



## The Role of Integrated Mixed Methods Autoethnography in Design-Based Research

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### Abstract

As we (Tony and Sandra) immerse ourselves in the dynamic world of educational research methodologies, the concept of design-based research (DBR) captures our attention and our imagination. DBR is not merely a methodology; it is a collaborative journey that draws us—alongside fellow researchers, educators, learners, and the broader community—into a shared quest for innovation in education, instructional technology, and the learning sciences. As we engage with DBR, we are captivated by its foundational premise: the collaborative fusion of minds—educators, learners, parents, and other stakeholders—each bringing their unique perspectives to bear on the complex and complicated educational challenges that dwell within the confines of our classrooms, communities, and beyond (Onwuegbuzie et al., 2023a). It is a methodology that is not only used to address research questions of interest, but also to foster a culture of co-investigation, co-creation, co-ideation, co-reflection, and, most importantly, co-decision making aimed at enhancing practice and generating actionable insights. We are particularly intrigued by the metaphorical dance between DBR and mixed methods research (MMR), coined by Onwuegbuzie et al. (2023b) as MM-DBR, which resonates deeply with our own research ethos. It is an approach that promises a more holistic understanding, integrating numerical precision with narrative complexity. Yet, as we explored the broad landscape of literature, guided by the meticulous review of research by Onwuegbuzie et al. (2023a), a striking observation emerged: only a handful of works, 68 to be precise, from the vast expanse of time stretching from January 1, 1960, to May 31, 2022, have involved the conduct of MM-DBR. These studies, predominantly emerging in the last decade, signal a growing interest, yet underscore a line of research ripe for exploration. In our methodological journey, we uncovered a curious gap: not a single study has involved either the integration of MM-DBR and autoethnography, or the integration of MM-DBR and mixed methods (MM) autoethnography—a fusion that we have coined *integrated mixed methods autoethnographic design-based research* (IMMA-DBR). Our narrative delves into this uncharted territory, illuminating the intersection of DBR and autoethnography through the lens of integrated mixed methods research. Here, we explore their reciprocal roles—how autoethnography enriches DBR and vice versa. Through our methodological proposition, we advocate for a holistic research paradigm—one that integrates the complex tapestry of human experience with empirical inquiry to generate empathetic, nuanced understandings and dynamic educational transformations—yielding a vast yet uncharted territory. We invite fellow researchers and practitioners alike to navigate the intricate interplay between the personal and the empirical, crafting research that is reflective and rigorous as well as deeply attuned to the complexities of educational ecosystems. Through IMMA-DBR, we envision a future wherein educational research not only addresses the theoretical and practical, but also embraces the profoundly personal, bridging gaps to foster a more empathetic, inclusive, and effective educational landscape.

**Keywords:** Autoethnography, mixed methods autoethnography, integrated mixed methods autoethnography, design-based research, mixed methods design-based research, integrated mixed methods autoethnographic design-based research, educational research methodology, 1 + 1 = 3 integration, 1 + 1 = 1 integration, partial integration, full(er) integration

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## **The Role of Integrated Mixed Methods Autoethnography in Design-Based Research: Our Autoethnographic Journey in the Fourth and Fifth Industrial Revolutions**

In my forthcoming article (Onwuegbuzie, in press), I (Tony) delve into an exploration initially inspired by the profound insights and contributions of the late Dr. Vimala Kamalodeen, a towering figure within the mixed methods research community. Her passing represents a significant loss, leaving a void in the landscape of mixed methods research. Drawing on the rich legacy that she left behind, I reflect on the historical progression of industrial revolutions as recognized within the Western context, identifying five distinct phases of industrial and technological evolution. As I note in my article (Onwuegbuzie, in press), the Fourth Industrial Revolution, or 4IR—which was popularized by Klaus Schwab, founder and executive chairman of the World Economic Forum (WEF)—characterized the trend of automation and data exchange in manufacturing technologies and other industries, integrating the physical, biological, and digital domains (Schwab, 2016).

At the heart of this revolution, we (Tony and Sandra), via our autoethnographic expeditions, have witnessed the ascent of Machine Learning and Artificial Intelligence (AI), akin to watching artists learn from their strokes, refining their crafts with each creation. These technologies—and their human designers—in their collective essence, have become the sculptors of the modern world, teaching machines to perceive and to understand, to learn from the vast tapestry of data that they are provided, and to undertake tasks that were once the sole territory of human intellect or beyond human comprehension and ability.

Our autoethnographic excursions have led us to experience the Internet of Things (IoT), which has transformed everyday reality of humans into a canvas of connectivity, wherein objects that once were overlooked have now become vital conduits of information, serving as repositories and transmitters of data. Our homes, our devices, even our city streets have become part of an interconnected web, each node communicating, making the mundane aspects of life seamlessly smart and integrated (Internet Society, 2015).

In our autoethnographic travels, we have been, and continue to be, extremely impressed by the dexterity of robotics and autonomous vehicles, which exemplify autonomy whereby machines undertake tasks with a precision and perseverance unfettered by human fatigue. Vehicles, once solely in the control of human drivers, now navigate the world with an autonomy that once belonged in the realms of science fiction.

Our autoethnographic voyage within the 4IR era also reveals 3D printing, alternatively known as additive manufacturing. This tool has emerged before us as a form of alchemy, turning digital dreams into tangible realities, layer by layer. Specifically, 3D printing, which represents the process of creating three-dimensional objects from a digital file, not only has revolutionized production across disciplines and fields, but also has helped to democratize creation, enabling individuals and communities to materialize their imaginations.

