

CHAPTER 16.

HOW MIGHT WE MEASURE
THAT? CONSIDERATIONS FROM
QUANTITATIVE RESEARCH
APPROACHES FOR LIFESPAN
WRITING RESEARCH

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If you open almost any journal article or book chapter that involves writing, you will most likely find a sentence that describes writing as a complex phenomenon. The Lifespan Writing Development Group laid out numerous reasons why writing is a complex phenomenon in the context of lifespan writing research (Bazerman et al., 2018). Dippre and Phillips (2020) continued that conversation to show that the complexities involved in understanding writing from a lifespan perspective had only just begun to be figured out. While that complexity often falls to the constellation of activities and experiences that researchers and educators attribute to writing, we argue that the complexity just as much falls on trying to delineate meaningful approaches to study the act of writing through time and context as is reflected in the leading question for this future-oriented chapter: *How might quantitative approaches assist researchers trying to make sense of how writing develops and what experiences matter to writers across the lifespan?*

Like the composition of the initial Lifespan Writing Development Group, we assume that lifespan writing researchers come from a variety of disciplines, hold different pedagogical and theoretical orientations, and have received advanced training in various (but not always similar) research methodologies. As highlighted in Bazerman et al. (2018), the cross talk across disciplines can be productive and challenging: “We swapped articles and papers, wrote research summaries, asked one another questions, traded citations, argued and quibbled at times, and developed lists of convergence points” (p. 13). We begin this

chapter with this mindset by acknowledging the challenges at hand for writing researchers interested in understanding lifespan writing development. The field of writing research is at times multidisciplinary, interdisciplinary, and transdisciplinary, given the many fields and communities involved (Adler-Kassner & Wardle, 2016; Berninger et al., 2012; Morin et al., 2021). Across these overlapping disciplinary identities are researchers who bring different insights, research designs, and methodological toolkits to the problems at hand. Our aim is to offer some insights into quantitative approaches given our own disciplinary expertise.

In the previous lifespan writing collection, we overviewed some broad concepts about quantitative methodologies and methods, particularly about more advanced longitudinal techniques using structural equation modeling (Zajic & Poch, 2020). This chapter continues that conversation but is not the next sequential step. Instead, this chapter takes a different perspective to how lifespan writing researchers might conceptualize the ways quantitative research approaches may inform future lifespan writing research. We focus on three main issues. First, we contextualize quantitative research within the broader landscape of research designs, methodologies, and methods. Second, we focus on quantitative longitudinal research approaches, highlighting their utility for lifespan writing researchers. Third, we draw from the eight principles put forth by the Lifespan Writing Development Group (Bazerman et al., 2018) to consider how quantitative research approaches may help to address the nuances of studying writing across the lifespan. We aim to highlight the utility of quantitative research approaches as *part* of the toolkit available to lifespan writing researchers and foster conversations among researchers to employ such designs and methods in future research endeavors. Thus, we focus on the productive conversations available within such a diverse collective where we can recognize the challenges but foresee the possibilities.

QUANTITATIVE RESEARCH DESIGNS, METHODOLOGIES, AND METHODS: DEFINITIONS AND CONCEPTUAL FOUNDATIONS

Researchers interested in lifespan writing development employ different theoretical frameworks for research designs that use a variety of methods. In many ways, this mirrors the broader literacy research field (Mallette & Duke, 2021), as literacy researchers, like writing researchers, make up a diverse discipline. In two recent studies, Parsons et al. (2016, 2020) conducted a series of content analyses across literacy research journals to determine the types of topics being studied and the theoretical perspectives and methods employed by literacy researchers. (Literacy as defined here includes “reading, writing, language, communication,

and more” [Parsons et al., 2020, p. 341].) In their analysis of 1,238 articles across nine journals, Parsons et al. (2016) found differences across journals among the research topics, adopted theoretical perspectives, research designs, and data sources; their main conclusions highlighted a fragmented research field. In their subsequent analysis of 4,305 articles published in 15 journals, Parsons et al. (2020) found similar differences with an additional factor being that approaches differed between research and practitioner journals. Important to our discussion, they highlight the need to diversify methods used in research articles, as diversity in approaches will enhance the knowledge base of the literacy research field (see Mallette & Duke, 2021).

