A 41-Year History of Mixed Methods Research in Education: A Mixed Methods Bibliometric Study of Published Works from 1980 to 2021

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Abstract. Over the last three decades, several researchers have investigated the prevalence of mixed methods research studies across numerous fields and disciplines—known as prevalence rate studies. With the exception of the field of nursing, the field of education in general and the discipline of mathematics education in particular consistently have had the highest prevalence rates of mixed methods research. However, the latest year examined in these education-based prevalence rate studies has been 2010. Yet, the last 12 years have witnessed rapid developments in the field of mixed methods research. Therefore, in this report, we use a mixed methods bibliometric approach—comprising bibliometric quantitative data being integrated with qualitative data—to document the prevalence and use of mixed methods research in the field of education since the paradigm wars of the 1980s, in general, and since 2010, in particular. A systematic review of the ProQuest, ERIC database, via Python coding, revealed that published mixed methods research in education grew exponentially during the first two decades of the 2000s. From 2017 to 2021, the percentage of mixed methods research studies represented within the total number of educational research publications increased yearly, with mixed methods research representing 6% in 2017 to 7.9% in 2021 of the published educational research studies. In 2021, only 78 published articles were identified that included "mixed method(s)" in the title (i.e., mixed methods-declared research studies)—indicating that at least 175 of the 253 indexed education-based journals (69.17%) did not include any mixed methods-declared research articles in any of their 2021 issues. Even more disturbingly, more than two thirds of these 78 education-based mixed methods-declared research articles either involved no integration (9.0%) or minimal integration (i.e., 59.0%) of the quantitative and qualitative components/phases, with only 12.8% involving what could be considered to represent full(er) integration of the quantitative and qualitative components/phases throughout many, if not most or all, stages of the mixed methods research process. Therefore, we call on more educational researchers seriously to consider adopting an integrative, integrated, and integral way of thinking, in order to help the field of mixed methods research grow from its current status of young adulthood to fully fledged adulthood.

Keywords: Educational research methodology; integration; 1 + 1 = 3 integration; 1 + 1 = 1 integration; partial integration; full(er) integration; integrated mixed methods research; integrative, integrated, and integral way of thinking

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Educational Research Defined

Educational research refers to the intentional (i.e., planned or emergent), formal, systematic, and multi-step process of collecting, analyzing, and interpretating data related to the field of education, and its related disciplines (see Table 1), for the purpose of knowledge acquisition, knowledge construction, and/or knowledge validation/legitimation—as well as meaning making. Data collected, analyzed, and interpreted in this field and across its related disciplines stem from the use of *traditionally quantitative-based measurement/assessment/evaluation tools* that include performance assessments (norm-referenced, criterion-referenced), teacher-made tests, researcher-made tests, and nonprojective instruments (e.g., personality inventories, attitude scales, creativity tests, interest inventories); and *traditionally qualitative-based tools* that include *projective instruments*, such as nonprojective instruments that represent the four modes of qualitative data sources identified by Leech and Onwuegbuzie (2008)—namely, talk (e.g., individual interviews, paired-depth interviews, focus group discussions), observations (emic-based [i.e., insider perspective; e.g., onsite observations] vs. etic-based [i.e., outsider perspective; e.g., Geographic Information Systems]; interactive [i.e., live observations] vs. non-interactive [i.e., past observations]; first-hand vs. second-hand), documents (i.e., digital vs. non-digital), images (i.e., still [e.g., photographs] vs. moving [e.g., videos]; two-dimensional vs. multidimensional; non-virtual [e.g., drawings] vs. virtual [e.g., Youtube, Panoramio, Flickr, iMovie, Instagram])—and projective instruments, such as unstructured performance assessments and psychological tests (e.g., cloud pictures, cartoons, Rorschach Test, Thematic Appreciation Test). These traditionally quantitative-based and qualitative-based tools have motivated what are known as *quantitative research approaches* and *qualitative research approaches*, respectively. As a result, in the context of Western philosophy, quantitative research approaches, firstly, and qualitative research approaches, secondly, have dominated educational research since ancient times. As described by Johnson and Gray (2010), during these ancient times, research was represented by *proto-rationalists* (i.e., absolutists who looked for certainty in entities; e.g., Plato [429-347 BCE]; Socrates [470-399 BCE])—who viewed truth as being immutable and, therefore, could be considered as *proto-quantitative*—and *sophists* (i.e., ontological relativists; e.g., Protagora [490-420 BCE]), who deemed truth to be both changing and relative and, therefore, could be considered as *proto-qualitative*.

Table 1

Educational Disciplines Listed in Alphabetical Order

Alternative education	Educational technology	Peace education
Art education	Elementary education	Physics education
Bilingual education	Higher education	Reading education
Chemistry education	Language education	Religious education
Comparative education	Legal education	Science education
Counselor education	Mastery learning	Special education
Critical pedagogy	Mathematics education	Sex education
Distance education	Medical education	Sociology of education
Early childhood education	Military education and training	Technology education
Educational leadership	Music education	Vocational education
Educational philosophy	Nursing education	
Educational psychology	Outdoor education	

Mixed Methods Research Defined

In its simplest form, the following definition of mixed methods research has become popularized:

> *Mixed methods research* is formally defined here as *the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*. [emphasis in original] (Johnson & Onwuegbuzie, 2004, p. 17)

However, a more comprehensive definition of mixed methods research was presented by Johnson et al. (2007), which involved a synthesis of definitions provided to them by 19 leaders from the mixed methods research community, as follows:

> Mixed methods research is an intellectual and practical synthesis based on qualitative and quantitative research; it is the third methodological or research paradigm (along with qualitative and quantitative research). It recognizes the importance of traditional quantitative and qualitative research but also offers a powerful third paradigm choice that often will provide the most informative, complete, balanced, and useful research results. Mixed methods research is the research paradigm that (a) partners with the philosophy of pragmatism in one of its forms (left, right, middle); (b) follows the logic of mixed methods research (including the logic of the fundamental principle and any other useful logics imported from qualitative or quantitative research that are helpful for producing defensible and usable research findings); (c) relies on qualitative and quantitative viewpoints, data collection, analysis, and inference techniques combined according to the logic of mixed methods research to address one's research question(s); and (d) is cognizant, appreciative, and inclusive of local and broader sociopolitical realities, resources, and needs. Furthermore, the mixed methods research paradigm offers an important approach for *generating* important research questions *and* providing warranted answers to those questions. This type of research should be used when the nexus of contingencies in a situation, in relation to one's research question(s), suggests that mixed methods research is likely to provide superior research findings and outcomes. [emphasis in original] (p. 129)

History of Mixed Methods Research

The origin of mixed methods research can be traced back to *proto-empiricists* (i.e., realists whose goal was to obtain understandings of what humans see and experience in their everyday lives; e.g., Aristotle [384-322 BCE])—who viewed intersubjectivity as being a component of truth. Throughout the *middle ages* (circa 5th century to 16th century), the *modern times* (circa 17th century to early 20th century) that included part of the *Renaissance period* (i.e., circa 17th century), the *Enlightenment period* (i.e., circa 17th century through the late 18th century), and the *Romantic period* (i.e., circa late 18th century through mid-19th century), the proto-mixed methods movement adopted a middle position between the (proto-)quantitative and (proto-)qualitative stances by making arguments such as knowledge construction stems from the combination of reason and imagination. However, despite this proto-mixed methods movement, throughout these four eras, in the field of educational research and beyond (e.g., social and behavioral sciences), mixed methods research approaches were marginalized by both (purist) quantitative researchers and (purist) qualitative researchers (Onwuegbuzie & Wisdom, 2014).

As outlined by Onwuegbuzie et al. (2022), since the turn of the 20th century, the mixed methods research movement has undergone the following eight major methodological stages: (a) the formal emergence of the social and behavioral sciences (1900 to 1929); (b) the traditional period (1930 to 1949); (c) the postpositivist era (1950 to 1969); (d) diversification of and advances in mixed methods in the human sciences (1970 to 1979); (e) the paradigm wars (1980 to 1989); (f) the institutionalization of mixed methods as a distinct methodological orientation (1990 to 2009); (g) emergence of mixed methods research into young adulthood (2010 to 2014); and (h) emergence of integration (i.e., Mixed Methods Research 2.0) (2015 to present day). These stages are summarized in Figure 1. This figure, which was adapted from Onwuegbuzie et al. (2022), presents a history of quantitative, qualitative, and mixed methods research from the 20th century onwards, alongside a history of educational assessments associated with these three research traditions for the same time period.

Figure 1

History of Quantitative, Qualitative, Mixed Methods Research, and Western-Based Educational Assessment: Twentieth Century to Present Day

Period	Quantitative Research[a]	Qualitative Research[b]	Mixed Methods Research[c]	Qualitative Educational Assessments and Quantitative Educational Assessments in the Western World
1900 - 1929	*Formal emergence of the social and behavioral sciences:* Classical positivism: introduced by Auguste Comte (French Philosopher) Logical positivism (circa 1920s): originated in the	*Moment 1: Traditional:* Many researchers who rejected (logical) positivism embraced the qualitative research paradigm	*Formal emergence of the social and behavioral sciences*	*Qualitative: Era of Colonial forms of qualitative research:* Qualitative research studies in foreign settings wherein White researchers (e.g., *Lone Ethnographers*) conducted fieldwork that involved so-called "objective," "imperialist," "monumentalist," and "timeless," assessments of the culture, customs, habits, and religions of the "Other" The Chicago school established the assessment of human group life *Quantitative: Era of standardized testing*: A team of U.S. colleges—namely, the College Entrance Examination Board—developed the first

	Vienna Circle, a group of European Scholars Birth of hypothetico-deductive model Development of basic statistical and anthropological methods			standardized admissions test to assess whether students were prepared for college-level course work (1901) First course in educational assessment that was taught by Thorndike at Columbia in 1902 (Meyer, 1965) Alfred Binet introduced the first modern standardized test of intelligence, which directly assessed students in order to identify students who needed educational assistance (1905) Karl Pearson is deemed to be the first investigator to employ ratings—namely, a 7-point scale—in research on intelligence (1907) First definition of true score in 1910 (Brown, 1910) National Council of Education published a major report on standards and tests for assessing school efficiency (1913) (cf. Strayer, 1913). By World War I, standardized testing was standard practice: aptitude quizzes called Army Mental Tests were conducted to assign U.S. servicemen jobs during the war effort. World War I yields a surge in psychological testing as thousands of U.S. recruits are screened for intellectual and emotional functioning (1914). The multiple-choice test was invented to combat the rise in student population in the United States (1915) Stanford-Binet IQ test was created (1916). Swiss psychiatrist Hermann Rorschach publishes his famous monograph, *Psychodiagnostics*, which led to the development of the Rorschach Inkblot Test to examine a person's personality characteristics and emotional functioning (1921). This test subsequently was used to assess students in school settings (e.g., mental tests, childhood and adolescence, educational psychology vocational guidance; cf. Hertz, 1934). Rugg publishes a four-part paper on rating scale methodology (1921-1922). *Journal of Educational Measurement* devoted several issues in 1921 to a symposium on scientific assessment of intelligence. The Scholastic Aptitude Test (SAT) was developed in 1926 by the College Board, which assessed knowledge of vocabulary and basic mathematics Carl Spearman publishes a two-factor theory of intelligence in which he postulates the existence of a general intellectual ability factor and specific components of that general ability (1927). Louis Leon Thurstone, a U.S. pioneer in the fields of psychometrics and psychophysics, developed the Thurstone Scale to assess attitudes towards religion (1928), which was subsequently used to educational constructs.