Embarking on our autoethnographic journey through the microscopic areas of science and engineering, we find ourselves mesmerized by the world of nanotechnology—a branch wherein the manipulation and exploration of materials take place on a scale so minuscule that it challenges the very limits of our imagination. In this intricate network of atoms and molecules, 1 nanometer is a mere one-billionth of a meter. Our voyage through nanotechnology is an interdisciplinary journey, weaving through the disciplines of physics, chemistry, materials science, biology, and engineering. It is a journey that empowers humans to manipulate matter at the nano level, unlocking a limitless array of new and enhanced properties that defy the



conventional limitations observed in the macro world. In the field of medicine, we have observed the precision of targeted drug delivery systems, the accuracy of advanced diagnostic tools, and the promise of regenerative therapies. The world of electronics has provided so much potential for miniaturization, with batteries and semiconductors achieving new levels of efficiency and compactness. The arena of environmental science offers visions of a cleaner world, with innovative filtration systems and sustainable energy technologies. With regard to materials science, we have witnessed the creation of materials that are stronger yet lighter and more versatile than ever before, revolutionizing construction, textiles, medicine, and aerospace industries.

In our autoethnographic expeditions into the domain of biotechnology, we have observed the delicate dance of utilizing and altering the very essence of human existence for purposes that span across industries. Here, the manipulation of genetic material opens doors to innovations in health, agriculture, and beyond, yielding a frontier of ethical considerations and potentials.

Our autoethnographic travels have brought to our attention blockchain and Distributed Ledger Technology (DLT) that have introduced us to a new paradigm of trust and transparency, wherein information and transactions are secured not by central authorities but by the collective verification of select participants across a network. We have observed how blockchain and DLT have led to decentralized digital systems for recording transactions and for tracking assets in a network across multiple locations, without the need for a central authority or intermediary—thereby allowing for the secure and transparent storage and transmission of information.

In our journey through the lens of autoethnography, we have encountered the captivating realm of quantum computing, a domain that transcends the conventional boundaries of computation as defined by classical physics. Our observations have unveiled that quantum computing stands as a pioneering frontier in computing, harnessing the enigmatic principles of quantum mechanics to manipulate information in ways profoundly more dynamic and potent than traditional computing methodologies allow. Central to this revolutionary approach is the employment of quantum bits, or qubits, which exhibit the extraordinary ability to occupy multiple states concurrently—being in a state of 0, 1, or both 0 and 1 simultaneously. This phenomenon, known as superposition, along with entanglement—a quantum state wherein qubits, regardless of the distance between them, find themselves intrinsically linked—empowers quantum computers to navigate and to process complex datasets and to execute calculations at a velocity that dwarfs the capabilities of their classical counterparts. We have witnessed applications of quantum computing that include drug discovery and development, financial modeling, optimizing complex systems, cryptography, and, what I (Sandra) have discussed elsewhere, namely, transforming artificial intelligence (Abrams, 2024). We agree with Reichental (2023), who contended that, when combined, quantum computing and AI have “the potential, without exaggeration, to bring about a new computing revolution. Transformation may be an understatement” (¶6).

Our navigation through the landscapes shaped by 4IR technologies has led us to the emerging landscape of the Fifth Industrial Revolution, or 5IR. We find ourselves reflecting on the seismic shifts from the Fourth Industrial Revolution (4IR) with its digital heartbeat of artificial intelligence (AI), robotics, and the Internet of Things (IoT)—to name a few tools—to the emergent dawn of the Fifth Industrial Revolution (5IR). This transition is more than just a chronological step; it represents a profound deepening of the relationship between human beings and technology—a relationship wherein the physical, biological, and digital domains



are not merely tools to be utilized, but are partners in a team that is reshaping the fabric of our world. Such a post-digital world wherein, for those with access, the seamless integration of technology (e.g., screens in daily lives) has become normalized and inherent in everyday literacy practices (Rowsell, in press).

In our lived experiences, 4IR gave us a sense of being ushered into a vast digital expanse, awestruck by the capabilities of AI and automation but, at the same time, tainted with a degree of apprehension about what this technological dominance might mean for the essence of our humanity. However, as our autoethnographic journey continues into 5IR, we embrace a shift towards integrating these astounding technological innovations with the mosaic of human creativity, values, ethics, and morality, moving towards a new vision of inclusive, human-centric and resilient industries and economies.

The journey of humans through 5IR should be characterized by a quest for harmony between advanced technology and the values that define us as individuals and as a collective. It is an era wherein the goal of integrating innovative tools is not just attaining technological advancement for the sake of advancement, but, rather, for nurturing a world whereby such advancements serve to address the global challenges that humans face, to enhance our quality of life, and to ensure the sustainability of our planet.

The essence of human existence in the era of 5IR is epitomized by the collaboration between humans and machines (cf. Onwuegbuzie, 2024), a partnership wherein technology expands human potential rather than diminishing it. This revolution speaks to us (Tony and Sandra) of a world whereby sustainability is not just a goal but a guiding principle, and whereby technology produces solutions that nurture and protect our environment. In our explorations, we have seen the potential of 5IR to promote personalization, inclusivity, and accessibility—involving the application of technological advances to address individual needs in education, in healthcare, and beyond. This era calls for a conscious, ethical, and responsible approach to technology development and deployment, reminding us of the weight of human responsibility to use such power wisely and responsibly, and for the greater good—striving for a world wherein progress does not come at the expense of the planet, of humanity, or of societal well-being.

