the news constructs multiple, subjective realities. Choosing a theoretical framework is an early step in developing your research study. Once it is selected, it will go on to inform your research methodology and methods of data collection and analysis. Furthermore, in your analysis chapters of your dissertation, you will be regularly leaning upon the ideas and concepts within your chosen theoretical framework to shed light on your observations. Academic research that uses theoretical frameworks is all about using theory to interpret the world and shed new light on phenomena. With theory, we can develop a cohesive understanding of our subjects and construct detailed, well-thought-out arguments throughout our work. Anfara Jr, V. A., & Mertz, N. T. (Eds.). (2014). Theoretical frameworks in qualitative research. Sage publications. Borsboom, D., van der Maas, H. L., Dalege, J., Kievit, R. A., & Haig, B. D. (2021). Theory construction methodology: A practical framework for building theories in psychology. Perspectives on Psychological Science, 16(4), 756-766. Connaway, L. S., & Radford, M. L. (2016). Research methods in library and information science. Los Angeles: ABC-CLIO. Given, L. M. (Ed.). (2008). The Sage encyclopedia of qualitative research methods. Sage publications. Gelso, C. J. (2006). Applying theories to research. The psychology research handbook: A guide for graduate students and research assistants, 455. Educators often approach their craft from one or several overarching theoretical frameworks, also sometimes referred to as pedagogies/instructional epistemologies. Why is it important to consider a theoretical framework? Depending on your outcomes, you may find specific teaching methods/strategies fit better with your framework. You may also find certain frameworks mesh better with your content discipline. Additionally, awareness of a range of frameworks can promote productive experimentation and diversity of skill sets. No framework is necessarily more effective than another because frameworks only serve to provide a conceptual overview, separate from methodologies or implementation. Though there are thousands of theoretical frameworks used in teaching, some of the more popular frameworks are:Andragogy/Adult Learning Theory – Theorists like Knowles (1980) believed adults are problem-oriented participants who want to incorporate experience and self-direction into subjects or projects that are relevant to their lives. Andragogic education tends to incorporate methods like constructivism and connectivism, leveraging task-oriented processes and projects and stressing application.Behaviorism – Theorists like Skinner (1953) often focused on observable behavior, believing learning was supported through drill and practice and related reinforcement. Behaviorist instruction tends to be directive, incorporating lectures and practice problems, often using objective assessments, including multiple-choice questions or other rote approaches. Cognitivism – Theorists like Gagné (Gagne, Wager, Golas, & Keller, 2004) focused more on thought processes and structures. For instance, Gagné developed nine events of instruction to describe optimal conditions for learning. Cognitivist instruction often incorporates lectures along with methods like visual tools or organizers to promote retention. It may use objective assessments with multiple choice, though also including response or essay activities for learners to demonstrate thought processes.Connectivism – Theorists like Siemens and Downes (2009) saw learners as part of many nodes or connections, driving their personal learning by leveraging the knowledge of that network, and contributing to the knowledge infrastructure. Connectivist instruction tends to be self-directed, including a variety of information sources/references, and is often used in online education. It could also be considered a constructivist approach.Constructivism – Theorists like Piaget (1950) & Brunner (1961) proposed individuals construct knowledge from within, contributing to the process by incorporating personal experience. Constructivist instruction tends to be social and exploratory, sometimes without clearly defined outcomes, often leveraging critical thinking activities, peer review, and/or collaborative projects.Objectivism – Theorists or writers like Rand (1943) believed knowledge exists outside the individual as opposed to constructivist perspectives valuing knowledge from within. Objectivist frameworks can describe both behaviorist and cognitivist perspectives. Objectivist instruction tends to be directive and linear, valuing inductive logic, and often leverages objective assessments.You can read more about these frameworks and how they might be practically applied through resources such as:Gitterman, A. (2004). Interactive andragogy: Principles, methods, and skills. Journal of Teaching in Social Work, 24(¾), 95-112. Retrieved from M. N. (2013). Extending the learning process: Using the theory of connectivism to inspire student collaboration. CULS Proceedings, 3, 18-27. Retrieved from G. P. & Janicki, T. J. (2013). Online course pedagogy and the constructivist learning model. Journal of the Southern Association for Information Systems, 1(1). Retrieved from ⧫Sobels, J. Szili, G., & Bass, D. (2015). Using constructivist teaching tools to stimulate active learning in first year environmental management undergraduates. Planet, 25(1), 21-26. Retrieved from ⧫Brunner, J.S. (1961). The act of discovery. Harvard Educational Review.Downes, S., & Siemens, G. (2009). Connectivism and connective knowledge: Getting started. MOOC Course, University of Manitoba. Gagne, R. M., Wager, W. W., Golas, K. C., Keller, J. M., & Russell, J. D. (2005). Principles of instructional design. Performance Improvement, 44(2), 44-46. Knowles, M. S. (1980). The modern practice of adult education: From pedagogy to andragogy. Piaget, J. (2005). The Psychology of Intelligence. Routledge. Rand, A. (1943). Introduction to Objective Epistemology: Expanded Second Edition. Penguin. Skinner, B. F. (1953). Science and Human Behavior. Simon and Schuster. A theoretical framework provides a structure for research by linking the study to existing theories, concepts, or models. It serves as a lens through which the research problem is examined, offering a foundation for understanding and analyzing data. Theoretical frameworks are crucial in ensuring the study is grounded in established knowledge and contributes meaningfully to the field. This article explores the definition, types, examples, and a step-by-step writing guide for creating an effective theoretical framework. A theoretical framework is a conceptual model that defines the key concepts, variables, and their relationships within a study. It provides a foundation for the research by situating it within a broader body of knowledge. The framework connects the research problem, objectives, and hypotheses to established theories or models, ensuring that the study aligns with academic principles. Example: A study exploring employee motivation might use