1930-1949	*Traditional period*: Discrediting of logical positivism Early forms of postpositivism Further extensions to the hypothetico-deductive model	*Moment 1: Traditional*	*Traditional period*: Uncontroversial but limited use of mixed methods research	*Qualitative: Era of Chicago school:* The Chicago school continued promoting the assessment of human group life. *Quantitative: Era of standardized testing and study of eye movement*: Miles Tinker and his collaborators began using photographic techniques to study eye movement of readers (1930). G. T. Buswell created the first non-contact device registering eye movements to assess the reading and watching of images (1935). Rensis Likert, psychologist, developed the Likert-format scale to assess people's attitudes, opinions, and perceptions (1932). The first automatic test scanner was developed (January 1, 1936). Kuder and Richardson (1937) published a seminal article on test Reliability. By 1938, more than 4,000 psychological tests were in print. SAT is normalized to make test scores as fair as possible (1941). Minnesota Multiphasic Personality Inventory was published to assess personality (1943). Government-funded schools began using written examinations that were first introduced in Boston (1945). Cronbach (1947) introduced several different kinds of reliability coefficients. The first version to the Wechsler Intelligence Tests for children was published (1949).
1950-1959	*Postpositivist era*:	*Moment 2: Modernist or golden age* Attempt to make qualitative research (e.g., grounded theory) as rigorous as quantitative research; causal narratives were central; many texts attempted to formalize qualitative research; new interpretive theories emerged (e.g., ethnomethodology, critical theory,	*Postpositivist era* Campbell and Fiske (1959) formalized the practice of using multiple research methods by introducing the concept of triangulation	*Qualitative: Era of the modernist ethnographer and sociological participant observers*: "Rigorous" qualitative assessments were taken of social processes. Postpositivism was the paradigm that greatly influenced qualitative assessment practices via new interpretive frameworks (e.g., phenomenological, ethnomethodology, critical theory, feminism). In particular, these qualitative researchers applied Campbell and Stanley's (1963) conception of internal validity and external validity to constructionist and interactionist notions of assessment in an attempt to make qualitative research as rigorous as quantitative research. These qualitative research studies often were characterized by assessments that were based on a combination of open-ended and quasi-structured interviewing schedules, as well as participant observations. *Quantitative: Era of standardized testing* and attribute assessment:

		feminism, phenomenology)		Louis Guttman developed the Guttman scale, which is a single (unidimensional) ordinal scale for the assessment of the attribute (1950). Publication of the first standards for educational and psychological assessment (American Psychological Association [APA], 1954). The first version of the Wechsler Adult Intelligence Tests was published (1955). Artificial Intelligence (AI) was coined by John McCarthy, an American computer scientist and cognitive scientist (1956). American College Testing (ACT) was developed as a competitor to the SAT (1959).
1960-1969	Publication of Thomas Kuhn's (1962) book	*Moment 2: Modernist or golden age* Publication of Thomas Kuhn's (1962) book	*Postpositivist era*: Emergence of multimethod designs Webb et al. (1966) conceptualized the use of multiple methods (i.e., multiple operationalism) Promotion of the use of quantitative and qualitative methods in social research	*Qualitative: Era of the cultural romantics*: Qualitative researchers, as cultural romantics, conducted qualitative assessments via an ironic and tragic view of society (Denzin & Lincoln, 2011) Farrah et al. (1968) developed the Self-Concept and Motivation Inventory (SCAMIN). Although it has been subsequently used as a quantitative assessment (Davis et al., 1988), it was originally developed as qualitative assessment, serving as a graphic method for use with children (Farrah et al., 1968). This graphic method involves children being shown different drawings of faces, comprising one face with a happy smile, a second face with a straight line for a mouth, and a final face with a mouth turned downward to depict sadness. Children are asked to select which face best characterizes their feelings about certain experiences, such as how they feel about school. For example, children can be asked to report which face belongs to each of their classmates, which would yield a SCAMIN drawing. *Quantitative: Era of personality assessment* Crespi developed the Stapel Scale (1961). Meyers Briggs Type Indicator (MBTI) was published (1962). Warren T. Norman publishes his first article on the Big Five Personality Factors (1962). Criterion-referenced and norm-referenced tests were coined by Robert Glaser, a U.S. educational psychologist (1963). The American Psychological Association (APA), American Educational Research Association (AERA), and National Council on Measurement in Education (NCME) jointly revised the standards for educational and psychological assessment (APA, AERA, & NCME, 1966). Fee waivers to take the SAT started to be offered to all eligible students who cannot afford the registration fee (1969). Automated facial recognition was pioneered (1960s).

1970-1979	Emergence of the causal model of explanation	*Moment 3: Blurred genres* Qualitative researchers had full arsenal of paradigms, methods, and strategies; computers came to the fore to aid qualitative analyses; new approaches surfaced (e.g., poststructuralism, neopositivism); several qualitative journals emerged; naturalistic, postpositivist, and constructionist paradigms gained power	*Diversification of and advances in methodologies in the human sciences*: First mixed methods-declared published work in 1972 (i.e., Parkhurst et al., 1972) Denzin (1978) outlined how to triangulate methods	*Qualitative: Era of blurred genres in qualitative assessment:* Qualitative assessment reflected blurring of boundaries between the social sciences and the humanities, with semiotics and hermeneutics playing an important role. Ecological maps or, more simply, ecomaps (i.e., eco-maps; also known as ecogram), developed in 1975 by Hartman (cf. Hartman, 1978, 1995), is a graphical representation that illustrates all of the systems involved in an individual's life. Although eco-maps were developed to be used in individual and family counseling within the social work and nursing profession, it can be used to study the field of education, for example, to record information of learning experiences and to show how these interactions support or hinder a student (Bennett & Grant, 2016). Information about important interactions in a student's life can help teachers and administrators to understand students in ways that might not be revealed via educational interactions (Bennett & Grant, 2016). This first-hand knowledge of a student's strengths or weaknesses can help teachers and administrators learn how to individualize student development, and can be an important part of students' performance, as well as their personal and professional growth (Bennett & Grant, 2016). Formalization of the ethnographic interview by Spradley (1979), wherein the assessor is "more collaborative and informal" with the assessed and "does not try to maintain an 'objective' or formal distance" from the assessed (Franklin & Jordan, 1995, p. 283). *Quantitative: Era of criticism of standardized assessment* APA, AERA, and NCME jointly published the second revision of the standards for educational and psychological assessment (APA, AERA, & NCME, 1974). This edition included standards for employment and college admissions testing and addressed test development, test use, and reporting, expanding the focus beyond only test development and documentation. The Joint Committee on Standards for Educational Evaluation, an American-/Canadian-based Standards Developer Organization, was formed in 1975, to develop evaluation standards and to improve the quality of standardized assessment. An increased skepticism prevailed about the efficacy and usefulness of student achievement and intelligence tests for schools, as well as perceived testing monopolies. These criticisms yielded some important legislative changes concerning the testing industry—particularly, the Truth-in-Testing law that was passed by New York in 1979, which required sponsors and manufacturers of college admissions examinations to offer test takers the right, at the time scores are reported, to obtain copies of the test along with their answer sheet and a key to the correct responses.

				American psychologist, Charles Egerton Osgood, developed the semantic differential scale to assess the *connotative meaning* of emotional attitude towards various matters (1979).
1980-1989	*Paradigm wars*	*Moment 3: Blurred genres* *Moment 4: Crisis of representation*: Research and writing became more reflexive and led to questions about issues of gender, race, and class; new models of truth, representation, and method were sought; issues such as validity, reliability, and objectivity re-emerged as being problematic; triple crises of representation (i.e. qualitative researchers can no longer directly capture lived experience), legitimation (i.e., makes problematic the traditional criteria for evaluating and interpreting qualitative research), and praxis (i.e., involves asking whether it is possible to effect change in the world if society is only and always a text) Emergence of newer paradigms such as constructivism that led to *paradigm wars*	*Paradigm wars* Continued development of rationale for the use of mixed research	*Qualitative: Era of crisis of assessment*: Qualitative assessment became more reflexive. Conflicts emerged between assessment and reporting. Formalization of the participant observation by Spradley (1980), which "vary along a continuum that encompasses two dimensions—observation and participation" (Franklin & Jordan, 1995, p. 289), wherein assessments can be obtained via many modes, such as descriptive observations, focused observations, and selective observations. PIE graphic assessment method developed (cf. Cowan, 1988) to assess qualitatively "individuals' and family members' psychological commitment to the different roles in their lives" (Franklin & Jordan, 1995, p. 288). This qualitative assessment method may be extended to the context of education. The first use of the phrase *culturally responsive assessment* by Cuellar et al. (1983). *Quantitative: Era of standards for quantitative assessment:* APA, AERA, and NCME jointly published the third revision of the standards for educational and psychological assessment, which represented a shift toward a unitary concept in validity theory (APA, AERA, & NCME, 1985). The Joint Committee on Standards for Educational Evaluation published the Personnel Evaluation Standards in 1988, which included a total of 21 standards.
1990-1999		*Moment 5: Post-modern period of experimental ethnographic writing:* Struggle to make sense of triple	*Institutionalization of mixed methods as a distinct methodological orientation*: Beginning of conversations between	*Era of experimental ethnographic ways of assessment reporting*: Emergence of action-, participatory-, and activist-oriented assessment. The social network map developed in 1990 for qualitatively assessing social support by taking into account both the structure and function of the

		crises; new ways of composing ethnography emerged (e.g., auto-ethnography); concept of passive observer discarded; more action-, participatory-, and activist-oriented research emerged *Moment 6: Post experimental Inquiry*: Writings connected to the needs of a free democratic society; experimental forms of qualitative writing published that blurred the boundaries between social sciences and humanities	quantitative and qualitative researchers Publication of seminal works promoting mixed research as a separate research movement Widespread publication of mixed methods research studies throughout the human sciences Conceptualization that much research is inherently mixed	individual's personal social network (Tracy & Whittaker, 1990). This social network mapping approach may be extended to the field of education to assess educational support. Repertory grids used "as a qualitative assessment tool for constructing personal meanings or constructs" (Franklin & Jordan, 1995, p. 286) and, therefore, are applicable to the field of education (see also Neimeyer, 1993). With respect to the field of education, repertory grids elicit a students' construction of some domain of experience by asking them to compare and to contrast representatives from that domain (e.g., classmates, teachers, administrators, family members) and then to describe systematically each of these representatives on their own repertory of dimensions of assessment, or personal constructs. The repertory grid can be administered formally orally (i.e., interview) or in writing—either offline or online Neimeyer, 1993). Development of Stories/Narrative Assessment Procedure (SNAP), which is an innovative assessment procedure using stories, which records the development of the narrative (i.e., language and communication) skills of young deaf children (Starczewski & Lloyd, 1999; Strong et al., 1998). *Era of post experimental Inquiry*: The Joint Committee on Standards for Educational Evaluation published the second edition of the Program Evaluation Standards in 1994. APA, AERA, and NCME jointly published the fourth revision of the standards for educational and psychological assessment, which emphasized that validity and reliability were functions of the interpretations of test scores for their intended uses and not of the test itself (APA, AERA, & NCME, 1999). New forms of assessment reporting blurred the boundaries between social sciences and humanities.
2000-2009		*Moment 7: Methodologically contested present:* Period of conflict, great tension, and retrenchment; growing body of literature on paradigms, approaches, and methods *Moment 8: Un-named* Period of confronting the methodological ramifications of the evidence-based social movement	*Institutionalization of mixed methods as a distinct methodological orientation*: *Handbook of Mixed Methods Research* published (2003) *Journal of Mixed Methods Research* launched (2007) *International Journal of Multiple Research Approaches* launched (2007)	*Qualitative: Era of diversity of assessment methods*: Different assessment methods were pitted against each other (e.g., unimodality vs. multimodalities). Qualitative assessment occurred during the evidence-based social movement. Shift to explore multimodalities (Kress & Jewitt, 2003; Kress & Van Leeuwen, 2001) and multiliteracies (Cope & Kalantzis, 2000), which created openings for assessments that include the examination of various modalities and multimodal analyses. The Edmonton Narrative Norms Instrument (ENNI), developed in 2005, is an assessment tool for collecting language information from children aged 4 to 9 through storytelling. Pictures that portray a story are presented to a child, who then tells the story to the examiner (Schneider et al., 2005).

		Moment 9: Fractured future: Methodologists form two opposing camps (i.e., "gold standard" of scientific research vs. socially, culturally, ethnically, and racially responsive, communitarian, justice-oriented research)	Special interest groups formed (e.g., American Educational Research Association) Emergence of dialectical pragmatism introduced as a meta-paradigm (2009)	*Quantitative*: *Era of diversity of assessment methods*: No Child Left Behind (NCLB) education reform led to the expansion of state-mandated standardized testing as a means of assessing school performance, wherein most students are tested each year of grade school (2001). Latent Dirichlet allocation (LDA) was developed, which is perhaps the most common topic model tool (i.e., a text-mining tool for discovery of hidden semantic structures in a body of text) (2002). The Joint Committee on Standards for Educational Evaluation published the Student Evaluation Standards in 2003. Changes to the SAT to assess what students are learning in school (2005). Online Research and Comprehension Assessments (ORCA), which are performance-based measures of students' ability to conduct online research and to write a short report of their results, were used with content stability issues, wherein target websites were subject to change during data collection (e.g., Henry, 2007). Therefore, "an assessment used at one time was not always comparable to the same assessment used at another time" (Leu et al., 2015, p, 42). The Joint Committee on Standards for Educational Evaluation published the second edition of the Personnel Evaluation Standards in 2008, which is based on knowledge about personnel evaluation gained from the professional literature and research/development since 1988. A total of 6 new standards were added to the original 21 standards of the first edition.
2010-2014		*Moment 10: Methodological Innovation* Utilization of innovative approaches to reflexivity and latest technology and computer-mediated communication	*Emergence of mixed methods research into young adulthood* Second edition of *Handbook of Mixed Methods Research* published (2010) Mixed Methods International Research Association Mixed Methods Research conferences held in multiple countries and continents Webinars held dialectical pragmatism changed to	*Qualitative: Era of technological innovation in assessment:* Use of the Narrative Assessment Protocol, which provides a direct assessment of children's language abilities within a narrative context via assessing the following five aspects of language: sentence structure, phrase structure, modifiers, nouns, and verbs. It involves a real-time online scoring procedure (Justice et al., 2010). Multilingual Assessment Instrument for Narratives (MAIN) developed by the Working Group for Narrative and Discourse as a tool for the evaluation of the narrative abilities of bilingual children across a variety of languages and language combinations. The design of the MAIN allows for the elicitation of narratives in three modes: (1) story generation (telling), (2) retelling, and (3) telling after listening to a model story (Gagarina et al., 2012). Ladson-Billings's (2014, 2017) concept of culturally relevant pedagogy, Paris and Alim's (2014) extension of culturally responsive pedagogy (CRP) into culturally sustaining pedagogy (CSP), and Randall et al.'s (2022) work in justice-oriented antiracist assessment creates space for discussions of issues with assessments that marginalize people of color.