### **Artificial Intelligence in the Fifth Industrial Revolution**

In our unfolding autoethnographic voyage through 5IR, AI emerges not just as a technology, but as a profound companion that shapes the path ahead. In our personal narrative, AI takes on the role of a catalyst, sparking innovation and transforming the landscape of possibility with its capacity for smart automation, enhanced decision-making, and the birth of intelligent products and services. Through our own lenses, AI is more than just a tool; it is a collaborator that extends the understanding and capability of humans to engage with complex challenges that span the spectrum that includes, but is not limited to, *formal sciences* (e.g., mathematics, statistics, computer sciences, logic), *social and behavioral sciences* (e.g., sociology, psychology, anthropology economics, political science, geography, history, communication studies, criminology and criminal justice, linguistics, social work, education), *natural sciences* (e.g., physics, chemistry, biology, earth sciences), and *applied sciences* (e.g., engineering, agricultural sciences, medical sciences, pharmaceutical sciences).



## Artificial Intelligence Within the Field of Education in the Fifth Industrial Revolution

Embarking on a reflective journey through the evolving landscape of education, we find ourselves at the intersection of tradition and innovation wherein AI emerges as a catalyst for educational change at every level, from early childhood and primary school, to middle and secondary education, to tertiary and adult education. As we have described elsewhere (Onwuegbuzie, Kara, et al., in press), through the lenses of our experiences, we have observed the potential of AI as a transformative agent in a number of ways, including the following:

- personalized learning experiences;
- adaptive learning platforms;
- automation of administrative tasks;
- intelligent tutoring systems;
- language translation and accessibility;
- language processing for writing assistance;
- early detection of and attention to learning disabilities;
- early identification and intervention of achievement gaps;
- virtual and augmented reality;
- assistive technologies;
- enhanced teacher professional development;
- enhanced interactive games;
- enhanced responsive learning; and
- data analysis and predictive analytics for decision-making.

As we reflect on these potentialities of AI, our (Tony's and Sandra's) narratives intertwine with the broader narrative of 5IR in education. The evolution of AI in the field of education does not merely provide a story about technological advancement but of a profound shift in how we approach learning and teaching, promising a future wherein education is more accessible, personalized, and attuned to the needs and aspirations of *every* student. As such, as in other fields, within the field of education AI stands as a cornerstone technology within 5IR, operating as a transformative force within 5IR, driving a reimagining of education. In this way, the application of AI in educational systems transcends the boundaries of traditional learning environments, inviting an evolving fusion of technology and pedagogy that is as dynamic as it is insightful.

Yet, amidst this promise, a critical reflection emerges from Tony's and Sandra's journey—a realization that the path to harnessing AI's full potential in education should not be tread by AI engineers alone. Instead, the voices of all stakeholders, including educators, parents, community members, and youth—in other words, *all* learners—imbued with the richness of pedagogical expertise and a deep understanding of learners' needs, must echo in the arena of AI development. The involvement of all stakeholders is not just beneficial but essential to ensure that AI technologies are advanced *and* are righteously aligned with the educational ethos and the pedagogical objectives.



Navigating the complex landscape of education, we embrace and even embody diverse roles—as learners, educators, mentors, parents or relatives, and, fundamentally, as researchers. It is through these multifaceted perspectives that we deeply acknowledge the critical significance of educational research concerning the intersection of AI and education, exploring how AI technologies can influence, can integrate with, and can be utilized in educational settings, in order to ensure the optimal design of educational interventions (Onwuegbuzie, Kara, et al., in press).

Of the array of research methodologies that can be used to inform AI technological development within the field of education, one stands out—design-based research (DBR). And so, amidst our reflection, DBR illuminates the way forward. In our autoethnographic journey, DBR emerges as a research approach and as a bridge between worlds—the world of educational researchers and the world of AI developers. Before we describe how DBR offers a pathway for educational researchers and AI developers to walk and to work together, it is important that we describe what DBR is, which we will now do.

### **Design-Based Research**

Our autoethnographic journey has led us to the realization that we are deeply entwined with the ethos of DBR, a methodology that is most widely used in the fields of education, instructional technology, and learning sciences. We have observed that design-based researchers, consistent with the collaborative ethos of DBR, ideally invite practitioners, educators, parents, community members, and learners into a shared space of creation and inquiry. This collaboration of researchers with practitioners and other stakeholders facilitates the development and evolution of innovative solutions to real-world educational challenges, with the goal of enhancing practice and generating practical knowledge that could illuminate paths forward (Anderson & Shattuck, 2012).