As we look at the table of contents of this current edition and the two previous edited collections (Bazerman et al., 2018; Dippre & Phillips, 2020), we could make similar conclusions simply based off researcher representations. Parsons et al. (2020) drew on the framework of “thought collectives” and “thought styles” (Fleck, 1979) to contextualize how research communities exchange ideas within a field. Importantly, they highlighted the benefit raised by Fleck (1979) that having multiple thought collectives and styles strengthened a research field, given that it provides diversity in thought and perspective. This current edition clearly highlights the multitude of different thought collectives and styles present to the study of lifespan writing research, as diversity brings novel ideas, approaches, and analytical toolkits.

Thinking of quantitative traditions as a thought collective (though an oversimplification, given several different ways one might think about quantitative data), we first define what we mean by quantitative research traditions. Quantitative traditions are best understood within the broader context of *research approaches* (“plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation”; Creswell & Creswell, 2018, p. 3). Research approaches encompass three areas that differ by research tradition: (a) philosophical assumptions, (b) research designs, and (c) research methods (including data collection, analysis, and interpretation).

PHILOSOPHICAL ASSUMPTIONS

Most often, quantitative research traditions are associated with postpositivist assumptions that value the identification of causal mechanisms that influence various outcomes, such as those specified in experimental studies (Creswell & Creswell, 2018). The focus tends to fall on testing the scientific method by drawing on relevant theories and collecting data (through careful observation and measurement techniques) to test said theories. While the former may not be as relevant to

our current discussion, we see the latter as an important contribution to emerging lifespan writing theories (e.g., Bazerman et al., 2018). However, a fixation solely on causal explanatory approaches limits the assumptions held with quantitative approaches. In his philosophical examination of different quantitative research methods, Haig (2013) referenced causal modeling as just one approach, with other prominent approaches highlighting the flexibility of exploratory approaches (e.g., exploratory data analysis) innate to quantitative approaches. Although confirmatory, causal, and experimental approaches may first come to mind when considering the assumptions underlying quantitative approaches, a focus on those approaches limits the perspectives taken by quantitative researchers and the potential value of such methods to lifespan writing research.

RESEARCH DESIGNS

Research designs set the context and specify the procedures required for enacting a research study. Selecting the appropriate research design can often be a challenging task (Vogt et al., 2012). Research designs may be experimental in nature, with two prominent designs being *true (or randomized) experiments* and *quasi-experiments* (Reichardt, 2019). *Nonexperimental designs* include correlational or observational designs (Kieffer, 2021), and *longitudinal designs* involve data collection over multiple time points. We discussed structural equation modeling designs in our previous chapter (Zajic & Poch, 2020), some of which involve longitudinal designs. Further, Creswell and Creswell (2018) highlight *survey research designs* as encompassing both nonexperimental and longitudinal designs.

RESEARCH METHODS

Lastly, the methods inform the process of data collection, analysis, and interpretation (Creswell & Creswell, 2018). Though the assumptions and designs are important and critical to the overall research process, this third component is perhaps the most challenging for lifespan writing researchers given the complexity around what factors researchers should target when thinking about the lifespan (Bazerman, 2018; Graham, 2018). Even outside of writing research, this is no easy task (Vogt et al., 2014). Creswell and Creswell (2018) group quantitative research methods into five broad categories to unpack some of their nuances. First, *pre-determined* means the types of items on instruments or tools used for data collection are typically close-ended (e.g., Likert or other rating scales). Second, *instrument-based questions* means data are collected using reliable and valid (and fair; American Educational Research Association et al., 2014) assessment tools. Third, *performance data, attitudinal data, observational*