			dialectical pluralism (2011) Emergence of critical dialectical pluralism (2013)	Qualitative assessment of wiki-based learning processes emerged (Balderas et al., 2012). Quantitative: Era of *technological innovation in assessment (Mislevy, 2016, 2019):* APA, AERA, and NCME jointly published the fifth revision of the standards for educational and psychological assessment (APA, AERA, & NCME, 2014). Continued development of ORCA (Leu et al., 2015).
2015-Present *Globalization of Social Movements* The *Me Too* (or #MeToo) (founded in 2006) movement began to spread virally as a hashtag on social media (2017) The Extinction Rebellion (XR) global environmental movement (2018) The Black Lives Matter movement (founded 2013) gained further international attention during the global George Floyd protests (2020)	*Emergence of Equity Movements:* **I**nstitute in **C**ritical **Q**uantitative, **C**omputational, & **M**ixed Methodologies (ICQCM) (2020)	*Moment 10: Methodological Innovation* Publication of Sage textbook entitled "Conducting qualitative research of learning in online spaces" (Gerber et al., 2017)	*Mixed Methods Research 2.0: Emergence of Integration* Oxford Handbook of Multimethod and Mixed Methods Research Inquiry (2015) The Comprehensive Literature Review Process framed as a Mixed Methodology (Onwuegbuzie & Frels, 2016) *Emphasis on two forms of integration instead of mixing:* (1) Emergence of "1 + 1 = 3" integration formula in 2015 (Fetters & Freshwater, 2015) (2) Emergence of "1 + 1 = 1" integration formula in 2017 (Onwuegbuzie, 2017; Onwuegbuzie & Hitchcock, 2019a) Integration of multiple methods research and mixed methods research (Onwuegbuzie & Hitchcock, 2019b) The Routledge Reviewer's Guide to Mixed Methods Analysis (Onwuegbuzie & Johnson, 2021)	*Qualitative: Technological innovation in assessment, continued:* Culturally sustaining pedagogies (Paris & Alim, 2017) and culturally relevant pedagogical assessment. *Quantitative*: *Technological innovation in assessment, continued (Mislevy, 2016, 2019):* Continued development of ORCA (Leu et al., 2015) Ofqual (i.e., Office of Qualifications and Examinations Regulation)—which regulates qualifications, examinations, and assessments in England—created an algorithm to grade/mark GCSE (i.e., General Certificate of Secondary Education) and A-level (i.e., Advanced Level) examinations for determining university places in the United Kingdom because of students' inability to take face-to-face examinations as a result of the COVID-19 lockdowns (2020). The algorithm, based on four distinct terms, factored in the school's performances in each subject over the previous 3 years. The algorithm was abandoned soon after (August 13, 2020) when it was determined that, in England, Wales, and Northern Ireland, nearly 40% of the grades computed by the algorithm were lower than teachers' assessments. In the United Kingdom, GCSE, AS, and A level examinations did not take place in 2021. Instead, the students' grades were assessed by teachers based only on what they had been taught, and not what they had missed. The National Council of Teachers of English publishes position statements, such as Expanding Formative Assessment for Equity and Agency (Beck et al., 2020); the Definition of Literacy in a Digital Age (Witte et al, 2019) that acknowledges that "today's literacy demands have implication for how teachers plan, model, support, and assess student learning" (¶ 3); and Literacy Assessment: Definitions, Principles, and Practices (Yancey et al., 2018), which acknowledges "literacy assessment is a social process not a technical activity…literacy assessment includes more than cognitive activities; it also includes a range of practices and perceptions, including beliefs about literacy, dispositions toward literacy, and self-efficacy regarding literacy" (¶ 10).

			The Routledge Handbook for Advancing Integration in Mixed Methods Research (Hitchcock & Onwuegbuzie, 2022) *Emergence of New Methodologies:* Popularization of child-parent research as a mixed methodology (Abrams et al., 2020; also see Onwuegbuzie, 2020) *Emergence of Equity Movements:* **I**nstitute in **C**ritical **Q**uantitative, **C**omputational, & **M**ixed Methodologies (ICQCM) (2020) **I**ntegrative **M**ixed methods **A**nti-racist **G**roundwork for **I**nvestigating and **N**urturing **E**quity (IMAGINE) movement (2021) (Abrams, Onwuegbuzie, & Forzani, 2021; Abrams, Onwuegbuzie, Shannon-Baker, et al., 2021)	

[a] Johnson and Gray (2010); Teddlie and Johnson (2009)
[b] Denzin and Lincoln (2011); Onwuegbuzie, Leech, and Collins (2010, 2011)
[c] Johnson and Gray (2010); Johnson et al. (2007); Onwuegbuzie et al. (2017); Teddlie and Johnson (2009)

Adapted from Onwuegbuzie, A. J., Forzani, E., & Abrams, S. S. (2022), *History of quantitative, qualitative, mixed methods research, and educational assessment: A review*. Unpublished manuscript, University of Cambridge, Cambridge, England. Copyright 2022 by A. J. Onwuegbuzie, E. Forzani, and S. S. Abrams.

As can be seen in Figure 1, the 1980s witnessed the most intense period of what has been called the *paradigm wars*—wherein "[t]here were two warring paradigm camps, the postpositivists (QUANS) and the constructivists (QUALS); the differences between them could not be erased" (Denzin, 2010, p. 421), and in which the *incompatibility thesis* ("which posits that qualitative and quantitative research paradigms, including their associated methods, cannot and should not

be mixed;" Johnson & Onwuegbuzie, 2004, p. 14; see also Howe, 1988) was promoted by purists on both sides of the quantitative and qualitative spectrum. However, the 1990s saw an increase in support of the *compatibility thesis*, which posits that qualitative and quantitative research traditions, including their associated methods, can and should be mixed when the research question justifies this action and that "allows researchers to mix and match design components that offer the best chance of answering their specific research questions" (Johnson & Onwuegbuzie, 2004, p. 15).

Current State of Affairs in Mixed Methods Research

With the refutation of the incompatibility thesis in favor of the compatibility thesis by the beginning of the 21st century, the last two decades have seen the mixed methods field enter what Teddlie and Tashakkori, in 2003, referred to as "adolescence," which was characterized by "many unresolved issues to address before a more matured mixed methods research area can emerge" (p. 3)—followed by the entering of what Onwuegbuzie and Hitchcock (2019a) declared in 2019 as "emerging adulthood" (p. 18), which, at the time of writing, has seen

- the publication of at least 95 books devoted primarily or exclusively to mixed methods research;
- the launch of one journal in 2007 (i.e., *Journal of Mixed Methods Research* [*JMMR*]) and one journal in 2020 (i.e., *Journal of Mixed Methods Studies* [*JOMES*]) that are devoted exclusively to mixed methods research, as well as one journal in 2007 devoted primarily (alongside multiple methods research; i.e., *International Journal of Multiple Research Approaches* [*IJMRA*]) to mixed methods research;
- the publication of five handbooks (2003 [i.e., Tashakkori & Teddlie], 2010 [i.e., Tashakkori & Teddlie], 2015 [i.e., Hesse-Biber & Johnson], 2021 [Onwuegbuzie & Johnson], and 2022 [Hitchcock & Onwuegbuzie], respectively);
- the launch of the Mixed Methods Research Special Interest Group (SIG) of the American Educational Research Association (AERA) in 2004;
- the launch of the Mixed Methods in Evaluation Topical Interest Group (TIG) as the 45th TIG of the American Evaluation Association (AEA) in 2010;
- the launch of the Multiple and Mixed Methodologies section (i.e., Section 4) of Division D (i.e., Measurement & Research Methodologies) in 2018; and
- the launch of the Mixed Methods International Research Association (MMIRA) in 2013.

In addition to these mixed methods research publications, mixed methods research outlets, and mixed methods research associations, another important recent development that has taken place has been the conceptualization of two forms of *integration* to replace the notion and practice of *mixing*—namely, the 1 + 1 = 3 integration approach in 2015 and the 1 + 1 = 1 integration approach in 2017. Both of these approaches will be described in the following two sections.

1 + 1 = 3 Integration Approach to Mixed Methods Research

In their editorial that they co-wrote as co-editors of *JMMR*, Fetters and Freshwater (2015) introduced what they called the "1 + 1 = 3 integration formula" (p. 116), as follows:

> Moving forward, we are posing to the mixed methods community to focus even greater attention to the "integration challenge." We describe the integration challenge qualitatively as the imperative to produce a whole through integration that is greater than the sum of the individual qualitative and quantitative parts….Now, with more experience under the field's belt, we hope to get all mixed methods researchers to consider the mixed methods challenge. Quantitatively, we express this as 1 + 1 = 3. That is, qualitative + quantitative = more than the individual components. We believe this framework should push all mixed methodologists to think about how integration has and can push research methods to higher levels that would not have been achieved by simply adding together the results of separate qualitative and quantitative studies conducted without full attention to integration….The 1 + 1 = 3 integration formula also gives permission to question the assumptions of qualitative and quantitative disciplinary borders and blinders, to test the waters, and to create and discover new ways of thinking and producing mixed methods results… (Fetters & Freshwater, 2015, pp. 115-116)

This 1 + 1 = 3 integration formula has intuitive appeal, representing a value-added approach over mixed methods research studies in which the quantitative components/phases and qualitative components/phases have little or no interaction with each other. However, as explained by Onwuegbuzie and Hitchcock (2019a, 2019b, 2022), the 1 + 1 = 3 integration formula reifies the dichotomy between qualitative research and quantitative research. According to Onwuegbuzie and Hitchcock (2019a),

> a potential problem emanating from this 1 + 1 = 3 integration approach is that it hypostatizes and reifies a quantitative–qualitative dichotomy[2]—which implies a strict one-to-one correspondence between data and analyses, with qualitative analyses used *only* to analyze qualitative data and quantitative analyses used *only* to analyze quantitative data (i.e., "non-cross-over mixed analyses"; Onwuegbuzie & Combs, 2010, p. 423). As such, with the 1 + 1 = 3 integration approach, the integration (mostly) occurs at the data interpretation stage, thereby potentially stunting innovation around integration. (p. 10)

Alternatively stated, this 1 + 1 = 3 integration approach "reinforces an old one [binary], namely, QL/QN [qualitative/quantitative] research…[whereon]…qualitative (QL) and quantitative (QN) research [are] conceived as two categorically different entities" (Sandelowski, 2014, p. 3). As such, adopting a 1 + 1 = 3 integration stance during the mixed methods research process leads to what Onwuegbuzie and Hitchcock (2019a) refer to as only *partial* integration of the quantitative and qualitative research components/phases.

1 + 1 = 1 Integration Approach to Mixed Methods Research

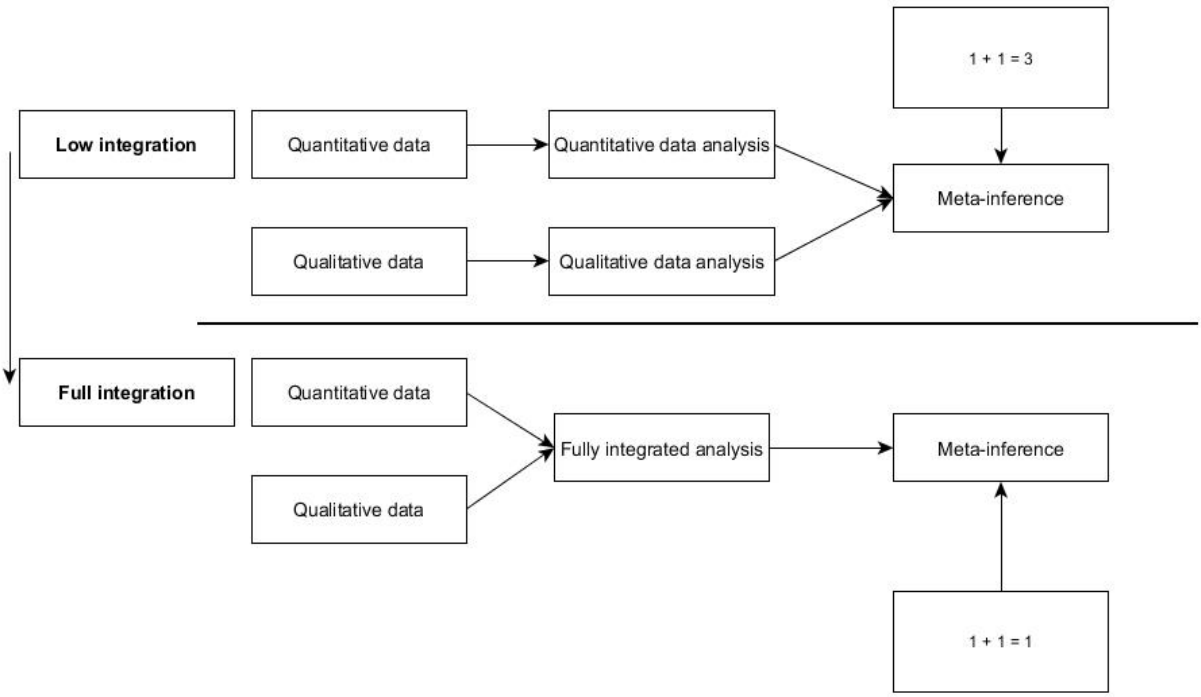
As a response to the dichotomous nature of the 1 + 1 = 3 integration approach, Onwuegbuzie (2017) introduced what he coined as the *1 + 1 = 1 integration approach*, which was further developed by Onwuegbuzie, Hitchcock, et al. (2018) and Onwuegbuzie and Hitchcock (2019a). This 1 + 1 = 1 integration approach, which serves as a complement to, but not a replacement of, the 1 + 1 = 3 integration approach, represents the *full[er]* integration of qualitative and quantitative elements at *all* stages of the mixed methods research process. Specifically, the 1 + 1 = 1 integration approach leads to a replacement of the quantitative–qualitative dichotomy that is promoted by the 1 + 1 = 3 integration approach with continua that facilitate this full[er] integration (Natesan et al., 2019; Newman et al., 2015).