DBR originally was developed for the fields of engineering and architecture; however, our extensive review of the related literature has revealed to us that, during the 1990s, DBR was adapted to the field of education (Tinoca et al., 2022). Ann Brown (1992) and Allan Collins (1992) each played a pivotal role in pioneering the concept of DBR within the field of education, independently delineating its core principles, methodologies, and processes while underscoring its capacity to address complex and complicated issues in education through the integration of design and research. These scholars highlighted the limitations of traditional educational research methods, which often fell short in terms of practicality and direct applicability to the challenges faced by educators and students. For example, although true experimental methods might yield findings that are high in internal validity, these findings often are low(er) in external validity (i.e., generalizability, transferability) due to the uniqueness of the research context studied. Brown (1992) and Collins (1992) made a case for transitioning towards a design science in education, emphasizing the creation of educational interventions and tools aimed at enhancing learning experiences. Moreover, they stressed the importance of incorporating research activities within the design process, advocating for a collaborative synergy between researchers and educators and other practitioners to create innovative educational solutions. Through this approach, the design process was envisioned not just as a tool for development, but as a dynamic avenue for exploration and discovery. As such, the aim of DBR is to create a balance between building theory and achieving practical impact, as well as a balance between research and practice, by conducting research in real-world contexts, systematically designing, implementing, testing, refining, and evaluating educational interventions and/or innovations to weave together theoretical insights with



practical solutions within an authentic educational context, as described by Anderson and Shattuck (2012). The essence of DBR, with its iterative design, offers a narrative of flexibility and adaptation, a story that resonates with our own scholarly pursuits.

DBR is intrinsically theory-driven, simultaneously contributing to and drawing from theoretical frameworks to craft interventions that resonate with the complex dynamics of learning and teaching. This theoretical grounding does not detract from its focus on generating practical solutions aimed at improving educational practice; rather, it enriches the development of interventions that are both innovative and deeply informed by educational theories.

Central to the DBR approach is the contextualization of research, ensuring that interventions are meticulously tailored to fit the unique aspects of each educational setting. This involves a deep consideration of students' needs, the learning environments, and any institutional constraints, fostering close collaboration between researchers and a wide array of stakeholders—including, but not limited to, practitioners, students, and parents—fostering a symbiotic relationship among them. Such collaborations support efforts for solutions to be both practical and squarely aimed at addressing the nuanced challenges faced by educators and by learners alike.

DBR contrasts with traditional research methodologies wherein there is an attempt to isolate various factors impacting learning. As a result, DBR has faced criticism from traditional experimental researchers who argue that it does not adhere to the formal definitions of scientific method, viewing it more as a product development process than as scientific research (cf. Anderson & Shattuck, 2012; Dede, 2004). Despite this criticism, DBR has continued to evolve, broadening its application across various educational research areas and contributing significantly to both theory and practice. Its emphasis on collaboration with research participants as co-researchers, iterative design, and the dual focus on tangible and intangible outcomes highlight its unique contribution to educational research and practice. Moreover, in our autoethnographic journey, these critiques have become part of the rich dialogue that DBR invites, a testament to its evolving nature and its capacity to stretch the boundaries of educational research.

In our autoethnographic reflections, DBR is not merely a method (Onwuegbuzie et al., 2023b); it is a methodology (Anderson & Shattuck, 2012; Onwuegbuzie et al., 2023b; Tinoca et al., 2022; Zheng, 2015) that honors the complexity, diversity, and richness of the educational experience. This has led to DBR being applied in a variety of contexts, extending beyond the field of education, including, but not limited to:

- healthcare (e.g., in designing and implementing interventions for patient education, healthcare delivery improvements, and public health initiatives);
- information technology and human-computer interaction (e.g., for the development of user-centered software, applications, and systems);
- environmental science and sustainability (e.g., in developing and assessing interventions aimed at promoting sustainable behaviors and environmental education);
- organizational development and business (e.g., for the design and implementation of organizational change initiatives, business models, and innovation strategies);



- social sciences and community development (e.g., in designing and in evaluating community-based interventions and social programs);
- engineering and product development (e.g., in the iterative design and testing of new products and engineering solutions); and
- urban planning and architecture (e.g., for the participatory design and evaluation of urban spaces, buildings, and infrastructure projects).

DBR's reliance on a data-driven approach underpins its commitment to evidence-based decision-making, with the analysis and interpretation of data playing a crucial role in refining interventions and assessing their impact. Additionally, the longitudinal perspective adopted by many DBR researchers supports an exploration of how interventions evolve over time, offering insights into sustainability and the long-term efficacy of educational innovations. This comprehensive approach, highlighted by Wolcott et al. (2019), underscores DBR's unique capacity to blend theory with practice, ensuring that educational interventions are both grounded in real-world challenges and enriched by scholarly inquiry.

DBR has been instrumental in crafting innovative solutions within the educational sector, embodying an array of common elements that enhance its effectiveness and applicability in real-world settings (Wolcott et al., 2019). A defining trait of DBR is its grounding in authentic environments where research unfolds not in the abstract confines of laboratories or simulations but within the lived realities of educational contexts. This authenticity ensures that the interventions developed are operational, designed for theoretical exploration and also with a keen eye on the interventions' scalability and implementation across various educational landscapes. As noted previously, this methodology champions an iterative process, characterized by cycles of design, implementation, refinement, and evaluation. Ideally, this allows researchers continuously to tweak and to enhance their interventions, drawing on emerging insights to inform the evolution of both practice and theory.

### **Poetic Reflections on the Core Elements of Design-Based Research**

The following, which represents an integration of found poetry (Prendergast, 2006) and research poetry (Faulkner, 2009), summarizes the core elements of DBR. We hope that this poem is consistent with what Lahman et al. (2011) referred to as "good enough research poetry" (p. 894) that is associated with novice research poets like us:

In the field where learning's flame burns bright,  
Design-Based Research (DBR) takes its flight.  
Wolcott et al., in 2019's light,  
Identified the elements that give DBR its might.