Maslow's Hierarchy of Needs as the theoretical framework to analyze factors influencing workplace satisfaction. Guides Research Design: Helps identify research questions, hypotheses, and methodologies. Establishes Relevance: Connects the study to established theories and highlights its contribution to the field. Explains Relationships: Provides clarity on how variables interact within the research context. Improves Rigor: Ensures the study is grounded in academic principles, enhancing its credibility. Enables Comparisons: Facilitates comparisons with other studies using similar theoretical foundations. Description: Focus on describing phenomena without attempting to explain causes or relationships. Use Case: Often used in exploratory research or studies aimed at documenting phenomena. Example: Using Erikson's stages of psychosocial development to describe the challenges faced by adolescents. Description: Seek to explain why and how phenomena occur by establishing causal relationships. Use Case: Common in hypothesis-driven research. Example: Applying the Theory of Planned Behavior to understand factors influencing recycling habits. Description: Aim to predict outcomes based on identified variables and established relationships. Use Case: Frequently used in quantitative research. Example: Using Expectancy Theory to predict employee performance based on motivation levels. Description: Focus on organizing and integrating concepts from various theories to address a specific research problem. Use Case: Useful in multidisciplinary studies. Example: Combining theories of technology adoption and user satisfaction to study e-learning platforms. Description: Compare different theoretical perspectives to analyze a phenomenon. Use Case: Employed in research seeking to contrast various schools of thought. Example: Comparing Piaget's and Vygotsky's theories of cognitive development in understanding classroom learning. Framework: Social Cognitive Theory Application: Examining how self-efficacy influences academic performance in students. Framework: Conflict Theory Application: Analyzing the impact of income inequality on access to education. Framework: Constructivist Learning Theory Application: Exploring the effectiveness of project-based learning in enhancing critical thinking skills. Framework: Resource-Based View (RBV) Application: Studying how internal resources affect a company's competitive advantage. Framework: Health Belief Model Application: Investigating factors influencing patients' adherence to prescribed medications. Define the main variables or concepts relevant to your research. Example: In a study on employee productivity, key concepts might include motivation, job satisfaction, and performance. Explore existing theories, models, and studies related to your research problem. Example: Reviewing Herzberg's Two-Factor Theory for insights into workplace motivation. Select a theory that aligns with your research objectives and provides a clear framework for analysis. Example: Using the Theory of Planned Behavior for a study on healthy eating habits. Explain how the variables in your study are related based on the chosen theory. Example: Hypothesizing that increased job satisfaction leads to higher productivity, guided by Maslow's theory. Explain why the selected theory is suitable for your research. Example: "Maslow's Hierarchy of Needs is chosen because it comprehensively addresses the motivational factors affecting employee behavior." Create a conceptual diagram or flowchart showing the relationships between variables. Example: A chart linking motivation to productivity through variables like incentives and work environment. Present the theoretical framework in a structured format, typically in the literature review or methodology section. Study Topic: Factors Influencing E-Learning Adoption Among College Students Framework:This study employs the Technology Acceptance Model (TAM) to examine the adoption of e-learning platforms among college students. According to TAM, two primary factors influence technology adoption: perceived ease of use (PEOU) and perceived usefulness (PU). Perceived Ease of Use: Refers to the degree to which students believe the platform is user-friendly. Perceived Usefulness: Represents the extent to which students perceive the platform as enhancing their learning experience. These factors interact with external variables such as prior technological exposure and accessibility. By applying TAM, the study aims to identify barriers to e-learning adoption and provide recommendations for improving platform design and usability. Be Concise: Focus on the key theories and concepts directly relevant to your study. Ensure Clarity: Clearly define how the theory applies to your research problem. Use Credible Sources: Reference original works or reputable studies to support your framework. Visualize Relationships: Use diagrams or flowcharts to illustrate connections between variables. Adapt as Necessary: Modify or combine theories to suit the specific needs of your research. Lack of Focus: Including unrelated or overly broad theories can dilute the framework's impact. Poor Justification: Failing to explain why the chosen theory is relevant. Overcomplication: Using too many theories or concepts without clear connections. Ignoring Alternatives: Not considering other theories that could explain the phenomenon. Weak Integration: Failing to link the framework to research objectives or hypotheses. The theoretical framework is a critical component of research, providing a structured foundation for analyzing and interpreting data. By identifying relevant theories, defining key concepts, and explaining their relationships, researchers can ensure their study is grounded in established knowledge. Following the types, examples, and writing guide outlined here, you can create a robust theoretical framework that enhances the clarity, credibility, and impact of your research. Creswell, J. W. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Sage Publications. Bryman, A. (2015). Social Research Methods. Oxford University Press. Kumar, R. (2019). Research Methodology: A Step-by-Step Guide for Beginners. Sage Publications. Maxwell, J. A. (2013). Qualitative Research Design: An Interactive Approach. Sage Publications. Glanz, K., Rimer, B. K., & Viswanath, K. (2015). Health Behavior: Theory, Research, and Practice. Jossey-Bass. As a library, NLM provides access to scientific literature. Inclusion in an NLM database does not imply endorsement of, or agreement with, the contents by NLM or the National Institutes of Health. Learn more: PMC Disclaimer | PMC Copyright Notice . 