The 1 + 1 = 3 integration approach yields a mixed methods research study being conducted in somewhat of a piecemeal manner, being characterized by one or more distinct quantitative phases and one or more distinct qualitative phases. Although this approach promotes synergy at the data interpretation stage, important synergy (potentially) is omitted from at least some of the other phases of the mixed methods research process. In contrast, optimally, the 1 + 1 = 1 integration approach enhances synergy at every stage of the mixed methods research process, thereby yielding *full(er) integration*. Therefore, the 1 + 1 = 1 integration approach represents a synechist (i.e., anti-dualistic) approach to mixed methods research.

Figure 2 illustrates the difference in degree of integration between a 1 + 1 = 3 integration approach and a 1 + 1 = 1 integration approach. As can be seen in this figure, the 1 + 1 = 3 approach provides *partial integration*—as noted earlier—whereas the 1 + 1 = 1 approach yields *full(er) integration*. Therefore, the 1 + 1 = 1 integration approach is consistent with (a) Mason's (2006) call for thinking that transcends or even problematizes the qualitative-quantitative divide, and supports her call for the use of multidimensional research strategies; (b) Sandelowski's (2014) call for an "unmix[ed] mixed-methods research with a view toward 'putting the mixed back into' (Onwuegbuzie, 2012) the understanding, conduct, and teaching of all health sciences [and other fields of] research" (p. 3); and (c) Creamer's (2018) stance wherein "the qualitative and quantitative strands are engaged in a dialectic manner at all stages of the study" [emphasis in original] (p. xix).

Figure 2

Contrasting 1 + 1 = 3 Partial Integration and 1 + 1 = 1 Full Integration in Mixed Methods Research



Adapted from "Using fully integrated Bayesian thinking to address the 1 + 1 = 1 integration challenge," by A. J. Onwuegbuzie, J. H. Hitchcock, P. Natesan, and I. Newman 2018, *International Journal of Multiple Research Approaches, 10*(1), p. 668. Copyright 2018 by Dialectical Publishing Inc.

> In the spirit of full(er) integration, the 1 + 1 = 1 integration approach goes well beyond the integration of *data*. Indeed, optimally, full[er] integration can occur during all four *research-producer* stages of the mixed research process—namely: *research conceptualization* (e.g., extracting information via an integrated research synthesis, determining the integrated goal of the study, identifying the integrated objective[s], determining the research/integration rationale[s], determining the research/integration purpose[s], determining the integrated research question[s]); *research planning* (e.g., selecting the integrated sampling design, selecting the integrated research design), *research implementation* (e.g., collecting the integrated data, conducting an integrated analysis, legitimating/validating the integrated data and data interpretations, interpreting the integrated data via meta-inferences), and *research dissemination* (e.g., writing the final integrated research report, re-conceptualizing the integrated research question[s])—as well as the *research-consumer* stage of *research utilization* (e.g., the consumer of the integrated research report using the findings in an integrated manner for practical or research purposes). (Onwuegbuzie & Hitchcock, 2019a, p. 14)

Most importantly, the 1 + 1 = 1 integration approach promotes the quest for full(er) integration with regard to seven broad elements. These elements comprise integrating the following components: (a) quantitative and qualitative research approaches (Integration Component 1), (b) mixed methods research and multimethod research approaches (Integration Component 2), (c) disciplines/fields (Integration Component 3), (d) arts and sciences (Integration Component 4), (e) Global North and Global South researchers (Integration Component 5), (f) online and offline spaces (Integration Component 6), and (g) researchers and participants (Integration Component 7). Although these seven elements are not exhaustive, they represent major pathways for attaining full(er) integration.

In summary, both 1 + 1 = 3 integration approaches and 1 + 1 = 1 integration approaches represent an improvement over the traditional way of conducting mixed methods research that typically occurred prior to turn of the 21st century. Indeed, many of these pre-21st century mixed methods research studies resembled more of a *1 + 1 = 2 integration approach* that involves what Tashakkori and Teddlie (1998) referred to as *parallel mixed methods research designs*, wherein the quantitative component(s)/phase(s) and the qualitative component(s)/phase(s) are conducted separately and independently from each other, and the subsequent empirical reports are written either as two distinct parts within the same (published) work or as two separate works. The decision as to whether to use a 1 + 1 = 3 integration approach or a 1 + 1 = 1 integration approach depends both on the research question(s) and on the level of integration needed to address it/them.

Prevalence of Mixed Methods Research Across Fields and Disciplines

Over the last three decades, several researchers have investigated the prevalence of mixed methods research studies across numerous fields and disciplines. Alise and Teddlie (2010) refers to such studies as *prevalence rate studies* (p. 104). According to Alise and Teddlie (2010),

> Researchers examining prevalence rates are interested in determining the percentage of QUAN [quantitative], QUAL [qualitative], and MM [mixed methods] research studies that occur within different disciplines across the social sciences. These rates are especially important to individuals interested in MM, because they indicate the degree of awareness that researchers in different disciplines have of the utility of MM research and how it can be used to uniquely answer certain types of questions in their areas of study. (p. 104)

Further, Alise and Teddlie (2010) stated that these prevalence rate studies help researchers to "determine if the paradigm wars have subsided in selected disciplines by assessing (a) the prevalence rates of MM [mixed methods] in those fields and (b) the degree to which disciplines are still dominated by the traditional postpositivist QUAN [quantitative] approaches" (p. 107). Alise and Teddlie (2010) concluded the following:

> As more research evidence accumulates, we will get a better picture of the overall prevalence rates of MM throughout the social/behavioral sciences and how that evolves over time. These prevalence rates studies are crucial at this time for mixed methodologists because they allow us to understand how MM techniques are spreading across a variety of disciplines and how they are evolving as they expand into areas where other methodologies have previously dominated. (p. 120)

Onwuegbuzie and Corrigan (2018) conducted what they coined as a *meta-prevalence rate study* (p. 2), which represents *a prevalence rate study of prevalence rate studies*. Their meta-prevalence rate study yielded 46 prevalence rate studies that had taken place between 1994 and 2015 wherein the prevalence of mixed methods research studies across various fields or disciplines had been documented. Of these 46 studies, 45 had taken place since 2003, which, as stated previously, was the year that mixed methods research was declared by Tashakkori and Teddlie (2003) as entering adolescence. Further, of these 46 studies, 41 yielded prevalence rate data, as opposed to frequency count data wherein the total number of occurrences is reported but not the proportion/percentage. Of these 41 studies, the prevalence rates across fields and disciplines ranged from <1% for family science research (Plano Clark et al., 2008) to 42% for evaluation (Christie & Fleischer, 2010), with an overall meta-prevalence rate mean of 11.65% (Median = 9.6%, *SD* = 9.92%). Interestingly, slightly more than one half (i.e., 51.2%) of the prevalence rate studies contained prevalence rates that were less than 10.00%, 78.0% of these studies contained prevalence rates that were less than 15.00%, and 87.8% of these studies contained prevalence rates that were less than 20.00%. Inferentially, no statistically significant relationship was found between the year of the prevalence rate study and the prevalence rate (r_s = -.03, p = .86), which indicates that the prevalence rates in these 41 studies had not been increasing over time.

Prevalence of Mixed Methods Research in the Education Field and Education Disciplines

With the exception of the field of nursing, the field of education (Alise & Teddlie, 2010 [24.0% for the year 2005]; Collins, Onwuegbuzie, & Jiao, 2007 [39.0% for the years 1887-2006]; Ivankova & Kawamura, 2010 [21.2% for empirical articles / 15.0% for methodological works for the years 2000-2008]; Niglas, 2004 [19.0% for unknown years]; Truscott et al., 2010 [14.0% for the years 1995-2005]) in general and the discipline of mathematics education (Hart et al., 2009 [29.0% for the years 1995-2005]; Ross & Onwuegbuzie, 2010 [33.0% for the years 1999-2008], 2012 [31.0% for the years 2002-2006], 2014 [34.0% for the years 2006-2010]) in particular consistently have had the highest prevalence rates of mixed methods research. Interestingly, as can be seen, all four prevalence rate studies of the mathematics education have

consistently revealed that approximately one third of studies published in this discipline represent mixed methods research, which demonstrates that use of mixed methods research has been relatively more common with respect to this discipline. Interestingly, Ross and Onwuegbuzie's (2012) qualitative analysis of mixed methods research articles published in the area of mathematics education led them to conclude that mathematics education researchers are interested in "revealing a big picture associated with mathematics teaching and learning, with high emphasis on thinking patterns, behaviors, understanding, and the relations thereof, providing justification for a higher proportion of qualitative-dominant mixed methods research articles" (p. 100).

Although not as high as is the case for mathematics education, other education disciplines have yielded prevalence rates that approximately equal or exceed the mean prevalence rate across the 41 studies of 11.65%. Specifically, Taylor and Abernathy (2014) reported a mixed methods research prevalence rate of 15.0% for studies published in special education journals from 2005 to 2010 and 18.3% for doctoral dissertations representing the special education discipline for these same years. Collins, Onwuegbuzie, and Sutton (2007) documented a mixed methods research prevalence rate of 11.5% for studies representing the special education discipline for the years 2000 to 2005. Coleman et al. (2007) reported a mixed methods research prevalence rate of 17.7% for studies representing the gifted education discipline for the years 1985 to 2003. Finally, representing the remaining prevalence rate study of an education discipline, Hutchinson and Lovell (2004) reported a mixed methods research prevalence rate of only 6.3% for the discipline of higher education for the years 1996 to 2000.

These 13 remaining prevalence rate studies, representing either the field of education in general or a specific education discipline, involved an examination of years that were at least 12 years before the time of writing, with both Taylor and Abernathy (2014) and Ross and Onwuegbuzie (2014) examining publications that ended in 2010. However, the last 12 years have witnessed rapid developments in the field of mixed methods research. With this point in mind, the purpose of the remainder of this report is to document the prevalence and use of mixed methods research in the field of education since the paradigm wars of the 1980s, in general, and since 2010, in particular.

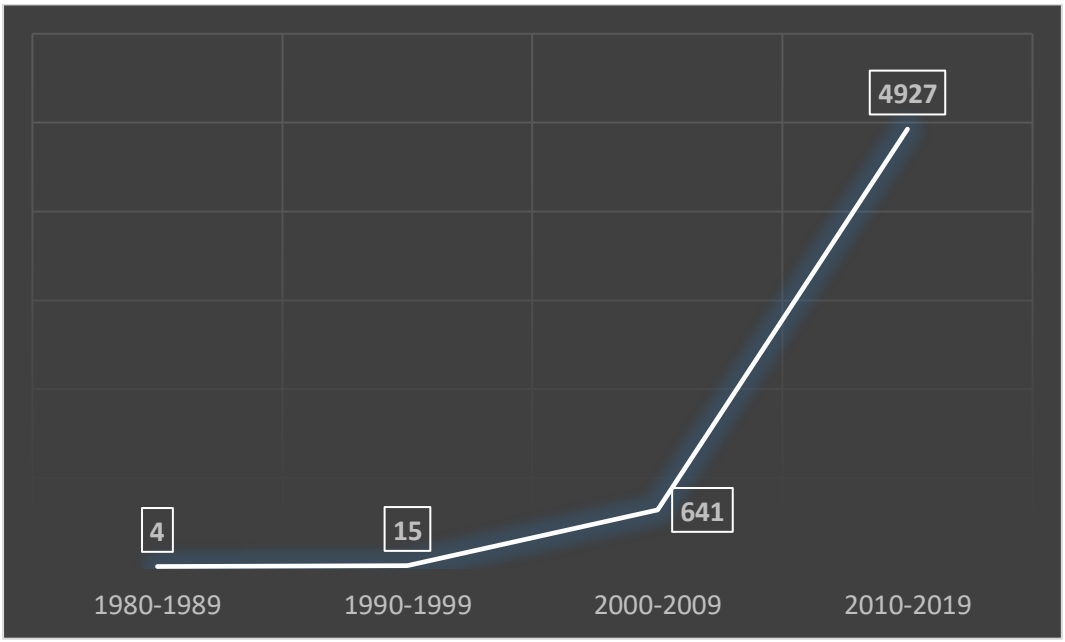
Systematic Review

In order to contextualize the trend in published mixed methods research articles representing the field of education, we conducted a cursory ERIC search via the ProQuest database of research in education published between 1980 and 2021 in which "mixed method(s)" was included in the title and/or abstract. As depicted in Figure 3, published mixed methods research in education grew exponentially during the first two decades of the 2000s. Figure 4 presents published mixed methods research studies representing the field of education for the 12 years spanning from 2010 to 2021. This period of time, which covers years that have not been studied to date with respect to the prevalence rate of published education-based mixed methods research studies, represents the period marking the emergence of mixed methods research into young adulthood as well as the emergence of Integration (see Figure 1). It can be seen from Figure 4 that, apart from 2021—that is, from 2010 to 2021—the prevalence rate of published education-based mixed methods research studies increased monotonically. It is possible, if not likely, that

the reduction in 2021 in published education-based mixed methods research studies to 2019 levels, at least in part, reflects COVID-19, which has been shown significantly to decrease levels of productivity (Ojo et al., 2022), especially for women academics (Abramo et al., 2022; Cui et al., 2021; Krukowski et al., 2021; Walters et al., 2021, 2022), who are statistically significantly more likely than are men lead authors (57.7% vs. 42.3% for *JMMR*, respectively; 64.5% vs. 35.5% for *IJMRA*, respectively) to be lead authors of mixed methods research articles (Wilcox et al., 2019).