data, and census data involve asking participants to engage in a task or share their thoughts and perspectives, observing participants engaging in activities, and examining broadly available secondary research data. Careful consideration should be made by the researcher when selecting the types of data to be collected and analyzed for a given study. *Statistical analysis* and *statistical interpretation* represent the analytical approaches researchers use to make sense of the data and to interpret statistical findings (Motulsky, 2017; Urdan, 2022). Statistical analysis and interpretation often seek to make inferences about a research sample in line with the underlying population of individuals they represent (see Zajic & Poch, 2020), though different ways of making those inferences exist. Readers are likely most familiar with *frequentist* approaches, which include steps to calculate and interpret *p-values* and *confidence intervals* in line with null hypothesis significance testing. However, other approaches, like *Bayesian* approaches, are also available that draw on different assumptions for both simple and complex analytical designs (e.g., Depaoli, 2021; Kaplan, 2014; Stanton, 2017).

So, readers might be asking, why spend time bothering ourselves with quantitative methods? Mallette and Duke (2021) lay out five core ideas in line with their literacy research methodologies handbook that echo the intention of the Lifespan Writing Development Group: (a) Many different research methodologies make valuable contributions to the study of literacy; (b) Different types of questions and claims require different types of research approaches; (c) Standards of quality exist for every type of research; (d) Synergy across research methodologies is not only possible but also powerful and advisable; and (e) Researchers must pursue synergistic collaborations across research methodologies (pp. 1-2). The charge set forth by the Lifespan Writing Development Group echoes these core ideas when we shift the focus from literacy research more broadly to lifespan writing development. As researchers, we need to bring our methodological expertise to the collaboration to foster new approaches and understandings. With that, we turn to considering more about what longitudinal approaches might mean for lifespan writing research.

LONGITUDINAL QUANTITATIVE RESEARCH DESIGNS AND METHODS: CONSIDERATIONS FOR LIFESPAN WRITING RESEARCHERS

Conceptualizing how longitudinal approaches fit into the development of lifespan writing research methodologies is a daunting task. Longitudinal designs, as mentioned previously, involve data collection over multiple time points to examine change over some specified time period (Hoffman, 2015). But longitudinal designs sit at the research design level; when we consider specific methods,

several approaches exist that depend on the nature of the research questions. Our prior chapter discussed the nuances of different time sampling designs and how choices in the data collection and analysis may impact the selection of appropriate longitudinal research methods (Zajic & Poch, 2020). Here, instead, we discuss some of the considerations for longitudinal, quantitative approaches in line with Bazerman's comments regarding the noted value (or lack thereof) of existing longitudinal studies from psychology (Bazerman, 2018).

In closing the Lifespan Writing Development Group's edited book, Bazerman (2018) provided an exhaustive discussion into the many facets researchers might consider when trying to conceptualize what exactly a lifespan study of writing development might look like. The thorough aspirations put forth by Bazerman in the technical complexity that lifespan writing research will need to properly understand the nuances of writing will keep researchers busy for decades to come. We want to highlight some of the key issues Bazerman brings to light as ways for writing researchers to consider the utility of quantitatively driven lifespan approaches.

Bazerman (2018) reviews a wide array of studies from fields other than writing research to draw on how those fields have performed this work and what they have learned. Of interest here, Bazerman (2018) highlights that much of the existing work is quantitative in nature (focused mainly on statistical issues, modeling issues, and computational tools) and may hold little relevance to the issues at hand with lifespan writing development. More specifically, Bazerman (2018) states the following:

Such studies can be useful in writing studies to see if there are patterns in family and social situations, schooling characteristics, and the amount of writing or use of writing that might predict later engagement with writing, or to uncover other patterns to be investigated by other means, but such studies do not seek out the meanings embodied in texts, writing strategies or repertoires, writing practices or processes, the quality or efficacy of the texts, complex processes and practices, or the orientations and meanings for the authors engaged in specific situations. So while some statistical measures may be of use for studying writing development, they would likely need to be used in conjunction with more qualitative, individualized studies (pp. 332-333).