In settings real, not labs of hypothetical dreams,  
DBR unfolds, where authenticity gleams,  
Aiming to scale, from operational streams,  
Solutions that thrive in educational beams.

A process that is iterative, round and round we go,  
Designing, implementing, testing, refining, letting knowledge flow.  
From cycle to cycle, our insights grow,  
Evaluating continually, letting improvement show.





Contextualized, tailored to the place,  
Where learning occurs, whether virtually or face-to-face,  
Learners, environments, creating a new space,  
In DBR's process, where solutions are embraced.

Practical solutions, real challenges to meet,  
New methods, curricula, where theory and practice greet.  
For learners' needs, these interventions compete,  
Addressing challenges, striving for success that's sweet.

Theory-driven, yet grounded in life's dance,  
Developing frameworks give learning a chance.  
With relevant theories, interventions enhance  
DBR, allowing technology and learning to advance.

Principles of design, like stars in the night,  
Guide future innovations, making education's prospect bright.  
Collaborations at its core, bring solutions to light,  
Researchers and practitioners together unite.

Data-driven decisions, the compass we hold,  
Informing, refining, making interventions bold.  
Assessing impacts, stories of change are told.  
In the quest for knowledge, these solutions unfold.

With a longitudinal gaze, over time we peer  
To see how changes unfold year after year.  
Sustaining interventions, making outcomes clear,  
In the landscape of education, DBR we hold dear.

So, here in verse, DBR's tale is spun,  
A methodology where theory and practice together run  
In the quest to educate one and all,  
And refinements knowledge respond to the call.

### **Mixed Methods Design-Based Research**

Alongside Drs. Elena Forzani and Julie Corrigan, I (Tony) had the pleasure of co-authoring two published articles on DBR. Our first article (i.e., Onwuegbuzie et al., 2023a) involved, what we referred to as, a fully integrated systematic review of Scopus-indexed publications from January 1, 1960, to May 31, 2022, in order to determine the prevalence of mixed methods DBR (MM-DBR) studies over this time period. Our review led to the identification of only 68 works wherein the author(s) explicitly declared their DBR study as representing some form of a MM-DBR study, with the majority of these MM-DBR studies being published within the last decade. Surprisingly, more than two thirds of the authors neither explicitly specified nor adequately described their mixed methods research design, and more than one half of the MM-DBR studies were not grounded within the mixed methods research literature to any degree at all. Our most significant observation that came to the fore from this review is that, except for



4 out of the 68 studies, the integration of mixed methods research predominantly fell on the lower spectrum of the integration continuum. In these instances, the blending of methods was restricted to only the interpretation phase of the DBR process—which represented only partial integration of the quantitative and qualitative research components/phases/cycles. Our findings support Maxwell's (2016) assertion that the mixed methods research community has yet to recognize fully the value of DBR.

In our second article (i.e., Onwuegbuzie et al., 2023b), we advocated for the application of our research philosophy, critical dialectical pluralism (i.e., CDP; Onwuegbuzie & Frels, 2013; Onwuegbuzie, Abrams, et al., in press), a philosophy that we developed, aimed at elevating marginalized voices, to enhance DBR's methodological integration and to promote equity. In our article, we highlight the evolution of mixed methods research towards *emerging adulthood* with significant developments, including specialized journals and associations. However, as we documented in our first article, the integration of mixed methods research in DBR remains underexplored, with most DBR studies not fully leveraging the potential of mixed methodologies or emphasizing equitable collaboration among all participants.

To address this gap, in our article, we (i.e., Onwuegbuzie et al., 2023b) proposed a more integrated, inclusive approach to DBR, emphasizing the importance of full integration of mixed methods research and the application of CDP. We outlined key principles and phases of an ideal MM-DBR process, emphasizing collaboration, iterative design, practical solutions, and the advancement of theoretical understanding. This approach aims to ensure that DBR not only addresses real-world educational challenges, but also contributes to theoretical knowledge and promotes social justice. Moreover, we called for a paradigm shift in DBR towards a more holistic, integrated mixed methods research approach, reflecting on the potential of DBR to bridge the gap between research and practice in education and beyond.

Anderson and Shattuck (2012) identified eight pivotal characteristics that underscore high-quality DBR studies, among which the utilization of mixed methods research approaches stands out, particularly for fulfilling the goal of “balancing numerical precision with narrative complexity” (Sandelowski et al., 2009, p. 208). Anderson and Shattuck asserted that DBR inherently embraces a wide spectrum of methodologies, including mixed methods research, to assess interventions on various indices. This approach aligns with the pragmatic philosophy, drawing on the insights of notable figures, such as Charles Sanders Peirce and John Dewey, to focus on authentic and meaningful educational issues. Similarly, Wolcott et al. (2019) emphasized DBR's pragmatic methodology that integrates both qualitative and quantitative strategies to gain a comprehensive understanding of learning within real-life contexts.

The essence of MM-DBR lies in its ability to provide a rich, holistic insight into complex educational phenomena, especially when studying multifaceted interventions in real-world settings. By integrating qualitative research approaches and quantitative research approaches, researchers can collect diverse forms of data, from interviews and observations to surveys and test scores, thereby enabling a more nuanced understanding of the educational intervention's impact. For instance, qualitative data can illuminate the personal experiences of those participating in the DBR, whereas quantitative data can provide evidence of the efficacy and effectiveness of the intervention.