Figure 3

Published Mixed Methods Research Studies Representing the Field of Education by Decade



To contextualize better the prevalence of mixed methods research in education, we examined the total number of mixed methods research articles in education published in the past 5 completed years in relation to the number of published research studies, regardless of methodology used. As illustrated in Figure 5, the trend pertaining to published education articles in general resembled the trend for education-based mixed methods research articles. Further, the percentage of mixed methods research studies represented within the total number of educational research publications, increased each year, with mixed methods research representing 6% in 2017 to 7.9% in 2021 of the published educational research studies.

Figure 4

Published Mixed Methods Research Studies Representing the Field of Education by Year: 2010-2021

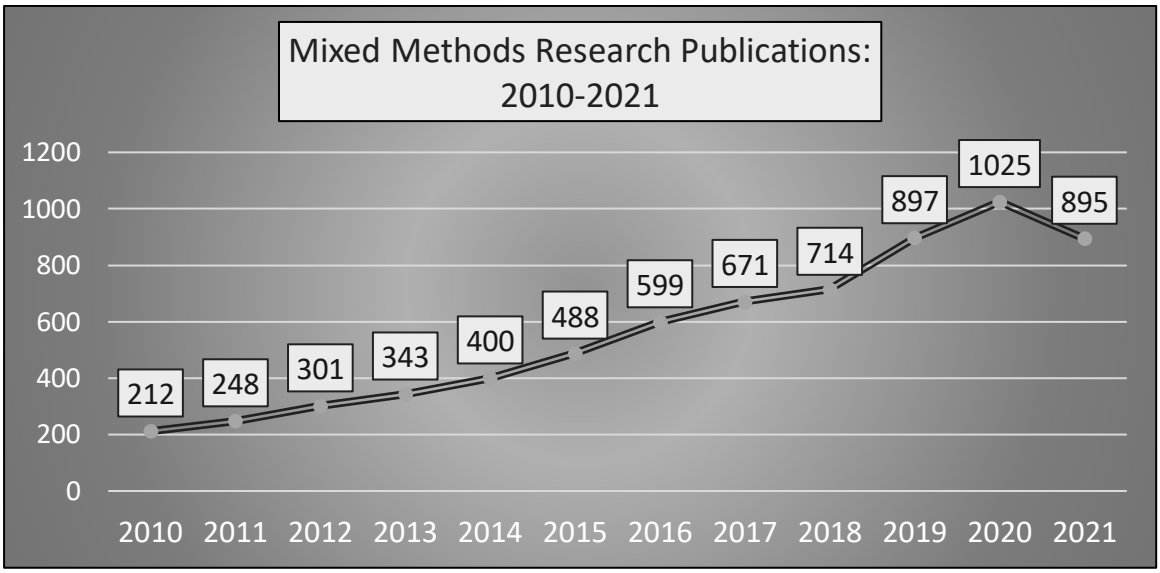
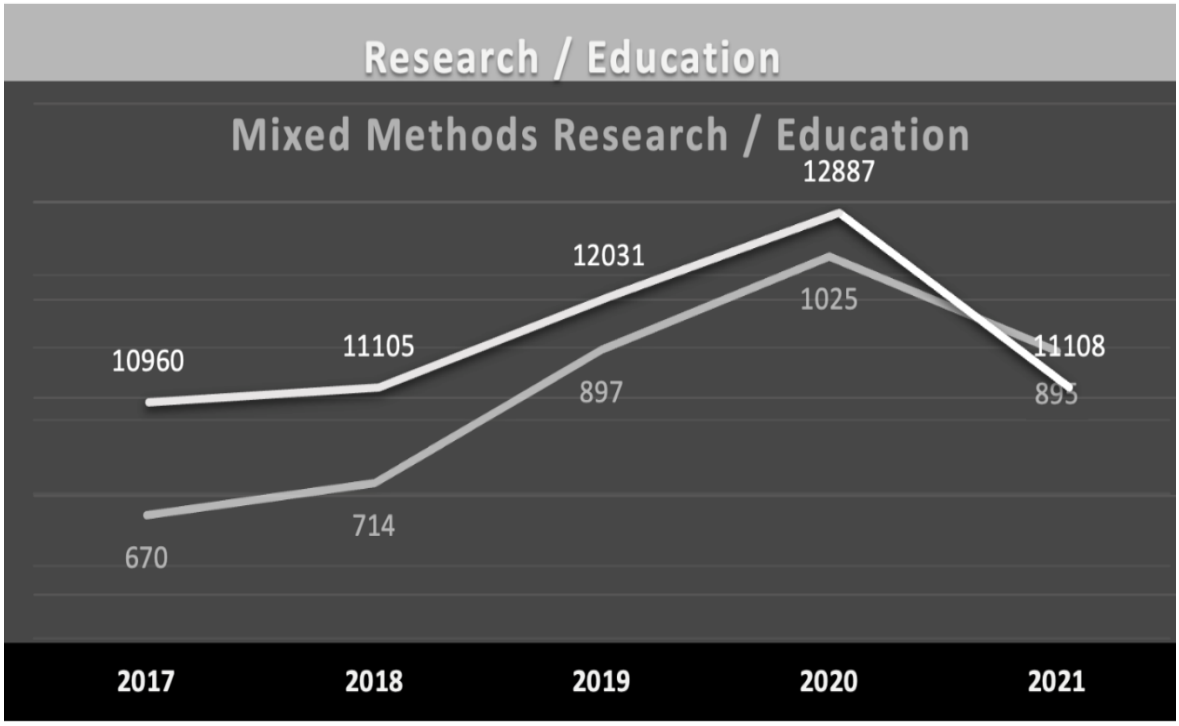


Figure 5

The Trend in Published Education-Based Mixed Methods Research Studies Mapped Onto the Trend in Published Education-Based Research Studies



Moving from the overall place of mixed methods research in education, the main purpose of the remainder of this report is to examine the state of mixed methods research in education. In doing so, we focused our analysis on mixed method research in education published between 2017 and 2021—representing the last 5 complete years at the time of writing. This timeframe allowed us to capture a broad and representative state of the field because the total number of publications during this period accounts for approximately 60% of all mixed methods publications since 2000.

Systematic Review: Method

Mixed Methods Bibliometric Study

In exploring the state of mixed methods research in education, we approached the task using what Onwuegbuzie, Wilcox, et al. (2018) conceptualized as a *Mixed Methods Bibliometric Study*. According to these researchers, in mixed methods bibliometric studies, bibliometric quantitative data are integrated with qualitative data for the purpose of helping researchers both to identify the patterns of publications within a given field, discipline, or body of knowledge (i.e., quantitative component[s]/phase[s]) and to understand how these patterns and trends have emerged (i.e., qualitative component[s]/phase[s]) in an attempt to determine the degree of development of various fields/disciplines/knowledge areas.

Research Philosophy

The research philosophy underlying this mixed methods bibliometric study was critical dialectical pluralism. In a nutshell, CDP 1.0 is a mixed methods research-based philosophy, originally developed by Onwuegbuzie and Frels (2013), to represent both a process philosophy and a communication theory that emphasizes procedural, process, and philosophical justice, as well as both universalistic theoretical knowledge and local practical knowledge. CDP 2.0—hereafter referred to as CDP—which builds on CDP 1.0, was introduced by Onwuegbuzie et al. (in press). Representing an upgrade of CDP, it has at its root the pursuit of **s**ocial justice, **i**nclusion, **d**iversity, **e**quity, and **s**ocial responsibility, which Onwuegbuzie et al. (in press) refer to as *the many SIDES of CDP*, and which represent five core elements that facilitate global justice (Al-Rodhan, 2009). Additionally, the integration of various epistemological perspectives are accounted for in this research philosophy (Onwuegbuzie & Frels, 2013).

Data Collection

Bibliometric Component

Data for the bibliometric component—which subsequently were subjected to both quantitative analyses and mixed analyses—were collected using a Proquest ERIC search in which the following search parameters were specified: (a) "mixed method*s" in the abstract field, (b) education in any field, (c) "scholarly journal" in the source type field, and (d) 2017-2021 in the publications field. This search yielded a total of 4,284 published articles. All articles were screened through a two-phase process. In the first phase—which comprised all articles published in 2017, 2018, and one half of the articles published in 2019 (n = 1,889)—articles

were screened via a review of their abstracts. The inclusion criteria included any article in which the author(s) stated using a mixed methods research design and/or mixed methods research approach to analyzing data (i.e., what Leech and Onwuegbuzie [2022] referred to as an *empirical mixed methods-declared research study*) or the topic of study was mixed methods research. Articles were excluded if they (a) referred to mixed methods in relation to describing methodologies in the literature review section, (b) focused the article on extracting partial data from a larger mixed methods study, or (c) suggested that future studies on the topic ought to be conducted using mixed methods research.

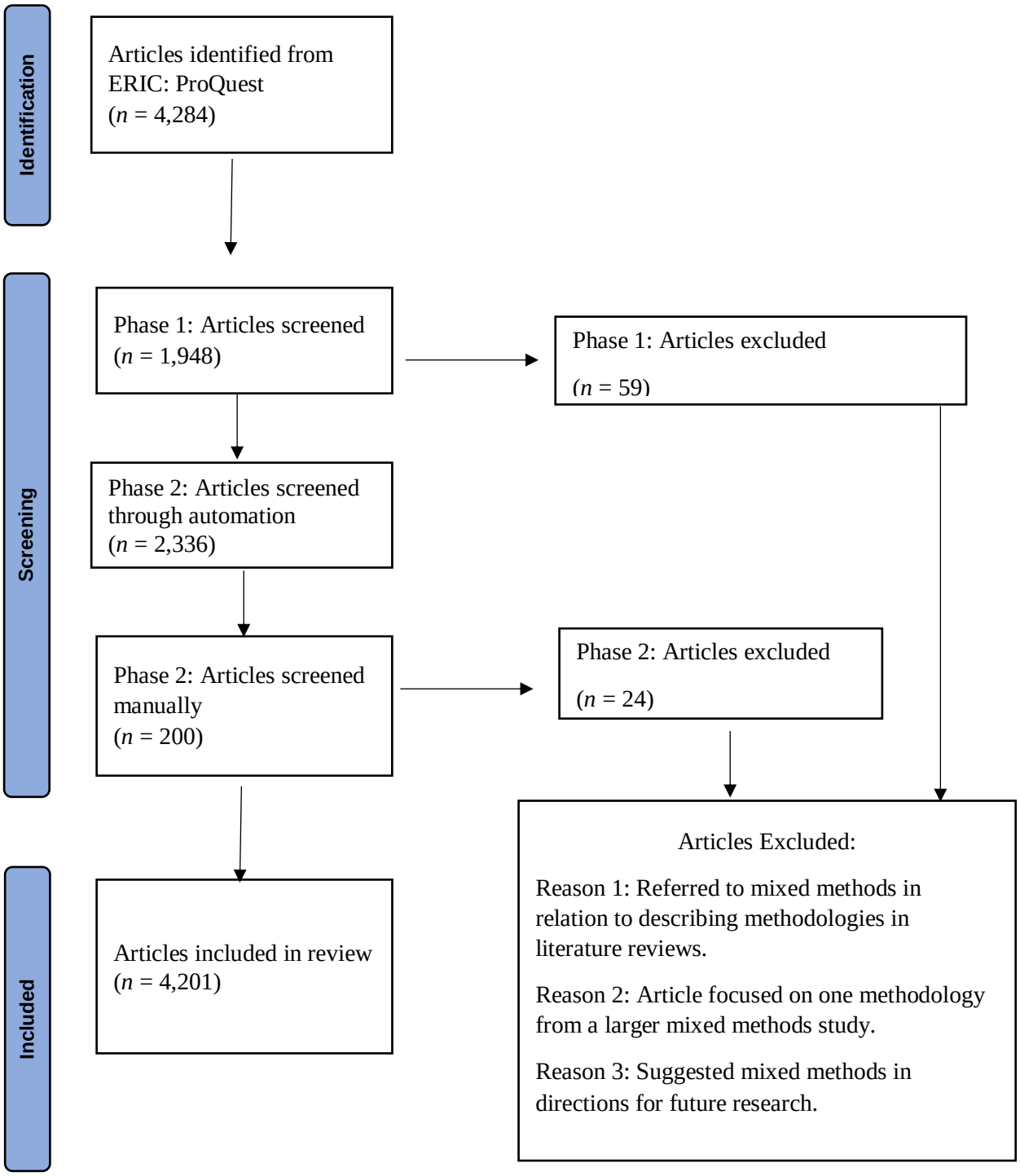
In the second phase of the quantitative analysis and mixed analysis components, we used the keywords from the articles excluded in the first phase to automate the process. That is, the third author (Kasey) wrote code in Python to scan the abstracts for the following keywords: (a) "literature review"; (b) "systematic review"; (c) "review of literature"; (d) "mixed methods of"; (e) "mixed method of"; and (f) "content analysis." This automated process returned articles for manual review, which comprised (a) 65 articles in 2019, (b) 45 articles for 2020, and (c) 90 articles for 2021. For each of these articles, the abstracts were reviewed to determine whether they fit the inclusion criteria. This two-phase review process for the quantitative analysis and mixed analysis components yielded a total of 4,202 mixed methods articles in education published between 2017 and 2021.

PRISMA (i.e., Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009) were used in the conduct of the systematic review process. As presented on the PRISMA Statement website (PRISMA, 2021), PRISMA provides detailed steps via a checklist (PRISMA, 2009), with the goal of helping systematic reviewers present a standardized reporting of their reviews. Although it was originally developed to assess the benefits and risks of health care interventions, it can be applied to other fields and disciplines—including the field of education.