We focus on three components of these takeaways: (a) What do longitudinal studies look at?; (b) What value are such designs to lifespan writing researchers?; and (c) How do we conceptualize the quantitative component of mixed methods designs?

WHAT DO LONGITUDINAL STUDIES LOOK AT?

Bazerman (2018) raises an important concern regarding what a quantitative lens brings to longitudinal studies. As Bazerman (2018) also highlights, there are typically five broad objectives for conducting longitudinal research (Baltes & Nesselroade, 1979):

1. Direct identification of intraindividual change (i.e., examining change within an individual over time).
2. Direct identification of interindividual similarities or differences in intraindividual change (i.e., examining if change occurs between individuals in similar or different ways).
3. Analysis of interrelationships in behavioral change (i.e., examining how certain changes are associated with each other).
4. Analysis of causes or determinants of intraindividual change (i.e., examining what factors serve as the catalyst for changes within individuals over time).
5. Analysis of causes or determinants of interindividual similarities or differences in intraindividual change (i.e., examining why different individuals change in different ways over time).

These objectives are not specific to quantitative approaches alone (see Rowe, 2018 for a further application to a mixed design in early childhood), but they have long guided quantitative approaches that use a longitudinal design. Different research methods are often used in line with these objectives (see McArdle and Nesselroade, 2014 for detailed examples). Other approaches allow for flexibility to answer several questions depending on the type of model specified within a group of models, such as observed with growth curve modeling (Grimm et al., 2016). To breakdown longitudinal design and analysis further, we highlight Hoffman (2015) who took a non-mathematical approach to introduce the complicated nature of longitudinal design and analysis.

First, Hoffman (2015) discusses the building blocks of longitudinal designs, offering definitions and examples of terminology common to such designs. Rather than define every term possible, we highlight two important terms in line with our list of objectives: *between-person* vs. *within-person*. Between-person analysis focuses on the differences that occur between different individuals. Such analyses are often focused on models measuring one outcome for an individual, as we care only to look at how differences occur between different individuals. We could have hundreds upon thousands of individuals for whom we have data, but we might still have only one outcome for all those individuals. Oftentimes, between-person analyses are conducted

solely using cross-sectional approaches, though between-person analysis still plays a role in longitudinal design. In contrast, within-person analyses focus on differences that occur within the same individual(s) over multiple occasions (i.e., repeated measurements). The focus turns not to how individuals differ from other individuals but to how individuals differ from themselves over multiple occasions. At its heart, longitudinal analysis is predominantly interested in within-person change over time, but researchers might be most interested in how individuals differ not only in relation to themselves (#1 from Baltes and Nesselrode, 1979), but also if people change in ways that are different from others (#2 from Baltes and Nesselrode, 1979). So, while we can think about between- and within-person analyses as distinct approaches, numerous longitudinal models incorporate both approaches to address research questions that deal with how individuals change within themselves as well as how individuals differ in that change compared to their peers.

Second, Hoffman (2015) focuses on one of the most important components needed for longitudinal research: time. If researchers were not interested in measuring the impact of time, then they would simply examine skills cross-sectionally. But there is not a single way of measuring or accounting for time in longitudinal research. Hoffman highlights a few different models that can be used to describe *within-person fluctuation* over time (i.e., how a skill varies within an individual), account for *fixed* and *random effects* around time (i.e., values that are constant for everyone in the model vs. values that are allowed to vary for each individual), and describe *within-person change* over time (i.e., accounting for trajectories of individual change and not solely fluctuation).

Third, Hoffman (2015) introduces the issue of predictors (i.e., variables that try to explain fluctuation or change over time). Such predictors can be considered time-invariant (i.e., they occur at a single time and do not vary across time) or time-varying (i.e., they can change across multiple time points). Nuances occur around how one might include both types of predictors into advanced models, and entire chapters are dedicated to the role that such predictors play in longitudinal models and models examining both within-person fluctuation and change.