As noted by Onwuegbuzie et al. (2023b), in essence, combining qualitative data and quantitative data enables design-based researchers to delve into minute details or to broaden their perspective to a wider scope (Willems & Raush, 1969), thereby enriching the subsequent meta-inferences—which involve drawing conclusions that integrate findings stemming from



both qualitative and quantitative research components of the DBR study into a unified understanding (Tashakkori & Teddlie, 1998). Employing both qualitative and quantitative research methods in DBR studies enables the transfer of insights from foundational research into the creation of innovative interventions, programs, and treatments—referred to as T1 research; the application of these findings into practical settings—referred to as T2 research; and the dissemination of these findings to broader communities—referred to as T3 research (Abernethy & Wheeler, 2011; Ivankova et al., 2018; Woolf, 2008). Ivankova et al. (2018) highlighted that progressing through T1 to T3—key phases in the DBR process—relies on crucial elements that include the flow of information (i.e., “availability and accessibility of data to guide change and transformation,” p. 358) as well as the modification of behaviors. By weaving together qualitative and quantitative insights, a DBR study can enhance both the flow of information and the potential for behavioral changes, encouraging the development of new patterns of communication. Thus, it is imperative for researchers judiciously to determine the optimal combination of qualitative and quantitative elements that align with the unique aims and contexts of their DBR endeavors.

Greene et al. (1989) identified five key purposes for integrating quantitative data and qualitative data, comprising (a) triangulation to increase the legitimation of DBR findings, (b) complementarity to balance methodological strengths and weaknesses, (c) development to inform subsequent research phases, (d) initiation to uncover paradoxes for theoretical refinement, and (e) expansion to broaden the DBR study’s scope. Furthermore, the theory-driven nature of DBR benefits significantly from the adoption of mixed methods, wherein qualitative data illuminate underlying mechanisms and quantitative data test theoretical hypotheses. This methodological plurality supports tailored research designs that can emphasize either qualitative or quantitative components depending on the goals of the DBR study. Such integration not only facilitates a deeper exploration of the intervention’s practical implications, but also enriches the understanding of its effectiveness and contextual deployment. Qualitative data collection, analysis, and interpretation add depth and context, and quantitative data collection, analysis, and interpretation assist in identifying patterns and relationships, together offering a more detailed picture of the educational landscape. This comprehensive approach underscores the potential of mixed methods research in enhancing the depth, the rigor, and the applicability of DBR findings. As such, MM-DBR has intuitive appeal, offering significant advantages in bridging research and practice.

### **Fully Integrated Mixed Methods Design-Based Research**

In the unfolding narrative of our journeys through the landscapes of mixed methods research, an account emerges of two paths converging, each marked by its own unique formula that guides the integration of qualitative and quantitative research elements. This account begins with a homage to the late Professor Michael Fetters and his colleague, Professor Dawn Freshwater, whose intellectual legacy we honor. Together, in 2015, they envisioned an integration approach wherein  $1 + 1 = 3$  (i.e., Fetters & Freshwater, 2015)—a mathematical metaphor that captures the essence of creating something greater than the sum of its parts through the integration of diverse research methodologies. We view this formula as yielding *value-added* outcomes wherein quantitative elements and qualitative elements unite to chart a course anew, producing a synergy that transcends traditional monomethod boundaries.

Inspired by the pioneering spirit of Mike and Dawn, 2 years later, I (Tony), during one of my keynote addresses that took place in Jamaica, conceptualized a new integration formula, namely,  $1 + 1 = 1$  (Onwuegbuzie, 2017). This metaphor symbolizes a journey beyond a



dichotomy, to a landscape wherein qualitative research approaches and quantitative research approaches are not mere passengers but integral components of a single, holistic voyage. Here, the dichotomy is dissolved, replaced by a continuum that embraces the full integration of mixed methods at every stage of inquiry (Natesan et al., 2019; Newman et al., 2015; Onwuegbuzie, 2017, 2023; Onwuegbuzie & Hitchcock, 2019a, 2022; Onwuegbuzie et al., 2018). And although distinct from the  $1 + 1 = 3$  integration formula, this new path does not seek to overshadow its predecessor, but to complement it, offering a different lens through which to view the conduct of mixed methods research.

Imagine, if you will, design-based researchers standing at the crossroads of a new innovative instructional prototype, navigating the dual terrains of direct and indirect learning. Under the guiding star of  $1 + 1 = 3$ , they might chart their course by separately cataloging the qualitative and quantitative phases and cycles of their DBR journey, thereby potentially overlooking the nuanced interplay of classroom dynamics. But what if, under the  $1 + 1 = 1$  formula, these DBR researchers embraced a more integrated approach, for example, by capturing the fluid dance of nonverbal cues and student engagement through video, thereby achieving a seamless melding of data streams? This is the essence of full(er) integration—a symphony wherein quantitative and qualitative elements of a DBR study intertwine in continuous, iterative harmony, each enriching the other to unveil a more profound understanding of educational practice.

In this autoethnographic reflection, we (Tony and Sandra) ponder the notion that all MM-DBR studies inherently possess the capacity for this holistic data integration. Such an approach not only facilitates a deeper engagement with the educational intervention, but also embodies the very spirit of integration, wherein research elements converge not as separate entities but as complementary threads of a single narrative fabric.