The goal in identifying abstracts in the Proquest ERIC database that included the aforementioned keywords was to identify education-based articles wherein the author(s) explicitly declared their works as representing mixed methods research (i.e., *empirical mixed methods-declared research articles*). As explained by Leech and Onwuegbuzie (2022), using this search strategy provided what the authors framed as mixed methods research articles, and not articles that involve use of both quantitative research approaches and qualitative research approaches in a minimal way such that the authors did not frame them as representing mixed methods research—thereby helping us avoid over-identifying mixed methods research articles because of the systematic reviewers' classification of mixed methods research articles that the author(s) themselves would not have classified as representing mixed methods research.

Figure 6 presents the PRISMA flowchart for the 2017-2021 years. As can be seen from the PRISMA flowchart (Figure 6), the initial search yielded 4,284 *mixed methods-declared articles* from the Proquest ERIC database. That 83 out of these initial 4,284 works did not qualify as a mixed methods-declared empirical article indicates that the *false positive rate* for identifying empirical mixed methods-declared articles during this 5-year period was 1.94%. Therefore, the final number of mixed methods-declared articles across this 2017-2021 time period ended up being 4,201.

Figure 6: *PRISMA Flow Chart Detailing Steps in the Identification and Screening of Author-Declared Mixed Methods Research in Education Through the ProQuest ERIC Database Published Between 2017 and 2021*



Qualitative Component

For this qualitative component, the first author (Tony) of the current chapter assumed a participant-researcher role, allowing him to provide an emtic viewpoint (i.e., that results from occupy the position of both insider and outsider rather than viewing the viewpoint exclusively as a dichotomy of either insider or outsider, which, optimally, yields maximum interaction between emic and etic viewpoints; Onwuegbuzie, 2012; see also Dwyer & Buckle, 2009) to the meaning-making process. Tony had an emtic viewpoint for a number of reasons. In particular, Tony serves/has served as editor-in-chief of three journals and editor of a fourth journal, as follows: (a) editor of *Educational Researcher* (*ER*)—one of the flagship journals of the American Educational Research Association—for 5 years during the adolescent period of the mixed methods research field (2006-2010); (b) editor-in-chief of *Research in the Schools* (*RITS*)—the flagship journal of the Mid-South Educational Research Association—for 19 years (2003-2021), and associate editor for 6 years (1997-2002) that spanned the pre-adolescent, adolescent, and young adulthood periods of the mixed methods movement; (c) *International Journal of Multiple Research Approaches* (*IJMRA*) for 5 years (2018 to present) that has spanned the young adulthood period of the mixed methods movement; and (d) *Journal of Mixed Methods Studies* (*JOMES*) (2022 to present) that also is spanning the young adulthood period of the mixed methods movement. Further, Tony has served as guest editor of several special issues for *IJMRA* (e.g., "Teaching Mixed Methodologies" [Volume 3, Issue 3; 2009]; "Mixed Methods Research in Education" [Volume 5, Issue 2; 2012]) and the *International Journal of Qualitative Methods* (*IJQM*) (i.e., "How Mixed Methods Informs and Enhances Qualitative Research I" [Volume 14, Issue 2; 2015]; How Mixed Methods Informs and Enhances Qualitative Research I" [Volume 15, Issue 1; 2016]). In addition, Tony has served on several editorial boards, including that of *JMMR* (2007 to present) that has spanned the young adulthood period of the mixed methods movement; and he has reviewed articles for more than 25 journals. Also, as an author, Tony has authored/co-authored more articles than has any other scholar representing the mixed methods research community. Moreover, according to the AD Scientific Index World Scientist and University Rankings (2022), within the Field of Education (i.e., Educational Research Scientist), Tony is ranked as follows:

- #1 in the world in terms of number of citations over the last 5 years
- #1 in the United Kingdom
- #1 in Africa (where he has affiliations with the University of Johannesburg and the University of South Africa)
- #2 in Europe
- #14 in the World

Most notably, at the time of writing, Tony was the #1 most cited Educational Research Scientist in the world in terms of number of citations over the last 5 years. Also, Research.com, which apparently is "one of the major websites for Social Sciences and Humanities research offering credible data on scientific contributions since 2014" (Research.com, 2022), recognizes Tony as a top cited Social Sciences and Humanities Scientist—being ranked as #5 in the United Kingdom and #64 in the World. Therefore, it was believed that Tony was well-placed to provide an emtic perspective.

The main qualitative instrument utilized for data collection was a reflexive journal. This reflexive journal was guided by questions such as the following: (a) "In your experience as editor/editor-in-chief and reviewer of several journals, to what extent have you observed an increase over the years in the number of submissions of empirical mixed methods research manuscripts submitted to journals?"; (b) "To what extent has the quality of empirical mixed methods research articles improved?"; and (c) "What has been the impact of empirical mixed methods research articles across the pre-adolescent, adolescent, and young adulthood periods of the mixed methods movement?" Also, mixed methodological articles authored/co-authored by Tony were analyzed to extract information regarding methodological trends and practices used by mixed methods researchers at the time of writing.

Data Analysis

Bibliometric Component

Quantitative analysis. We began our in-depth quantitative data analysis by identifying each empirical mixed methods-declared research article published in 2021. Specifically, in order to secure a representative corpus of mixed methods research, we identified articles that included "mixed method(s)" in the title. All identified articles were coded with consideration of the following 12 characteristics:

1. Whether the author(s) identified a mixed methods research design;
2. Whether the design was qualitative dominant, quantitative dominant, or equal status;
3. Whether the data were collected in a sequential or a concurrent manner;
4. The extent to which the author(s) grounded the research design in mixed methods literature: (0 = no mixed methods citations; 1 = one mixed methods citation; 2 = several mixed methods citations in the methods section; 3 = several mixed methods citations throughout the article);
5. The number of authors;
6. The country in which the lead author's institution was affiliated;
7. The gender of the lead author;
8. The number of article pages;
9. The number of times the articles was cited;
10. The impact factor of the journals in which the articles were published;
11. Characteristics of the titles of the works; and
12. The level of integration: (0 = no integration of the quantitative and qualitative data; 1 = no integration of the quantitative and qualitative data until the discussion; 2 = small to moderate integration of the quantitative and qualitative data; 3 = full[er] integration of the quantitative and qualitative data).

Depending on the scale of measurement (i.e., nominal, ordinal, interval, ratio) of the coded variables involved in the analysis, descriptive analyses (e.g., means, standard deviations,

percentages, odds ratios) and inferential statistics analyses (e.g., independent samples *t* test, chi-square analysis, Fisher's Exact Test) were utilized.

Mixed analysis. WordStat 8.0.28 (Provalis Research, 2020) was used to conduct topic modeling using factor analysis to extract the main themes from the titles of the identified empirical mixed methods research articles. The use of topic modeling yields a mixed analysis because it involves quantitatively analyzing text (i.e., qualitative) data (Van Haneghan, 2021). In the present investigation, topic modeling was conducted by computing a word x word correlation matrix and then conducting a factor analysis in order to extract an appropriate number of factors. All words with a factor loading higher than a specific criterion then were identified as part of each extracted topic. In topic modeling, the factor analysis might yield a word being associated with more than one factor, unlike the case for hierarchical cluster analysis, wherein each word appears only in one cluster. According to Provalis Research (2014), the former scenario represents "a characteristic that more realistically represents the polysemous nature of some words as well as the multiplicity of context of word usages" (p. 45). In order to maximize the stability of the factoring solution, all low frequency items were excluded (Provalis Research, 2014).

Qualitative Component

Constant comparison analysis (Glaser, 1965) was conducted to analyze data from the reflexive journal via (a) open coding, (b) axial coding, and (c) selective coding. During the open coding stage, raw data from the reflexive journal were organized into meaningful groups, which then were assigned labels (Glaser, 1965). The labeled groups (i.e., codes) were organized further into categories (i.e., axial coding), after which they were further grouped and refined during the selective coding stage in order to produce an illuminating narrative (i.e., social phenomenon; Glaser & Strauss, 1967). Finally, classical content analysis (Berelson, 1952) was used to analyze the selected mixed methodological articles.

Systematic Review: Results

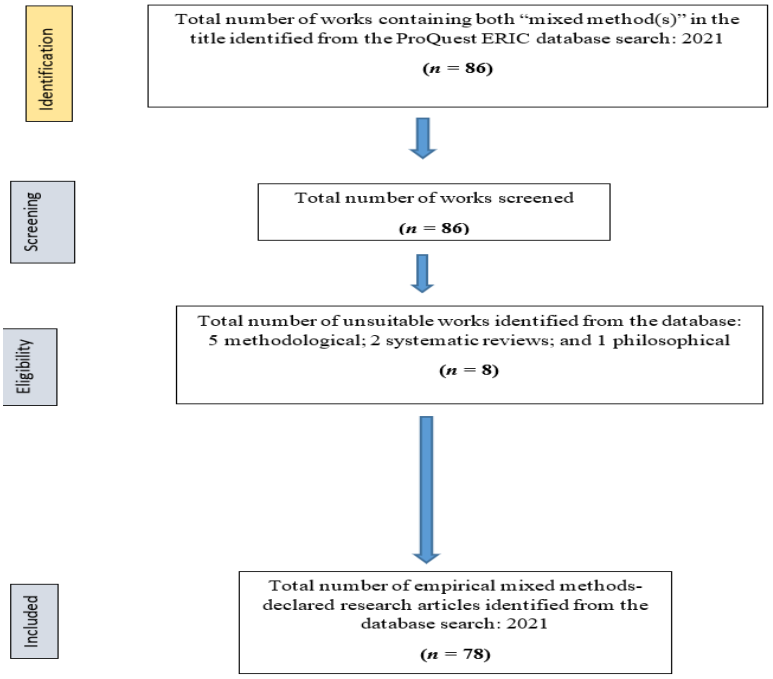
In seeking to understand the complexities of research using mixed methods, we conducted an in-depth analysis of empirical mixed methods research articles published in 2021. In support of our decision to identify what Leech and Onwuegbuzie (2023) referred to as the *empirical mixed methods-declared prevalence rate*, another systematic review conducted by the present authors via the Scopus database of all articles published in *JMMR* between its first issue in 2007 (i.e., Volume 1, Issue 1; January 2007) and the latest issue at the time of writing in 2022 (i.e., Volume 16, Issue 3; July 2021)—comprising 316 refereed articles (i.e., excluding 14 review articles, 6 notes, 84 editorials, 1 letter, and 2 errata)—revealed that 294 articles (i.e., 93.04%) have included the phrase "mixed methods" or one of its variants (i.e., "mixed methodology") in the title and/or abstract. This Scopus-indexed finding demonstrates that searching the title and/or the abstract alone would capture the overwhelming majority of empirical mixed methods-declared research articles, thereby yielding a low false-negative rate. Further, because 225 of the 316 refereed articles (i.e., 71.20%) have included "mixed methods" or one of its variants in the title alone, for our in-depth analysis of the empirical mixed methods-declared research articles published in 2021, we decided to narrow our analysis from the 895 published mixed

methods research articles in 2021 to the 78 mixed methods-declared research articles published in this year that included "mixed method(s)" in the title.

As can be seen from the 2021 PRISMA flowchart (Figure 7), the initial search yielded 86 ProQuest ERIC-indexed articles that represent a mixed methods-declared research approach, as identified by their titles. After reading these 86 works, as documented in the PRISMA flowchart, we identified 8 articles that did not qualify as an empirical mixed methods research study for the following reasons: they represented either a methodological work, a systematic review, or a theoretical piece. This yielded a total of 78 articles wherein, in the title, the author explicitly declared their study as representing some form of a mixed methods research study. That 8 out of these initial 86 articles did not qualify as a mixed methods-declared research study indicates that the *false positive rate* for identifying empirical mixed methods-declared research articles from the ProQuest ERIC database was 0.093%. In his reflexive journal, when discussing the 78 mixed methods-declared articles published in 2021, Tony noted the following:

> Considering that there are 253 journals that represent education, education research, and related areas that are indexed in the Social Sciences Citation Index (SSCI), the Arts and Humanities Citation Index (A&HCI), and the Sciences Citation Index (SCI), as well as journals on humanities education and science education—not to mention lower-tiered journals in the field of education—the 78 education-based mixed methods-declared research articles published in 2021 is surprisingly small to me because it means that, at most (i.e., assuming that, although unlikely, each of these 78 articles was published in a different journal), less than one third (i.e., ≤ 30.83%) of the journals published a mixed methods-declared research articles in 2021. Alternatively stated, at least 175 indexed education-based journals did not include any mixed methods-declared research articles in any of their 2021 issues!

Figure 7: *PRISMA Flow Chart Detailing Steps in the Identification and Screening of Author-Declared Mixed Methods Research in Education Through the ProQuest ERIC Database Published in 2021*



Whether the Author(s) Explicitly Specified the Type of Mixed Methods Research Design

Across the 78 empirical mixed methods-declared research articles published in 2021, 80.8% of the authors specified the type of mixed methods research design. However, it is somewhat disturbing that, although 19.1% of the authors declared that their studies involved use of a mixed methods research approach, they did not provide a label for their mixed methods research design, nor did they (adequately) describe their design. As a result, their research studies were not sufficiently transparent in terms of their overall mixed methods research approaches.