Fourth, Hoffman (2015) provides a brief overview of more advanced applications that address many of the objectives outlined by Baltes and Nesselrode (1979). Did you know that researchers can account for time on a variety of different metrics within longitudinal research designs? And what if we have groups of individuals across multiple time points; can we account for not only individuals but also individuals nested within groups over time? Needless to say, we recommend Hoffman (2015) as an introductory text that highlights many of the capabilities possible when thinking about longitudinal data.

WHAT VALUE ARE SUCH DESIGNS TO LIFESPAN WRITING RESEARCHERS?

The earlier examples offered by Bazerman (2018) align with the aforementioned objectives, as the focus falls on the identification of predictors at one time point, while anticipating a later time point. However, quantitative methods might allow for more nuance than simply identifying familial or contextual characteristics tied to later writing engagement (or other broad patterns of relationships). As mentioned earlier, a prominent issue in quantitative research methods is defining the phenomena for further examination. And existing studies often employing the use of quantitative methods most often do not have writing researchers on those teams. We are not at all surprised by Bazerman's main critiques of the existing literature being focused on issues of model fitting and statistical significance because said models were most often conducted without the nuances of writing development in mind. The wealth of knowledge and expertise carried by the members of the Lifespan Writing Development Group may provide new issues at hand for quantitative methodologists to wrestle with, which in turn can help researchers produce higher quality research for the fields of writing and research methodology.

Furthermore, we would argue that some of Bazerman's examples may be analyzable from quantitative perspectives that would contribute to but not remove the need for rich qualitative inquiry. If writing strategies or repertoires were assessed via direct observation or self-report over an extended period, could quantitative methods be applicable then? If writing practices and processes were observed, documented, or tracked for extended periods, could quantitative methods offer a novel perspective to understanding within- and between-person fluctuation and change? (And could particular factors like context, purpose, and genre be added as important covariates or predictors to the models to help explain how such examples might covary with observed fluctuations and changes?) Could we apply person-centered methods (approaches seeking to understand the presence of unobserved variability at the person level rather than the variable level; Laursen & Hoff, 2006) to understand within-group variability such as how we think about ourselves as writers and to what extent we shift in our thinking over time? Could we apply dyadic data approaches (Kenny et al., 2020) that look to interrelationships between individuals and collaborators to expand our knowledge about how writers write together? Put more simply, quantitative methods may help provide a nuanced perspective to issues like those laid out here, but it will take quantitative researchers on the research team to offer such perspectives. If we want these approaches to be appropriate for the kinds of data we care about as lifespan writing researchers, then we need to foster these

collaborations to help disentangle the complicated construct that lifespan writing researchers conceptualize as writing.

HOW DO WE CONCEPTUALIZE THE QUANTITATIVE COMPONENT OF MIXED-METHODS DESIGNS?

Collaboration is central to the future of lifespan writing research methodologies, both for quantitative and qualitative approaches. Bazerman's final point about the need to use quantitative approaches in conjunction with qualitative ones is extremely important to not only this complex area of research but also to leveraging the expertise we have across disciplines. The point echoes the broader landscape of literacy research methodologies (Mallette & Duke, 2021). We need both quantitative and qualitative researchers in the conversations around what writing skills should be valued and understood from a lifespan framework. We need mixed methods researchers as well to contribute to discussions in both small- and large-scale projects to foster rich datasets where analysis would be informed by both quantitative and qualitative methods. Such involvement of multiple perspectives speaks to both the point raised by Bazerman (2018), as well as what we argued for in Zajic and Poch (2020). When taking into consideration the multiple factors that impact writing from both sociocultural and cognitive perspectives (Graham, 2018), we need multidisciplinary research teams to bridge representation across methodological communities to conduct not only high-quality research, but also research that informs other methodologies. Mixed methods designs are not solely the merging of quantitative and qualitative research methodologies, however, as careful considerations must be made as to their own design and use of methods from conceptualization through interpretation (Creswell & Creswell, 2018; Onwuegbuzie & Mallette, 2021).