2022 Fall;21(3):rm33. doi: 10.1187/cbe.21-05-0134 To frame their work, biology education researchers need to consider the role of literature reviews, theoretical frameworks, and conceptual frameworks as critical elements of the research and writing process. However, these elements can be confusing for scholars new to education research. This Research Methods article is designed to provide an overview of each of these elements and delineate the purpose of each in the educational research process. We describe what biology education researchers should consider as they conduct literature reviews, identify theoretical frameworks, and construct conceptual frameworks. Clarifying these different components of educational research studies can be helpful to new biology education researchers and the biology education research community at large in situating their work in the broader scholarly literature. Discipline-based education research (DBER) involves the purposeful and situated study of teaching and learning in specific disciplinary areas (Singer et al., 2012). Studies in DBER are guided by research questions that reflect disciplines' priorities and worldviews. Researchers can use quantitative data, qualitative data, or both to answer these research questions through a variety of methodological traditions. Across all methodologies, there are different methods associated with planning and conducting educational research studies that include the use of surveys, interviews, observations, artifacts, or instruments. Ensuring the coherence of these elements to the discipline's perspective also involves situating the work in the broader scholarly literature. The tools for doing this include literature reviews, theoretical frameworks, and conceptual frameworks. However, the purpose and function of each of these elements is often confusing to new education researchers. The goal of this article is to introduce new biology education researchers to these three important elements important in DBER scholarship and the broader educational literature. The first element we discuss is a review of research (literature reviews), which highlights the need for a specific research question, study problem, or topic of investigation. Literature reviews situate the relevance of the study within a topic and a field. The process may seem familiar to science researchers entering DBER fields, but new researchers may still struggle in conducting the review. Booth et al. (2016b) highlight some of the challenges novice education researchers face when conducting a review of literature. They point out that novice researchers struggle in deciding how to focus the review, determining the scope of articles needed in the review, and knowing how to be critical of the articles in the review. Overcoming these challenges (and others) can help novice researchers construct a sound literature review that can inform the design of the study and help ensure the work makes a contribution to the field. The second and third highlighted elements are theoretical and conceptual frameworks. These guide biology education research (BER) studies, and may be less familiar to science researchers. These elements are important in shaping the construction of new knowledge. Theoretical frameworks offer a way to explain and interpret the studied phenomenon, while conceptual frameworks clarify assumptions about the studied phenomenon. Despite the importance of these constructs in educational research, biology educational researchers have noted the limited use of theoretical or conceptual frameworks in published work (DeHaan, 2011; Dirks, 2011; Lo et al., 2019). In reviewing articles published in CBE—Life Sciences Education (LSE) between 2015 and 2019, we found that fewer than 25% of the research articles had a theoretical or conceptual framework (see the Supplemental Information), and at times there was an inconsistent use of theoretical and conceptual frameworks. Clearly, these frameworks are challenging for published biology education researchers, which suggests the importance of providing some initial guidance to new biology education researchers. Fortunately, educational researchers have increased their explicit use of these frameworks over time, and this is influencing educational research in science, technology, engineering, and mathematics (STEM) fields. For instance, a quick search for theoretical or conceptual frameworks in the abstracts of articles in Educational Research Complete (a common database for educational research) in STEM fields demonstrates a dramatic change over the last 20 years: from only 778 articles published between 2000 and 2010 to 5703 articles published between 2010 and 2020, a more than sevenfold increase. Greater recognition of the importance of these frameworks is contributing to DBER authors being more explicit about such frameworks in their studies. Collectively, literature reviews, theoretical frameworks, and conceptual frameworks work to guide methodological decisions and the elucidation of important findings. Each offers a different perspective on the problem of study and is an essential element in all forms of educational research. As new researchers seek to learn about these elements, they will find different resources, a variety of perspectives, and many suggestions about the construction and use of these elements. The wide range of available information can overwhelm the new researcher who just wants to learn the distinction between these elements or how to craft them adequately. Our goal in writing this paper is not to offer specific advice about how to write these sections in scholarly work. Instead, we wanted to introduce these elements to those who are new to BER and who are interested in better distinguishing one from the other. In this paper, we share the purpose of each element in BER scholarship, along with important points on its construction. We also provide references for additional resources that may be beneficial to better understanding each element. Table 1 summarizes the key distinctions among these elements. Comparison of literature reviews, theoretical frameworks, and conceptual reviews Literature reviews Theoretical frameworks Conceptual frameworks Purpose To point out the need for the study in BER and connection to the field. To state the assumptions and orientations of the researcher regarding the topic of study To describe the researcher's understanding of the main concepts under investigation Aims A literature review examines current and relevant research associated with the study question. It is comprehensive, critical, and purposeful. A theoretical framework illuminates the phenomenon of study and the corresponding assumptions adopted by the researcher. Frameworks can take on different orientations. The conceptual framework is created by the researcher(s), includes the presumed relationships among concepts, and addresses needed areas of study discovered in literature reviews. Connection to the manuscript A literature review should connect to the study question, guide the study methodology, and be central in the discussion by indicating how the analyzed data advances what is known in the field. A theoretical framework drives the question, guides the types of methods for data collection and analysis, informs the discussion of the findings, and reveals the subjectivities of the researcher. The conceptual framework is informed by literature reviews, experiences, or experiments. It may include emergent