Although nearly one fifth of the authors did not explicitly specify the type of mixed methods research design used, it was still possible to determine (i.e., code) the emphasis placed between the qualitative and quantitative phases/components of their studies. This analysis revealed that the majority (61.54%) of mixed methods research designs involved (approximately) equal quantitative and qualitative phases/components. Nearly one third of the studies (30.77%) were quantitative-dominant, with only 7.69% being qualitative-dominant. In terms of data collection procedures, the authors utilized concurrent designs and sequential designs in approximately the same frequency, with 51.3% concurrent designs being used versus 48.7% sequential designs. In his reflexive journal, when discussing the dominance of quantitative research and qualitative research approaches within mixed methods research studies, Tony noted the following:

> In examining closely all the education-based prevalence rate studies identified in my previous research (i.e., Onwuegbuzie & Corrigan, 2018), Julie Corrigan and I noticed that there are some disciplines in which qualitative-dominant published studies are more prevalent than are quantitative-dominant published studies. For example, Ross and Onwuegbuzie (2010) who examined the trends of mixed methods research articles published in *Journal for Research in Mathematics Education* (*JRME*; *n* = 151) and the *American Educational Research Journal* (*AERJ*; *n* = 247) over a 10-year period (i.e., 1999-2008), and who documented that mixed methods research accounted for 33% of empirical articles published in these flagship journals—the highest prevalence rate of all education fields—reported that qualitative-dominant published studies (54%) are more prevalent than are quantitative-dominant published studies (32%). This finding regarding the 78 mixed methods-declared research articles indicates that a statistically significantly greater number of the studies were quantitative-dominant than qualitative-dominant; however, the majority of these 78 articles have (approximately) equal status, which is an encouraging finding because equal-status mixed methods research studies tend to represent more complex research designs as a result of both approaches involving playing an important role in the mixed methods research approach—as opposed to a more complex research approach (e.g., qualitative) being mixed or integrated with a less complex research approach (e.g., quantitative), as might be the case for a (qualitative-) dominant mixed methods research study—that necessitates full(er) integration.

Extent to Which the Study was Grounded Within the Mixed Methods Research Literature

In considering that these articles were selected as being representative of mixed methods research, because the authors chose to include "mixed method(s)" in the titles, we expected the authors would ground their work in the mixed methods literature. Thus, it is disturbing that nearly one fourth (i.e., 24.4%) of the authors of the mixed methods-declared research studies

did not ground their research approach within the mixed methods research literature to *any* degree at all. Indeed, these authors did not cite a single mixed methodological work. A further 52.6% of the studies involved grounding of their work to a minimum degree, typically representing the mixed methods research literature with only one citation and describing their mixed methods research approach using as little as one sentence. Another 19.2% of the studies represented the mixed methods research literature moderately. Finally, only three (i.e., 3.8%) of the studies represented the mixed methods research literature in a significant manner. That more than three fourths (i.e., 77.0%) of the authors grounded their research approach within the mixed methods research literature to little or no degree is extremely disturbing, bearing in mind the positive relationship between number of citations and quality of article documented by Onwuegbuzie et al. (2013). In his reflexive journal, Tony noted the following:

> One has to wonder why such a small percentage of these authors sufficiently grounded their research approach within the mixed methods research literature when there are so many mixed methodological articles, book chapters, and books that could be cited? What steps can be taken to encourage authors to ground their mixed methods research approaches to a greater extent?

Authorship

With regard to level of collaboration, the number of authors ranged from 1 to 13 (M = 3.29, SD = 2.25)—yielding a total of 257 authors across the 78 articles. The highest frequencies of publications were authored by the least number of scholars; that is, 21.8% were single-authored, another 21.8% were written by 2 co-authors, and 20.5% were written by 3 co-authors. In contrast, there were only two articles (2.6%) with 8 co-authors, one article (1.3%) with 9 co-authors, and one article (1.3%) with 13 co-authors. The remaining author combinations were 4 co-authors (14.1%), 5 co-authors and 6 co-authors (each at 6.4%), and 7 co-authors (3.8%).

The overall level of collaboration (M = 3.29, SD = 2.25) is statistically significantly (t = 1.99, p = .049; Cohen's [1988] d = .30) higher than is the overall level of collaboration (M = 2.71, SD = 1.72) reported by Onwuegbuzie, Wilcox, et al. (2018) across all articles (n = 146) published in *JMMR* from 2007 (its inception) to 2014. Interestingly, although the number of authors was not statistically significantly related to the impact factor (r = .00, p = .99), a statistically significant and moderate positive relationship emerged between the number of authors and both the number of article pages (r_s = .23, p = .039) and the number of citations yielded by the manuscript (r_s = .35, p = .002). Specifically, the mixed methods-declared research studies with the most co-authors were more likely to produce longer articles that yielded the most citations. In his reflexive journal, Tony noted the following:

> The finding that the majority of articles (i.e., 56.4%) involved three or more authors, coupled with the finding from the studies of published *JMMR* articles (i.e., Onwuegbuzie, Wilcox, et al., 2018), provides strong evidence that the conduct of mixed methods research studies in general and education-based mixed methods research studies in particular involves collaboration more so than do quantitative research studies and qualitative research studies.

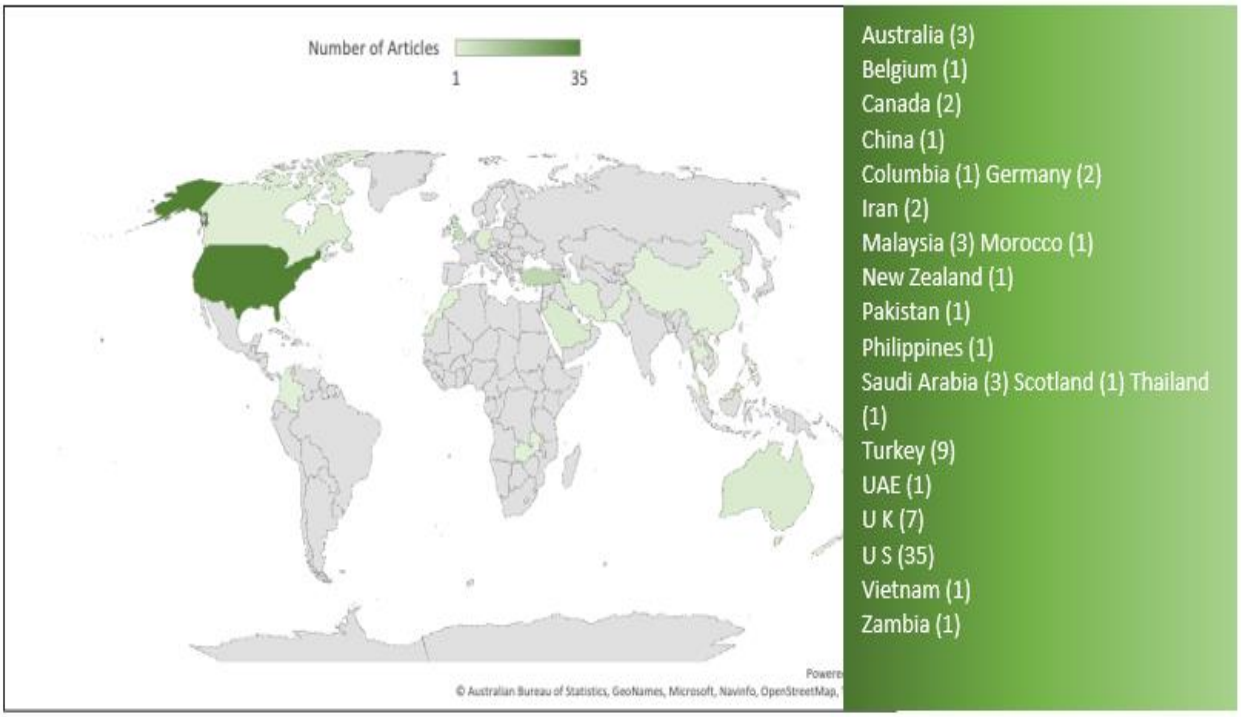
The lead authors involved in these 78 mixed methods-declared research studies represented 27 countries. The United States was the country most represented, with 35 publications (44.87%), followed, respectively, by 9 from Turkey (11.54%), 7 from the United Kingdom (8.97%), and then 3 each from Saudi Arabia, Malaysia, and Australia (3.85%).

Figure 8 displays a Geographic Information Systems (GIS) map of countries represented by all lead authors of mixed methods-declared research studies. This map illustrates the dominance of U.S. authors, and, to an even greater degree, the dominance of authors from English-speaking Western countries (i.e., United States, United Kingdom, Scotland, Canada, Australia, New Zealand), which represented 62.82% of these articles. In his reflexive journal, Tony made the conclusion:

> The mixed methods research community needs to develop strategies to encourage the conduct of mixed methods research studies and the publication of mixed methods research articles in education-based journals and beyond.

Figure 8

Geographic Information Systems Map of Countries Represented by Lead Authors of Author-Declared Mixed Methods Research Studies



The lead author of these 78 mixed methods-declared articles was predominately represented by women (i.e., 62.8%), which was statistically significantly ($p < .001$) higher than men (37.2%). This proportion of women lead authors is slightly larger than that of Wilcox et al. (2019), who reported that, for articles published in the *JMMR* from 2007 to 2014 ($n = 146$), women (57.7%) were statistically significantly ($p = .0388$) more likely than were men (42.3%) to be lead

authors. However, this difference in the proportion of women lead authors is not statistically significant (p = .48). In his reflexive journal, Tony noted the following:

> I regard this finding relating to the high proportion of mixed methods-declared research articles being predominately represented by women as a particularly encouraging one because it represents a departure from what Cole and Zuckerman (1984) called the *productivity puzzle*, which reflects the finding that men generally publish more works than women" (p. xxvii), as well as that, across numerous fields, women are underrepresented as lead authors. For instance, Jagsi et al. (2006), who examined 35 years (i.e., 1970–2004) of the medical literature, documented that only 10.3% of articles were published with a woman as lead author among six prominent journals. As another example, Rigg et al. (2012) documented that, within the geography field, men dominated lead authorship within collaborative research studies across 15 journals over a 15-year period.

Number of Pages of Each Article

The number of pages of the mixed methods-declared research articles ranged from 8 to 36 (M = 19.24, SD = 5.75). No statistically significant relationship emerged between the number of article pages and either the number of citations (r = .20, p = .08) or the impact factor (r = .04, p = .79). However, a statistically significant and positive relationship was found between the number of article pages and the number of authors (r = .23, p = .04). That is, articles with more co-authors tended to produce longer articles.

Number of Times Each Work had been Cited

The number of times the mixed methods-declared research studies had been cited ranged from 0 to 24 (M = 3.08, SD = 4.29). Of these 78 articles, 24 (30.77%) had not received any citations. However, it should be noted that all of these articles were published in 2021 and, therefore, have not been in circulation for a sufficient time to be cited. In addition to the lack of a statistically significantly relationship between the number of citations and the number of article pages—as presented earlier—there was also no statistically significantly relationship between the number of citations and the impact factor (r = .13, p = .32). Contrastingly, a statistically significantly relationship emerged between the number of citations and the number of authors (r = .35, p = .002), with articles with the most co-authors tending to receive the most citations. In his reflexive journal, Tony declared the following:

This finding provides further incentive for mixed methods researchers to collaborate!

Impact Factor of Each Work

With respect to the contribution of each work to the literature, the impact factor ranged from 1.00 to 5.81 (M = 1.71, SD = 1.23). Interestingly, Sombatsompop and Markpin (2005) reported impact factors for the following 12 fields: the Neurosciences (n = 197 journals; the 2002 Impact Factor for Journals Ranked in the top 25% [IF-A]= 3.275); Pharmacology and Pharmacy (n = 188; IF-A = 2.565); Medicine—General, and Internal (n = 107; IF-A = 1.673); Physics—

Multidisciplinary (*n* = 68; IF-A = 1.565); Chemistry—Multidisciplinary (*n* = 119; IF-A = 1.421); Plant Sciences (*n* = 135; IF-A = 1.556); Biology (*n* = 62; IF-A = 1.934); Environmental Sciences (*n* = 132; IF-A = 1.496); Polymer Science (*n* = 74; IF-A = 1.182); Education—Scientific Disciplines (*n* = 16; IF-A = 0.797); Engineering—Mechanical (*n* = 102; IF-A = 0.701); and Mathematics (*n* = 170; IF-A = 0.601). The IF-A for these 12 fields ranged from 0.601 to 3.275 (*M* = 1.56, *SD* = 0.77). Although the mean impact factor for the 78 mixed methods-declared research studies (*M* = 1.71) was higher than was the average 2002 impact factor across 12 different fields reported by Sombatsompop and Markpin (2005) (i.e., 1.56), it was not statistically significantly higher (*t* = 0.57, *p* = .57). Therefore, these mixed methods-declared research studies are being published in journals characterized by impact factors that, on average, are typical for impact factors across several fields.

Characteristics of the Titles of the Works

Table 2 presents the high-probability terms from the k = 6 topic model for each of six topics that emerged from the titles of the 78 education-based mixed methods-declared research articles that were published in 2021. For each topic, as recommended by topic modelists (e.g., O'Callaghan et al., 2015; Provalis Research, 2014; Wang et al., 2017), this table lists the 10 high-probability terms that best distinguish the topics from one another, followed by additional terms that were extracted. As can be seen from this table, the following six topics emerged from the corpus of titles: Thinking and Learning, Teaching and Teachers, Language Teachers and Learners, Mixed Methods, Early Childhood, and Students. Table 2 also presents the topic coherence, which refers to the semantic interpretability of the terms used to describe a particular topic, and the relative proportion pertaining to articles representing these six topics. We present the topics (i.e., themes) extracted from Table 2, wherein the themes are presented in boldface text and the subthemes derived from these topics are presented in italics.