APPLYING QUANTITATIVE THINKING TO THE LIFESPAN WRITING PRINCIPLES

In this final section, we focus on the original eight principles offered by the Lifespan Writing Development Group (Bazerman et al., 2018) to offer some considerations for future quantitative inquiry in lifespan writing research. For each principle, we offer some broadly aligned connections to designs and analytical approaches.

PRINCIPLE 1: WRITING CAN DEVELOP ACROSS THE LIFESPAN AS PART OF CHANGING CONTEXTS

To define context, we have opted to replace the term with community to represent

changes in writing communities (Graham, 2018). Changing communities may represent both intraindividual change in community (i.e., how a writer changes in their writing as a product of themselves changing communities) or interindividual similarities or differences in intraindividual change in communities (i.e., how different individuals change in different ways across a variety of writing communities over time). Some questions that come to mind when thinking about changing contexts is naturally how writers perceive the writing demands of the various communities they write in. Testing hypotheses about involvement in educational, social, and professional communities over time could be done through developing instruments that examine constructs like beliefs and attitudes in those spaces and that seek to examine observed change across contexts as well as heterogeneity observed at the person level. We might adopt macro-level perspectives to communities in general or conduct more micro-level examinations into the different sub-communities that make up larger communities (i.e., different classrooms or spaces within a school, different online social media outlets, and different teams or team members we converse with for different reasons).

PRINCIPLE 2: WRITING DEVELOPMENT IS COMPLEX BECAUSE WRITING IS COMPLEX

The assumed complexity is ideal for testing hypotheses and theories using approaches like multilevel modeling and structural equation modeling. Such approaches build from simpler univariate and multivariate approaches to posit the complex interrelationships between different skills (through observable skills and unobservable constructs) and that individuals may be clustered based on specific contexts or time points (see Heck et al., 2022). Though we spent more time in Zajic and Poch (2020) covering structural equation modeling than we did here, when we hear the word *complex*, we think of analytical tools that allow for specifying complex relationships between both observable skills and unobservable constructs. The complexity of writing might be tested within or between the levels of the writers(s)-within-community framework (Graham, 2018), or we might test the same set of variables across communities to see if communities demonstrate properties of invariance either between groups or between time periods (i.e., do the constructs of interest have the same meaning across groups of individuals or across periods within the same communities?). Part of the challenge here for quantitative approaches will be operationalizing how to measure writing beyond foundational writing skills. But this might be an opportunity for defining constructs of interest through cross-disciplinary collaboration to understand how constructs may differ in observed manifestations while still representing a similar underlying phenomenon.

PRINCIPLE 3: WRITING DEVELOPMENT IS VARIABLE; THERE IS NO SINGLE PATH AND NO SINGLE ENDPOINT

Fortunately for those interested in quantitative approaches, path models do not have a single path, either! (We do, however, need to specify a final-time point, as models would not be able to be estimated without one.) With no single path or endpoint, we immediately think about the flexibility offered by some approaches like growth curve modeling where time points may be flexible (i.e., the time elapsed between time points does not need to be in equal intervals) and paths may include multiple skills at once to capture both change overtime as well as relationships between change overtime (Grimm et al., 2016). However, we also think potentially of person-centered approaches like latent class analysis and latent profile analysis with the added longitudinal component being latent transition analysis. Briefly, such approaches use mixture modeling applications to uncover hidden homogeneous subgroups within a larger heterogeneous group (see Abarda et al., 2020; Finch & French, 2015; Heck et al., 2022; Ryoo et al., 2018). But what if we believe those individuals might transition between groups over some extended period? Latent transition analysis examines how (if at all) individuals transition between identified classes and profiles over time (along with considering invariance assumptions across time points). Such designs may be useful for making sense of the heterogeneity present among individuals regarding how writing changes across the lifespan. Discussed models also allow for examination into issues of moderation (i.e., an interaction between predictors whose influence may depend on each other) and mediation (i.e., where variables can be both predictors and outcomes to examine both direct and indirect effects on variables of interest).