ideas that are not yet grounded in the literature. It should be coherent with the paper's theoretical framing. Additional points A literature review may reach beyond BER and include other education research fields. A theoretical framework does not rationalize the need for the study, and a theoretical framework can come from different fields. A conceptual framework articulates the phenomenon under study through written descriptions and/or visual representations. This article is written for the new biology education researcher who is just learning about these different elements or for scientists looking to become more involved in BER. It is a result of our own work as science education and biology education researchers, whether as graduate students and postdoctoral scholars or newly hired and established faculty members. This is the article we wish had been available as we started to learn about these elements or discussed them with new educational researchers in biology. A literature review is foundational to any research study in education or science. In education, a well-conceptualized and well-executed review provides a summary of the research that has already been done on a specific topic and identifies questions that remain to be answered, thus illustrating the current research project's potential contribution to the field and the reasoning behind the methodological approach selected for the study (Maxwell, 2012). BER is an evolving disciplinary area that is redefining areas of conceptual emphasis as well as orientations toward teaching and learning (e.g., Labov et al., 2010; American Association for the Advancement of Science, 2011; Nehm, 2019). As a result, building comprehensive, critical, purposeful, and concise literature reviews can be a challenge for new biology education researchers. There are different ways to approach and construct a literature review. Booth et al. (2016a) provide an overview that includes, for example, scoping reviews, which are focused only on notable studies and use a basic method of analysis, and integrative reviews, which are the result of exhaustive literature searches across different genres. Underlying each of these different review processes are attention to the search process, appraisal of articles, synthesis of the literature, and analysis: SALSA (Booth et al., 2016a). This useful acronym can help the researcher focus on the process while building a specific type of review. However, new educational researchers often have questions about literature reviews that are foundational to SALSA or other approaches. Common questions concern determining which literature pertains to the topic of study or the role of the literature review in the design of the study. This section addresses such questions broadly while providing general guidance for writing a narrative literature review that evaluates the most pertinent studies. The literature review process should begin before the research is conducted. As Boote and Beile (2005, p. 3) suggested, researchers should be "scholars before researchers." They point out that having a good working knowledge of the proposed topic helps illuminate avenues of study. Some subject areas have a deep body of work to read and reflect upon, providing a strong foundation for developing the research question(s). For instance, the teaching and learning of evolution is an area of long-standing interest in the BER community, generating many studies (e.g., Perry et al., 2008; Barnes and Brownell, 2016) and reviews of research (e.g., Sickel and Friedrichsen, 2013; Ziadie and Andrews, 2018). Emerging areas of BER include the affective domain, issues of transfer, and metacognition (Singer et al., 2012). Many studies in these areas are transdisciplinary and not always specific to biology education (e.g., Rodrigo-Peiris et al., 2018; Kolpikova et al., 2019). These newer areas may require reading outside BER; fortunately, summaries of some of these topics can be found in the Current Insights section of the LSE website. In focusing on a specific problem within a broader research strand, a new researcher will likely need to examine research outside BER. Depending upon the area of study, the expanded reading list might involve a mix of BER, DBER, and educational research studies. Determining the scope of the reading is not always straightforward. A simple way to focus one's reading is to create a "summary phrase" or "research nugget," which is a very brief descriptive statement about the study. It should focus on the essence of the study, for example, "first-year nonmajor students' understanding of evolution," "metacognitive prompts to enhance learning during biochemistry," or "instructors' inquiry-based instructional practices after professional development programming." This type of phrase should help a new researcher identify two or more areas to review that pertain to the study. Focusing on recent research in the last 5 years is a good first step. Additional studies can be identified by reading relevant works referenced in those articles. It is also important to read seminal studies that are more than 5 years old. Reading a range of studies should give the researcher the necessary command of the subject in order to suggest a research question. Given that the research question(s) arise from the literature review, the review should also substantiate the selected methodological approach. The review and research question(s) guide the researcher in determining how to collect and analyze data. Often the methodological approach used in a study is selected to contribute knowledge that expands upon what has been published previously about the topic (see Institute of Education Sciences and National Science Foundation, 2013). An emerging topic of study may need an exploratory approach that allows for a description of the phenomenon and development of a potential theory. This could, but not necessarily, require a methodological approach that uses interviews, observations, surveys, or other instruments. An extensively studied topic may call for the additional understanding of specific factors or variables; this type of study would be well suited to a verification or a causal research design. These could entail a methodological approach that uses valid and reliable instruments, observations, or interviews to determine an effect in the studied event. In either of these examples, the researcher(s) may use a qualitative, quantitative, or mixed methods methodological approach. Even with a good research question, there is still more reading to be done. The complexity and focus of the research question dictates the depth and breadth of the literature to be examined. Questions that connect multiple topics can require broad literature reviews. For instance, a study that explores the impact of a biology faculty learning community on the inquiry instruction of faculty could have the following review areas: learning communities among biology faculty, inquiry instruction among biology faculty, and inquiry instruction among biology faculty as a result