Table 2

Topics Extracted from the Titles of the Education-Based Mixed Methods-Declared Research Articles, 2021 (n = 78)

No.	Topic Labels	High Probability Terms	Coherence	Relative Proportion (%)
1	Thinking and Learning	Problem, solving, skills, based, thinking, effect, critical, mathematical, inquiry, based learning critical thinking, thinking skills, problem solving, critical thinking skills, solving skills, based learning approach, science process skills	0.383	9.85
2	Teaching and Teachers	Service, pre, teachers, pedagogical, content, knowledge, beliefs, professional, development, mathematics preservice, service teachers, professional development, preservice teachers, content	0.382	24.99

		knowledge, mathematics teachers, science teachers, pedagogical content knowledge		
3	Language Teachers and Learners	Language, English, learners, EFL, foreign, speaking, anxiety, writing, Saudi, English language EFL learners, foreign language, language learning, language teaching, language learners, language teachers, English as a foreign language, English language teachers	0.362	12.84
4	Mixed Methods	Mixed, methods, study, method, research, mixed methods, methods study, mixed methods study, method study, mixed method methods approach, mixed method study, mixed methods research	0.350	30.33
5	Early Childhood	Early, childhood, children, parents, young, care, early childhood, early childhood education, young children, early childhood educators early childhood teachers	0.325	4.97
6	Students	School, high, African, secondary, south, schools, students, primary, middle, school students high school, high school students, secondary school, secondary school students, middle school, middle school students, primary school, primary school students	0.285	17.01

It can be seen from Table 2 that **Mixed Methods** (Topic 4) had the highest relative proportion of works, with high-probability terms including *mixed, methods, study, method, research, mixed methods, methods study, mixed methods study, method study,* and *mixed method*. This topic is not at all surprising, bearing in mind that having the phrase "mixed method(s)" in the title was the criteria for selection in this 2021 systematic review. The Mixed Methods topic is followed by the **Teaching and Teachers** topic (Topic 2), which had the highest relative proportion of works, with high-probability terms including *service*, *teachers*, *pedagogical*, *content*, *knowledge*, *beliefs*, *professional*, *development*, and *mathematics*. This topic indicates that preservice teachers and inservice teachers, their professional development, and their content knowledge and pedagogical content knowledge are a major focus of mixed methods-declared research. The next topic in terms of relative proportion size is **Students** (Topic 6), with high-probability terms that include *School, high, African, secondary, south, schools, students, primary, middle,* and *school*. This topic, which is in contrast to the Teaching and Teachers topic,

indicates that school students at all levels—from primary to secondary/high school—are another major focus of these articles. The Student topic is followed by the **Language Teachers and Learners** (Topic 3), with high-probability terms such as *language*, *English*, *learners*, *EFL*, *foreign*, *speaking*, *anxiety*, *writing*, *Saudi*, and *English language*. This topic is much more specific than is the Teaching and Teachers topic because it pertains to the context of language classroom context. The fifth topic is **Thinking and Learning** (Topic 1), with high-probability terms that include *problem*, *solving*, *skills*, *based*, *thinking*, *effect*, *critical*, *mathematical*, *inquiry*, and *based learning*. This topic indicates that critical thinking and problem solving are another major focus. The final topic is **Early Childhood** (Topic 5), with high-probability terms such as *early*, *childhood*, *children*, *parents*, *young*, *care*, *early childhood*, *early childhood education*, *young children*, and *early childhood educators*. This topic indicates that pre-school children also are a major focus. In his reflexive journal, Tony made the following reflection:

> The year 2021 represents the first full year since the declaration by the World Health Organization (WHO) on 11 March 2020 of COVID-19 as a global pandemic (WHO, 2020). With COVID-19 still in our midst, at the time of writing, and with other world crises, such as numerous armed conflicts, civil wars, political unrest, energy shortages, rapid global food shortages, cost-of-living increases, poverty, supply chain challengers, and the effects of climate change (e.g., floods, fires)—to name a few life-threatening issues—it will be interesting to find out what topics will be addressed using mixed methods research approaches in the next few years.

Level of Integration Inherent in the Mixed Methods Research Designs

A very disturbing finding was that slightly more than two thirds of the 78 mixed methods-declared research articles either involved no integration (9.0%) or minimal integration (i.e., 59.0%) of the quantitative and qualitative components/phases. A further 19.2% of the articles contained a moderate level of integration—which is consistent with the 1 + 1 = 3 integration approach that involved integration of the quantitative and qualitative components/phases (predominantly) at the data interpretation stage when meta-inferencing and meaning making took place. Finally, only 12.8% contained what could be considered to represent full(er) integration—which is consistent with the 1 + 1 = 1 integration approach that involved integration of the quantitative and qualitative components/phases throughout many, if not most or all, stages of the mixed methods research process.

Predictors of Level of Integration in Mixed Methods Declared Research Studies

A series of *All Possible Subsets* (APS) canonical discriminant analysis was undertaken to determine which of the variables that emerged from the systematic review were predictors of the level of integration (i.e., little or no integration vs. moderate or full[er] integration). Each of these systematic review variables served as a predictor (i.e., independent) variable in separate analyses, with the level of integration serving as the dependent variable in each of these analyses. All possible models involving one or more of the systematic review variables were examined (Onwuegbuzie & Daniel, 2003). In fact, in APS canonical discriminant analyses, separate discriminant functions are computed for all predictor variables singly, all possible pairs

of predictor variables, all possible trios of predictor variables, and so on, until the best subset of predictor variables has been identified according to some prespecified criteria—in this case, the Wilks's lambda, the probability level (i.e., *p* value), the canonical correlation coefficient, and both the standardized canonical discriminant function coefficients and the structure coefficients (which served as primary effect size measures).

The selected discriminant analysis model revealed a statistically significant canonical function ($\chi^2[3] = 16.27$, $p < .001$; Wilks's Lambda = 0.24). The corresponding canonical correlation was .44, which suggested a large effect size (Cohen, 1988). In addition, the group centroid (the average score on the discriminant function for both levels of integration) for this function was -0.34 for articles with little or no integration and .71 for articles with moderate or full(er) integration. These statistics indicated that the discriminant function maximally separated these two types of articles.

An inspection of the standardized canonical discriminant function coefficients (Table 3) revealed that, using a cut-off loading of 0.3 (Lambert & Durand, 1975), gender of the lead author, number of article pages, and level of grounding within the mixed methods research literature (i.e., little or no grounding vs. moderate or high grounding) were practically significant. Further, the structure coefficients (i.e., structure matrix) between the set of predictor variables and the standardized canonical discriminant function (Table 3) indicated that, also using a cut-off loading of 0.3 (Lambert & Durand, 1975), all three variables significantly discriminated the level of integration. The negative coefficient for the number of article pages suggests that the number of article pages was inversely related to the level of integration, with articles with little or no integration ($M = 20.30$, $SD = 6.14$) being statistically significantly ($t = 2.44$, $p = .017$) longer than articles with moderate or full(er) integration ($M = 17.00$, $SD = 4.09$), yielding a moderate effect size ($d = .59$; 95% confidence interval [CI] = 0.11, 1.08). In summary, the APA discriminant analysis revealed that mixed methods-declared research articles with moderate to full levels of integration tended to be characterized by men lead authors, to be the shortest, and tended to be the most grounded in the mixed methods research literature. In his reflexive journal, Tony expressed the following concern:

> I am disturbed by the finding of a gender context in terms of level of integration inherent in the mixed methods research studies that is in favor of men lead authors. More research is needed to find out why this might be the case.

Table 3

Standardized and Structure Coefficients for Gender of the Lead Author, Number of Article Pages, and Level of Grounding Within the Mixed Methods Research Literature: Little or No Integration of Mixed Methods Research Study Versus Moderate or Full(er) Integration of Mixed Methods Research Study

Variable	Standardized Coefficient	Structure Coefficient
Gender of Lead Author	0.34*	32*
	-0.56*	-.57*
The extent to which the study was grounded within the mixed methods research literature	0.80*	.73*

Note: *Coefficients with effect sizes larger than .3 (Lambert & Durand, 1975).

Summary and Conclusions

Although mixed methods research can be traced at least to Aristotle (384-322 BCE), as identified by Collins, Onwuegbuzie, and Jiao (2007), it was not until 1972 when the first mixed methods-declared work (i.e., Parkhurst et al., 1972)—which happened to represent the field of education—was published. As can be seen in Figure 1, this took place during the mixed methods era of *diversification of and advances in methodologies in the human sciences*. However, as can be seen from Figure 3 and Figure 4, in terms of published works, mixed methods research did not become mainstream until 2010—which coincided with the emergence of mixed methods research into young adulthood (see Figure 1).

As concluded by Onwuegbuzie and Corrigan (2014), "If the three research traditions (i.e., quantitative research, qualitative research, and mixed methods research) have been utilized (approximately) equally, then one would expect that the prevalence rate for mixed methods research would have been (approximately) 33%" (p. 15). As illustrated in Figure 5, over the last 6 years, the percentage of mixed methods research studies represented within the total number of educational research publications accounted for 6% in 2017 to 7.9% in 2021. However, although representing an exponential increase, it could be argued that under the assumption of a 33% expected rate, these mixed methods prevalence rates are substantially below this expectation. Interestingly, as noted previously, the prevalence rate for the discipline of mathematics education is approximately one third for all four prevalence rate studies conducted to date in this area (Hart et al., 2009; Ross & Onwuegbuzie, 2010, 2012, 2014). Therefore, although the discipline of mathematics education has met the 33% threshold, the field of education in general and many, if not most, of the education-based disciplines in particular, are lagging behind.

One of the hallmarks of the young adulthood era for the mixed methods research community has been the development of 1 + 1 = 1 integration approaches that involve integration of the

quantitative and qualitative components/phases throughout many, if not most or all, stages of the mixed methods research process. Thus, bearing in mind the utility of full(er) mixed methods research approaches for answering complicated and complex questions (Onwuegbuzie & Hitchcock, 2019a), the low percentage (12.8%) of such approaches within the field of educational research over the last 5 years is disturbing.

With this last point in mind, we call on more educational researchers seriously to consider developing what Greene (2007) referred to as a mixed methods way of thinking. According to Greene (2007),

> A mixed methods way of thinking is a stance or an orientation toward social research and evaluation that is rooted in a multiplistic mental model and that actively invites to participate in dialogue—at the large table of empirical inquiry—multiple ways of hearing, multiple ways of making sense of the social world, and multiple standpoints on what is important and to be valued and cherished. A mixed methods way of thinking rests on assumptions that there are multiple legitimate approaches to social inquiry and that any given approach to social inquiry is inevitably partial…. A mixed methods way of thinking is thus generative and open, seeking richer, deeper, better understanding of important facets of our infinitely complex social world. A mixed methods way of thinking generates questions, alongside possible answers. It generates results that are both smooth and jagged, full of relative certainties alongside possibilities, and even surprises, offering some stories not yet told. (p. 20)

Moreover, we call on more educational researchers seriously to consider adopting what Onwuegbuzie and Hitchcock (2022) referred to as an "*integrative, integrated, and integral way of thinking*" (p. 572) [emphasis in original]—wherein, as explained by Onwuegbuzie (2012), an *integrative way of thinking* involves conducting research that offers multiple and diverse approaches via a centralized mode of delivery; an *integrated research way of thinking* involves mixing or combining diverse researchers and their different approaches into a single research team and making into the research team a unified whole by bringing together all the individual parts; and an *integral research way of thinking* "depends on the collective willingness of researchers to unite together to address the most important and most complex research questions" (p. 205).

If an educational researcher(s) does not have the necessary experience to conduct a (fully integrated) mixed methods research study, we recommend that he/she/they collaborates with (more) experienced mixed methods researchers. Further, in addition to integrating qualitative and quantitative research approaches (Integration Component 1), we recommend that educational researchers utilize not only mixed methods but also multiple methods within the same tradition (e.g., qualitative data being collected via both focus groups and individual interviews; the same quantitative data being analyzed via both exploratory factor analysis and principal components analysis) (Integration Component 2). Such use of multiple methods would yield what Onwuegbuzie and Hitchcock (2019b) referred to as *multi-mixed methods research approaches* (i.e., involving the partial integration of multiple methods research approaches and mixed methods research approaches) and *meta-methods research* approaches (i.e., involving the full[er] integration of multiple methods research approaches and mixed methods research approaches). Also, we recommend that educational researchers break down the education research silo—that is, moving away from conducting intradisciplinary research

studies—by conducting research that is *cross-disciplinary* (i.e., educational research studies that involve multiple education-based disciplines, as well as educational research studies wherein the field of education are viewed from the perspective of another field), *multidisciplinary* (i.e., wherein educational researchers are integrated with researchers representing different disciplines/fields to conduct research in a team, each drawing on their disciplinary knowledge), *interdisciplinary* (i.e., conducting research wherein knowledge and methods from the field of education and education-based disciplines are integrated with those from other fields, using a real synthesis of approaches), and *transdisciplinary* (i.e., wherein a unity of intellectual frameworks are created that are beyond the education-based disciplinary perspectives) (Integration Component 3). Additionally, we recommend that educational researchers conduct research that involves an integration of arts and sciences (Integration Component 4), Global North and Global South researchers (Integration Component 5), online and offline spaces (Integration Component 6), and researchers and participants (Integration Component 7). We believe that educational researchers adopting an integrative, integrated, and integral way of thinking would help, in the next decade or so, the field of mixed methods research to grow from young adulthood to fully fledged adulthood.

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