### **Design-Based Research and Autoethnography: A Marriage Made in Research?**

As we were writing the previous section of this article, it came to our minds that, just as DBR can be reframed as an integrated MM-DBR, or IMM-DBR, so, too, can autoethnography be reframed as an integrated MM-autoethnography, or IMMA, as we outlined in another article in this special issue, namely, Onwuegbuzie et al. (2024). In that article, we described the conduct of IMMA as seeking to meld qualitative-based autoethnographic insights with quantitative-based autoethnographic findings, aiming for a richer, more entangled and layered understanding of the subject matter that surpasses the insights possible through either approach alone. Our vision here is for a synthesis wherein methodological elements are adjacent *and* interlinked, each enhancing the depth and breadth of the other, culminating in a more holistic comprehension of the autoethnographic research focus. An autoethnographer adopting this method might interlace personal narratives with statistical analyses, aiming for an autoethnographic portrayal that bridges qualitative depth with quantitative breadth, presenting a unified narrative that encapsulates the complexity of their experience within a cultural milieu.

Pondering the synergistic potential of IMM-DBR and IMMA, a captivating question emerged within our collective mindscape: What precludes these approaches from being intertwined within the same scholarly exploration? This question sparked an intellectual curiosity, leading us to contemplate the essence of compatibility between IMM-DBR and IMMA. Could it be that these two methodologies, each individually robust and nuanced, are destined to be conjoined in a harmonious union, enriching and elevating the research landscape? This reflection beckons us to envision a situation whereby IMM-DBR and IMMA are not mere acquaintances within the field of research, but, instead, form a complementary and dynamic



partnership. Such a marriage promises to transcend conventional boundaries, merging the depth of IMM-DBR with the uniqueness of IMMA to forge a comprehensive understanding that is both intricate and illuminating. It is to this marriage that we now direct our scholarly gaze.

**The Marriage Between Design-Based Research and Autoethnography: To Have and To Hold, From This Day Forward, For Better and For Worse, For Richer and For Poorer, In Sickness and In Health, To Love and To Cherish**

Embarking on a journey wherein DBR and autoethnography intertwine, we find ourselves at the heart of a profound union, one that promises to illuminate the deeply personal, cultural, and contextual subtleties embedded within the fabric of design and implementation in specific arenas. This integration, a dance between two methodologies with distinct lineages and focal points, invites us into a space where the research process and its findings and interpretations are infused with a richer, more nuanced essence.

As we navigate this union, we are acutely aware of the unique contributions each approach—DBR and autoethnography—brings to our union. DBR, with its pragmatic and iterative nature, grounds us in the reality of educational environments, allowing for the refinement and real-world testing of interventions. Meanwhile, autoethnography offers a lens through which we can explore and can articulate the intricacies and entanglements of personal experience and cultural context, adding layers of depth and meaning that might otherwise remain obscured.

Together, these methodologies forge a symbiotic relationship, enhancing the texture and dimensionality of inquiries. Through this innovative marriage, we embark on a quest not just to observe and to report, but also to reflect and to make meaning, weaving the threads of DBR and autoethnography into a tapestry that both illustrates and celebrates the complexity of human experience within the field of (educational) research.

Integrating DBR and autoethnography can enrich the research process and outcomes in several ways. First, autoethnography's focus on personal narrative and reflection can provide deep insights into the design-based researcher's experiences with the design process. This introspective lens can reveal subjective experiences, biases, and reflections that often are overlooked in traditional DBR, which can provide profound understandings of both the process and outcomes of the research.

Second, autoethnography enables researchers to delve into how their cultural backgrounds and personal experiences influence the design and iterative process of DBR and its outcomes. This particularly is valuable in education and social sciences wherein understanding the cultural and the contextual dynamics is crucial for designing effective interventions.

Third, both DBR and autoethnography are iterative in nature, emphasizing reflection and refinement. Combining them supports a deeper reflective practice whereby researchers not only adapt their designs based on empirical data, but also systematically reflect on their own backgrounds, roles, beliefs, biases, assumptions, influences, and areas for improvement throughout the DBR process (i.e., during each cycle)—characteristics and insights that might not be evident through more traditional data analysis methods. As a result, there is an enriched understanding of the intervention and its impact on the research context. Furthermore, the narrative aspect of autoethnography can complement the iterative cycles of DBR by documenting the evolution of the researcher's understanding and how it shapes each design iteration. This narrative can provide valuable insights into the design process's context,



challenges, and decision making, as well as reveal underlying dynamics and factors influencing the intervention's effectiveness and sustainability.

Fourth, autoethnographic elements can enhance the validity of DBR findings by providing a transparent account of the researcher's perspective, which helps in understanding the situatedness of the research findings. This transparency can be particularly valuable in most fields, given that the researcher's identity and perspective significantly can impact the research outcomes.

Fifth, incorporating autoethnography can foster a deeper empathy for participants and stakeholders involved in the DBR process. It encourages design-based researchers to engage more personally with the challenges and experiences of those for whom they are designing innovations, potentially leading to more empathetic and user-centered designs.

Sixth, through sharing personal narratives, researchers can engage more deeply with stakeholders (e.g., participants, collaborators), fostering a collaborative environment that values diverse perspectives and experiences.

Seventh, autoethnographic accounts can highlight the importance of context in DBR, illustrating how personal, social, cultural, and historical factors influence the design and implementation of interventions, offering a deeper understanding of the intervention's place within these broader contexts. Moreover, autoethnography's focus on the cultural context of the researcher's experiences can enrich DBR by ensuring that designs are sensitive to and reflective of the cultural and the social dimensions of the context in which they are implemented.