of professional learning. Biology education researchers need to consider whether their literature review requires studies from different disciplines within or outside DBER. For the example given, it would be fruitful to look at research focused on learning communities with faculty in STEM fields or in general education fields that result in instructional change. It is important not to be too narrow or too broad when reading. When the conclusions of articles start to sound similar or no new insights are gained, the researcher likely has a good foundation for a literature review. This level of reading should allow the researcher to demonstrate a mastery in understanding the researched topic, explain the suitability of the proposed research approach, and point to the need for the refined research question(s). The literature review should include the researcher's evaluation and critique of the selected studies. A researcher may have a large collection of studies, but not all of the studies will follow standards important in the reporting of empirical work in the social sciences. The American Educational Research Association (Duran et al., 2006), for example, offers a general discussion about standards for such work: an adequate review of research informing the study, the existence of sound and appropriate data collection and analysis methods, and appropriate conclusions that do not overstep or underexplore the analyzed data. The Institute of Education Sciences and National Science Foundation (2013) also offer Common Guidelines for Education Research and Development that can be used to evaluate collected studies. Because not all journals adhere to such standards, it is important that a researcher review each study to determine the quality of published research, per the guidelines suggested earlier. In some instances, the research may be fatally flawed. Examples of such flaws include data that do not pertain to the question, a lack of discussion about the data collection, poorly constructed instruments, or an inadequate analysis. These types of errors result in studies that are incomplete, error-laden, or inaccurate and should be excluded from the review. Most studies have limitations, and the author(s) often make them explicit. For instance, there may be an instructor effect, recognized bias in the analysis, or issues with the sample population. Limitations are usually addressed by the research team in some way to ensure a sound and acceptable research process. Occasionally, the limitations associated with the study can be significant and not addressed adequately, which leaves a consequential decision in the hands of the researcher. Providing critiques of studies in the literature review process gives the reader confidence that the researcher has carefully examined relevant work in preparation for the study and, ultimately, the manuscript. A solid literature review clearly anchors the proposed study in the field and connects the research question(s), the methodological approach, and the discussion. Reviewing extant research leads to research questions that will contribute to what is known in the field. By summarizing what is known, the literature review points to what needs to be known, which in turn guides decisions about methodology. Finally, notable findings of the new study are discussed in reference to those described in the literature review. Within published BER studies, literature reviews can be placed in different locations in an article. When included in the introductory section of the study, the first few paragraphs of the manuscript set the stage, with the literature review following the opening paragraphs. Cooper et al. (2019) illustrate this approach in their study of course-based undergraduate research experiences (CUREs). An introduction discussing the potential of CURES is followed by an analysis of the existing literature relevant to the design of CUREs that allows for novel student discoveries. Within this review, the authors point out contradictory findings among research on novel student discoveries. This clarifies the need for their study, which is described and highlighted through specific research aims. A literature reviews can also make up a separate section in a paper. For example, the introduction to Todd et al. (2019) illustrates the need for their research topic by highlighting the potential of learning progressions (LPs) and suggesting that LPs may help mitigate learning loss in genetics. At the end of the introduction, the authors state their specific research questions. The review of literature following this opening section comprises two subsections. One focuses on learning loss in general and examines a variety of studies and meta-analyses from the disciplines of medical education, mathematics, and reading. The second section focuses specifically on LPs in genetics and highlights student learning in the midst of LPs. These separate reviews provide insights into the stated research question. A well-conceptualized, comprehensive, and critical literature review reveals the understanding of the topic that the researcher brings to the study. Literature reviews should not be so big that there is no clear area of focus; nor should they be so narrow that no real research question arises. The task for a researcher is to craft an efficient literature review that offers a critical analysis of published work, articulates the need for the study, guides the methodological approach to the topic of study, and provides an adequate foundation for the discussion of the findings. In our own writing of literature reviews, there are often many drafts. An early draft may seem well suited to the study because the need for and approach to the study are well described. However, as the results of the study are analyzed and findings begin to emerge, the existing literature review may be inadequate and need revision. The need for an expanded discussion about the research area can result in the inclusion of new studies that support the explanation of a potential finding. The literature review may also prove to be too broad. Refocusing on a specific area allows for more contemplation of a finding. It should be noted that there are different types of literature reviews, and many books and articles have been written about the different ways to embark on these types of reviews. Among these different resources, the following may be helpful in considering how to refine the review process for scholarly journals: Booth, A., Sutton, A., & Papaioannou, D. (2016a). Systemic approaches to a successful literature review (2nd ed.). Los Angeles, CA: Sage. This book addresses different types of literature reviews and offers important suggestions pertaining to defining the scope of the literature review and assessing extant studies. Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & Fitzgerald, W. T. (2016b). The craft of research (4th ed.). Chicago: University of Chicago Press. This book can help the novice consider how to make the case for an area of study. While this book is not specifically about literature reviews, it offers suggestions about making the case for your study. Galvan, J. L., & Galvan, M. C. (2017). Writing literature reviews: A guide for students of the social and behavioral sciences (7th ed.). Routledge. This book offers guidance on writing different types of literature reviews. For the novice researcher, there are useful suggestions for creating coherent literature reviews. As new education researchers may be less familiar with theoretical frameworks than with literature reviews, this discussion begins with an analogy. Envision a biologist, chemist, and physicist examining together the dramatic effect of a fog tsunami over the ocean. A biologist gazing at this phenomenon may be concerned with the effect of fog on various species. A chemist may be interested in the chemical composition of the fog as water vapor condenses around bits of salt. A physicist may be focused on the refraction of light to make fog appear to be "sitting" above the ocean. While observing the same "objective event," the scientists are operating under different theoretical frameworks that provide a particular perspective or "lens" for the interpretation of the phenomenon. Each of these scientists brings specialized knowledge, experiences, and values to this phenomenon, and these influence the interpretation of the phenomenon. The scientists' theoretical frameworks influence how they design and carry out their studies and interpret their data. Within an educational study, a theoretical framework helps to explain a phenomenon through a particular lens and challenges and extends existing knowledge within the limitations of that lens. Theoretical frameworks are explicitly stated by an educational researcher in the paper's framework, theory, or relevant literature section. The framework shapes the types of questions asked, guides the method by which data are collected and analyzed, and informs the discussion of the results of the study. It also reveals the researcher's subjectivities, for example, values, social experience, and viewpoint (Allen, 2017). It is essential that a novice researcher learn to explicitly state a theoretical framework, because all research questions are being asked from the researcher's implicit or explicit assumptions of a phenomenon of interest (Schwandt, 2000). Theoretical frameworks are one of the most contemplated elements in our work in educational research. In this section, we share three important considerations for new scholars selecting a theoretical framework. The first step in identifying a theoretical framework involves reflecting on the phenomenon within the study and the assumptions aligned with the phenomenon. The phenomenon involves the studied event. There are many possibilities, for example, student learning, instructional approach, or group organization. A researcher holds assumptions about how the phenomenon will be effected, influenced, changed, or portrayed. It is ultimately the researcher's assumption(s) about the phenomenon that aligns with a theoretical framework. An example can help illustrate how a researcher's reflection on the phenomenon and acknowledgment of assumptions can result in the identification of a theoretical framework. In our example, a biology education researcher may be interested in exploring how students' learning of difficult biological concepts can be supported by the interactions of group members. The phenomenon of interest is the interactions among the peers, and the researcher assumes that more knowledgeable students are important in supporting the learning of the group. As a result, the researcher may draw on Vygotsky's (1978) sociocultural theory of learning and development that is focused on the phenomenon of student learning in a social setting. This theory posits the critical nature of interactions among students and between students and teachers in the process of building knowledge. A researcher drawing upon this framework holds the assumption that learning is a dynamic social process involving questions and explanations among students in the classroom and that more knowledgeable peers play an important part in the process of building conceptual knowledge. It is important to state at this point that there are many different theoretical frameworks. Some frameworks focus on learning and knowing, while other theoretical frameworks focus on equity, empowerment, or discourse. Some frameworks are well articulated, and others are still being refined. For a new researcher, it can be challenging to find a theoretical framework. Two of

different constructs or different terms for similar and overlapping constructs (e.g., inquiry, teacher beliefs, pedagogical content knowledge, or active learning). Authors must describe their conceptualization of a construct if the research is to be understandable and useful. There are some key areas to consider regarding the inclusion of a conceptual framework in a study. To begin with, it is important to recognize that conceptual frameworks are constructed by the researchers conducting the study (Rocco and Plakhotnik, 2009; Maxwell, 2012). This is different from theoretical frameworks that are often taken from established literature. Researchers should bring together ideas from the literature, but they may be influenced by their own experiences as a student and/or instructor, the shared experiences of others, or thought experiments as they construct a description, model, or representation of their understanding of the phenomenon under study. This is an exercise in intellectual organization and clarity that often considers what is learned, known, and experienced. The conceptual framework makes these constructs explicitly visible to readers, who may have different understandings of the phenomenon based on their prior knowledge and experience. There is no single method to go about this intellectual work. Reeves et al. (2016) is an example of an article that proposed a conceptual framework about graduate teaching assistant professional development evaluation and research. The authors used existing literature to create a novel framework that filled a gap in current research and practice related to the training of graduate teaching assistants. This conceptual framework can guide the systematic collection of data by other researchers because the framework describes the relationships among various factors that influence teaching and learning. The Reeves et al. (2016) conceptual framework may be modified as additional data are collected and analyzed by other researchers. This is not uncommon, as conceptual frameworks can serve as catalysts for concerted research efforts that systematically explore a phenomenon (e.g., Reynolds et al., 2012; Brownell and Kloser, 2015). Sabel et al. (2017) used a conceptual framework in their exploration of how scaffolds, an external factor, interact with internal factors to support student learning. Their conceptual framework integrated principles from two theoretical frameworks, self-regulated learning and metacognition, to illustrate how the research