PRINCIPLE 4: WRITERS DEVELOP IN RELATION TO THE CHANGING SOCIAL NEEDS, OPPORTUNITIES, RESOURCES, AND TECHNOLOGIES OF THEIR TIME AND PLACE

Taking into consideration the ways each of these areas shape individual experiences with writing activities and development requires clear delineation of their measurable features. For example, technologies might include various mediums (e.g., handwriting; typing on a keyboard vs. a tablet; and dictating into a phone, a tablet, or a computer). Even reflecting on the use of technologies over the last two decades in educational spaces and the state of the research on how technology impacts learning for children with and without disabilities lends itself to an entire field of research. What comes to mind is thinking about models that might consider major shifts in one's writing development, such as access to your

first computer or demarcating points of entry and exit of different jobs as ways to delineate writing experiences in different professional contexts. Analytical tools like regression discontinuity (a quasi-experimental design that introduces a treatment effect by assigning a particular cut-off above or below when that treatment is assigned; Weiland et al., 2021) and survival models that place the focus of the analysis on the time from when an event occurs (Legrand, 2021) may be useful to investigate how time around a change may impact writing activities. Considering the types of data to be collected to capture the different communities where individuals engage in writing and offer opportunity for valuing the changing use of writing across development may be challenging to operationalize, though still potentially feasible given a group of multidisciplinary experts.

PRINCIPLE 5: THE DEVELOPMENT OF WRITING DEPENDS ON THE DEVELOPMENT, REDIRECTION, AND SPECIALIZED RECONFIGURING OF GENERAL FUNCTIONS, PROCESSES, AND TOOLS

Writers rely on more than their writing skills to engage with writing across their lifespan. Much of the group's recommendations in terms of functions, processes, and tools highlight the use of cognitive mechanisms delineated in the writer(s)-within-community framework (Graham, 2018). Understanding how general functions, processes, and tools shape written language development and expectations speak directly to the authors' interests in understanding how to support writers who are considered neurodivergent in the context of learning and developmental disabilities (Poch et al., 2020; Zajic & Brown, 2022), so we are excited by this principle for reasons other than quantitative methods! As we highlighted in Poch et al. (2020), lifespan writing researchers need to understand how functions, processes, and tools play out beyond the educational spaces for individuals with disabilities. Again, what comes to mind might be mixture models that take into consideration underlying heterogeneous profiles of how writers engage with writing daily and come to think about their own writing processes across time and context, and how writing shapes and shifts conceptions of the self.

PRINCIPLE 6: WRITING AND OTHER FORMS OF DEVELOPMENT HAVE A RECIPROCAL RELATION AND MUTUAL SUPPORTING RELATIONSHIPS

At the heart of longitudinal models is the focus on covariance (i.e., how much two variables vary together). The reciprocal relationship between writing and other forms of development may be well suited to be understood using dyadic modeling, which was highlighted earlier as a way to understand the processes

that unfold in dyads (Kenny et al., 2020). However, many other models are well suited to examine the covariance of interrelated skills over time, both in terms of autoregressive paths and in growth curve models (Grimm et al., 2016; Zajic & Poch, 2020). However, such skills may also be modeled by looking beyond just writing performance to thinking about ways of modeling the writing process across contexts or how writers engage with text over a prolonged period. Many applications come back to how (and if) a phenomenon of interest can be measured and studied quantitatively vs. qualitatively.