team conceptualized students' use of scaffolds in their learning (Figure 1). Sabel et al. (2017) created this model using their interpretations of these two frameworks in the context of their teaching. Conceptual framework from Sabel et al. (2017).A conceptual framework should describe the relationship among components of the investigation (Anfara and Mertz, 2014). These relationships should guide the researcher's methods of approaching the study (Miles et al., 2014) and inform both the data to be collected and how those data should be analyzed. Explicitly describing the connections among the ideas allows the researcher to justify the importance of the study and the rigor of the research design. Just as importantly, these frameworks help readers understand why certain components of a system were not explored in the study. This is a challenge in education research, which is rooted in complex environments with many variables that are difficult to control. For example, Sabel et al. (2017) stated: "Scaffolds, such as enhanced answer keys and reflection questions, can help students and instructors bridge the external and internal factors and support learning" (p. 3). They connected the scaffolds in the study to the three dimensions of metacognition and the eventual transformation of existing ideas into new or revised ideas. Their framework provides a rationale for focusing on how students use two different scaffolds, and not on other factors that may influence a student's success (self-efficacy, use of active learning, exam format, etc.). In constructing conceptual frameworks, researchers should address needed areas of study and/or contradictions discovered in literature reviews. By attending to these areas, researchers can strengthen their arguments for the importance of a study. For instance, conceptual frameworks can address how the current study will fill gaps in the research, resolve contradictions in existing literature, or suggest a new area of study. While a literature review describes what is known and not known about the phenomenon, the conceptual framework leverages these gaps in describing the current study (Maxwell, 2012). In the example of Sabel et al. (2017), the authors indicated there was a gap in the literature regarding how scaffolds engage students in metacognition to promote learning in large classes. Their study helps fill that gap by describing how scaffolds can support students in the three dimensions of metacognition: intelligibility, plausibility, and wide applicability. In another example, Lane (2016) integrated research from science identity, the ethic of care, the sense of belonging, and an expertise model of student success to form a conceptual framework that addressed the critiques of other frameworks. In a more recent example, Sbeglia et al. (2021) illustrated how a conceptual framework influences the methodological choices and inferences in studies by educational researchers. Sometimes researchers draw upon the conceptual frameworks of other researchers. When a researcher's conceptual framework closely aligns with an existing framework, the discussion may be brief. For example, Ghee et al. (2016) referred to portions of SCCT as their conceptual framework to explain the significance of their work on students' self-efficacy and career interests. Because the authors' conceptualization of this phenomenon aligned with a previously described framework, they briefly mentioned the conceptual framework and provided additional citations that provided more detail for the readers. Within both the BER and the broader DBER communities, conceptual frameworks have been used to describe different constructs. For example, some researchers have used the term "conceptual framework" to describe students' conceptual understandings of a biological phenomenon. This is distinct from a researcher's conceptual framework of the educational phenomenon under investigation, which may also need to be explicitly described in the article. Other studies have presented a research logic model or flowchart of the research design as a conceptual framework. These constructions can be quite valuable in helping readers understand the data-collection and analysis process. However, a model depicting the study design does not serve the same role as a conceptual framework. Researchers need to avoid conflating these constructs by differentiating the researchers' conceptual framework that guides the study from the research design, when applicable. Explicitly describing conceptual frameworks is essential in depicting the focus of the study. We have found that being explicit in a conceptual framework means using accepted terminology, referencing prior work, and clearly noting connections between terms. This description can also highlight gaps in the literature or suggest potential contributions to the field of study. A well-elucidated conceptual framework can suggest additional studies that may be warranted. This can also spur other researchers to consider how they would approach the examination of a phenomenon and could result in a revised conceptual framework. It can be challenging to create conceptual frameworks, but they are important. Below are two resources that could be helpful in constructing and presenting conceptual frameworks in educational research: Maxwell, J. A. (2012). Qualitative research design: An interactive approach (3rd ed.). Los Angeles, CA: Sage. Chapter 3 in this book describes how to construct conceptual frameworks. Ravitch, S. M., & Riggan, M. (2016). Reason & rigor: How conceptual frameworks guide research. Los Angeles, CA: Sage. This book explains how conceptual frameworks guide the research questions, data collection, data analyses, and interpretation of results. Literature reviews, theoretical frameworks, and conceptual frameworks are all important in DBER and BER. Robust literature reviews reinforce the importance of a study. Theoretical frameworks connect the study to the base of knowledge in educational theory and specify the researcher's assumptions. Conceptual frameworks allow researchers to explicitly describe their conceptualization of the relationships among the components of the phenomenon under study. Table 1 provides a general overview of these components in order to assist biology education researchers in thinking about these elements. It is important to emphasize that these different elements are intertwined. When these elements are aligned and complement one another, the study is coherent, and the study findings contribute to knowledge in the field. When literature reviews, theoretical frameworks, and conceptual frameworks are disconnected from one another, the study suffers. The point of the study is lost, suggested findings are unsupported, or important conclusions are invisible to the researcher. In addition, this misalignment may be costly in terms of time and money. Conducting a literature review, selecting a theoretical framework, and building a conceptual framework are some of the most difficult elements of a research study. It takes time to understand the relevant research, identify a theoretical framework that provides important insights into the study, and formulate a conceptual framework that organizes the finding. In the research process, there is often a constant back and forth among these elements as the study evolves. With an ongoing refinement of the review of literature, clarification of the theoretical framework, and articulation of a conceptual framework, a sound study can emerge that makes a contribution to the field. This is the goal of BER and education research. Allee, V. (2000). Knowledge networks and communities of learning. OD Practitioner, 32(4), 4–13. [Google Scholar] Allen, M. (2017). The Sage encyclopedia of communication research methods (Vols. 1–4). 