PRINCIPLE 7: TO UNDERSTAND HOW WRITING DEVELOPS ACROSS THE LIFESPAN, EDUCATORS NEED TO RECOGNIZE THE DIFFERENT WAYS LANGUAGE RESOURCES CAN BE USED TO PRESENT MEANING IN WRITTEN TEXT

Oral language skills play a critical role in written language development, especially in early development. However, the Lifespan Writing Development Group draws attention beyond the early years. A multitude of modeling approaches may be beneficial when hypothesizing the role that language plays across the lifespan. Examining oral and written language in multiple languages over time (again, perhaps bound by certain points in time, such as taking courses in a second or third language) allows for models that measure multiple processes simultaneously over time. The interrelationship between oral and written language may also vary by context, prompting for approaches that capitalize on variability present across contexts both between and within individuals. Bazerman et al. (2018) draw attention to the need to attend to micro-level textual features, such as looking at oral and written language in produced documents over time (and perhaps across contexts). Panel designs may be particularly useful, as they allow for modeling parallel processes occurring simultaneously over multiple time points.

PRINCIPLE 8: CURRICULUM PLAYS A SIGNIFICANT FORMATIVE ROLE IN WRITING DEVELOPMENT

Our schooling experiences impact how we use and think about writing throughout our lives. Schooling experiences vary across classrooms, districts, cities, states, and countries, leading to nested data that requires multi-level approaches. Careful considerations need to be made about the contextual spaces where writing occurs over the school-age years and how access to those resources may change or influence future thinking about writing post formal schooling. Models may attempt to show growth and change in growth in children in a single school

system or across multiple school systems, potentially being able to account for variability in classroom experiences (or examining how experiences contribute to variability in outcomes, such as writing self-concept or self-efficacy). For quantitative approaches to be helpful, researchers need tools to document the writing spaces that occur across primary, secondary, and postsecondary educational contexts. These tools should be sensitive to the dynamic contexts across grade levels and school systems. Documenting the many ways children engage with written text across the grade levels is a welcome initial point to help think about the multitude of variables involved. Such efforts may lead to developing effective models that document both short- and long-term longitudinal growth (and how such growth might impact understanding writing in contexts outside of school).

CONCLUSION

We began this chapter focused on the complexity innate to writing development, and we hope you still see writing as a complex construct. However, we also hope you have come to understand a bit more about the nuances of quantitative approaches. Our initial discussion highlighted what quantitative researchers generally consider when conceptualizing a quantitative study. Our look into the longitudinal issues at play highlighted that if we want methodological tools that are applicable and useful to writing research, then writing researchers need to be involved in those cross-disciplinary collaborations. We highlighted that quantitative approaches may hold important implications for the continued study of the lifespan principles that underlie writing development. We do not expect everyone to become an expert in quantitative methods (we would argue we feel similar, given the breadth of methodological expertise that exists in the field), but we hope this chapter leaves you with an appreciation for what quantitative approaches might bring to lifespan writing development research.

Given this edited collection and the focus on methods, we end on a hopeful note. We have been encouraged by the rich discussions fostered by the researchers involved with the Lifespan Writing Development Group that have begun tackling disciplinary divides and issues that occur when bringing together writing researchers across disciplines. While sometimes difficult and uncomfortable, these conversations are an opportunity for learning more about different and diverse methodological and philosophical approaches and beliefs rather than opposing such approaches and beliefs because they do not align with one's own. We are excited by the rich role that methodology will play in the ongoing understanding of how writing develops across the lifespan, both in terms of quantitative approaches and designs that incorporate qualitative and mixed methods. However, we highlight a cautionary note raised by Creswell and Creswell

(2018): We must focus on research questions and not solely our own personal experiences and existing research communities. We draw strength by bringing together diverse perspectives and disciplines interested in this complex phenomenon called writing. We need to leverage that strength for productive collaboration, whether that be exploring potential uses for quantitative approaches or for how different methodologies may help to understand the many unexplored questions. Forming collaborations will produce research questions that can be answered using the diverse methodological toolkits at our disposals. It is now on us as writing lifespan researchers to enact these methods and propose research designs that lay the foundation for understanding the complexity of writing development and the use of writing across the lifespan.

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