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C. (2018). Moving evolution education forward: A systematic analysis of literature to identify gaps in collective knowledge for teaching. CBE—Life Sciences Education, 17(1), ar11. [DOI] [PMC free article] [PubMed] [Google Scholar] This section collects any data citations, data availability statements, or supplementary materials included in this article. Articles from CBE Life Sciences Education are provided here courtesy of American Society for Cell Biology A research paradigm is a worldview or philosophical framework, including ideas, beliefs, assumptions and biases, that guides the research process. The research paradigm in which a study is situated helps determine how the research will be conducted. The philosophical basis of the study guides what knowledge is sought, how that knowledge can be discovered, and how to form the collected data into the results. The research paradigm is the framework into which the theories and practices of your discipline fit to create the research plan. This foundation guides all areas of your research plan, including the aim of the study, research question, research and analysis methods. Most research paradigms are based on one of two model types: interpretivism or positivism. These guide the theories and methodologies used in the research project. In general, interpretivist research paradigms lead to qualitative studies and positivist research paradigms lead to quantitative studies. There are many variations of these two research paradigm types, some of which lead to mixed-method studies. Interpretivism Positivism Reality is socially constructed Reality is objective and independent of human perception Knowledge is subjective and context-dependent Knowledge is objective and universal Research is influenced and shaped by researchers' worldviews and theories Research is neutral and unbiased Research methods are qualitative and interpretive Research methods are quantitative and empirical Research aims to understand and explain phenomena Research aims to measure and predict phenomena Other research paradigms include: pragmatism: reality is constantly renegotiated, debated and interpreted in light of its usefulness in new and unpredictable situations subjectivism: reality is what we perceive to be real critical theory: realities are socially constructed entities that are under constant internal influence Ontology, epistemology, methodology, and axiology The research paradigm framework is supported by four pillars: ontology, epistemology, methodology, and axiology. Ontology is the study of the nature of reality and attempts to answer questions such as: is there a single reality, multiple realities, or no reality at all? The often-used example of an ontological question is 'Does God exist?' Two possible single realities exist: yes or no. Scientists may be looking for specific results that ideally have clear yes or no answers. In educational research, there probably isn't one clear, specific answer to your research question but multiple possible realities, and the study results are interpreted through the researcher's viewpoint or paradigm. Epistemology is the study of knowledge and how we can know reality. It incorporates the extent and ways to gain knowledge and how to validate that knowledge. A frequently used example question in epistemology is 'How is it possible to know whether or not God exists?' The epistemology of your research project will help determine your approach to your study. For example, if a scientist believes there is one singular truth, an objective approach will be taken. On the other hand, if an educational researcher believes in multiple realities viewed through a cultural lens, the research results will be more subjective and understood differently in different contexts. This difference divides research studies into those using quantitative and qualitative techniques. Methodology is the study of how one investigates the environment and validates the knowledge gained. It attempts to answer the question 'how do I go about discovering the answer/reality.' Addressing this pillar leads to specific data collection and analysis plans. A scientist may create a research plan that includes a trial, during which tests that measure a specific phenomenon are conducted. These results are then analysed, with a focus on differences within groups. The educational researcher may conduct observations or set up interviews to determine certain aspects of reality for a particular group of learners. In this situation, yes or no answers are not sought, but a 'truth' is discovered. Axiology is the philosophical study of value. It explores the nature, types, and criteria of values and value judgments. Essentially, axiology seeks to understand what things are valuable and why they are valuable. Axiological concerns infuse research. Two general examples are: what makes a good researcher (e.g. objective, impartial, curious, caring, diligent, etc.) what is worthwhile research (e.g., correlational, causal, problem-centred, hypothesis-centred, experimental, etc.) Axiology is important when formulating a research question, e.g. what is valued as a research question and outcome? Formulating a research position Adapted from Patel, S. (2005) Summary of research paradigms Patel, S. (2005) The research paradigm outlines the path to investigate the topic, and brings clarity to developing the most appropriate methods of data gathering and analysis. Once the research paradigm has been determined, an appropriate research plan can be created. It is important for researchers to understand how their own beliefs, assumptions, and biases can affect the research process. The study's data collection, analysis, and interpretation will be impacted by the worldview of the researcher. Knowing the underlying research paradigm and how it frames the study allows researchers to better understand the effect of their perspective on the study results. Further sources Abdul Rehman, A. and Alharthi, K. (2016) 'An introduction to research paradigms', International Journal of Educational Investigations 3(8). Available at: Grad Coach (2023): 'Research Paradigms & Philosophy: Positivism, Interpretivism and Pragmatism Explained (With Examples), Grad Coach. 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