Eighth, researchers can keep detailed diaries, journals, and/or reflexive notes that chronicle their experiences throughout the DBR process, including their thoughts, their challenges, and their moments of insight. These narratives then can be analyzed alongside quantitative data to provide a richer understanding of the research process and outcomes.

In summary, the marriage of DBR and autoethnography is possible and can offer innovative insights, particularly in fields like education wherein the researcher's personal experience with teaching, learning, technology integration, and the like can provide valuable perspectives on the design and implementation of interventions. This marriage, however, requires a thoughtful integration of methodologies, ensuring that the strengths of each are leveraged while addressing their respective challenges. Given the eight reasons outlined, along with additional arguments presented in the subsequent sections, we anticipate that the marriage objection statement, "If anyone can show just cause why these two research approaches should not be lawfully united in matrimony, let them speak now or forever hold their peace," will be met with silence!

### **Toward a Framework for Combining Integrated Mixed Methods Autoethnography and Integrated Mixed Methods Design-Based Research**

In another article that we wrote about autoethnography (Onwuegbuzie et al., 2024), we posited that autoethnographic research designs can drive, as well as be driven by, monomethod research designs and/or mixed methods research designs. More specifically, in this article, we identified eight classes of autoethnographic research designs, as follows:

- Autoethnography-Driven Concurrent Research Designs
- Autoethnography-Driven Sequential Research Designs



- Qualitative-Driven Embedded Concurrent Autoethnographic Research Designs
- Quantitative-Driven Embedded Concurrent Autoethnographic Research Designs
- Qualitative-Driven Embedded Sequential Autoethnographic Research Designs
- Quantitative-Driven Embedded Sequential Autoethnography Research Designs
- Mixed Methods-Driven Embedded Concurrent Autoethnographic Research Designs
- Mixed Methods-Driven Embedded Sequential Autoethnographic Research Designs

Although any of these eight classes of designs can be reframed to capture the combination of DBR and autoethnography, in the context of MM-DBR, the first two classes and the last two classes are most relevant, and can be reframed as follows:

- Autoethnography-Driven Concurrent Design-Based Research Designs
- Autoethnography-Driven Sequential Design-Based Research Designs
- Design-Based Research-Driven Embedded Concurrent Autoethnographic Research Designs
- Design-Based Research-Driven Embedded Sequential Autoethnographic Research Designs

Now, because DBR involves iterative (i.e., multiple and recursive) cycles of designing, implementing, testing, and refinement, DBR inherently embodies elements of both concurrent and sequential designs. Specifically, concurrent aspects are seen when DBR involves the simultaneous employment of both qualitative elements and quantitative elements within a single cycle to inform the ongoing development and refinement of the intervention. This concurrent use of elements allows for a richer, more nuanced understanding of the intervention's effects and how it interacts with the educational context. In contrast, sequential aspects manifest in the progression from one cycle of the DBR to the next. Insights gained from one phase (e.g., initial implementation and testing) inform the design and approach of the subsequent cycle (e.g., refinement and further testing). This sequential progression is crucial for evolving the intervention based on empirical evidence and theoretical understanding. Therefore, although the concepts of concurrent and sequential designs still underpin the methodological choices and data integration strategies within and across DBR cycles, these designs are reimagined and are embedded within the iterative, dynamic process of DBR when integrated with autoethnography, contributing to DBR's goal of developing effective, contextually grounded educational interventions. As such, the first two classes of the aforementioned designs (i.e., autoethnography-driven concurrent research designs and autoethnography-driven sequential research designs) can be merged into one class that can be named as *autoethnography-driven DBR*. Similarly, the last two classes of designs (i.e., mixed methods-driven embedded concurrent autoethnographic research designs and mixed methods-driven embedded sequential autoethnographic research designs) can be merged into a second class that we name as *mixed methods-driven autoethnographic research designs*. And, optimally, when *integrated* methods are utilized, in turn, these two classes expand to *integrated mixed methods autoethnography-driven integrated mixed methods design-based research* (i.e., IMMA-Driven IMM-DBR) and to *integrated mixed methods design-based research-driven integrated mixed methods autoethnographic research designs* (i.e., IMM-DBR-Driven



IMMA). Alternatively stated, respectively, optimally, these designs involve embedding IMM-DBR within IMMA and embedding IMMA research designs within IMM-DBR.

As we reflected on our journey through the integration of (mixed methods) autoethnography and (mixed methods) DBR, we found ourselves standing at the convergence of our own narratives and the empirical rigor of systematic inquiry. This intersection has been not only a methodological choice, but also a transformative experience that has reshaped our understanding of autoethnography and of DBR. As we began to integrate DBR studies into the narrative of our autoethnographic methods, as well as to weave autoethnographic methods into the fabric of DBR studies, we embarked on a path that blurred the lines between the researcher and the researched, between the subjective and the objective, between emic perspectives and etic perspectives, and between an impersonal writing style and a personalized writing style. Our journey of integrating (mixed methods) autoethnography and (mixed methods) DBR has been one of convergence—wherein personal narratives meet systematic research to create designs that are both innovative and dynamic. This approach has enriched our attitudes to both sets of research approaches and has offered a compelling reminder of the human element at the heart of design. In navigating this confluence, we have found a path for embedding both IMM-DBR within IMMA and IMMA within IMM-DBR that honors the rigor of systematic inquiry and the profound insights that only personal experience can provide. In the following sections, we explore both approaches to embedding in detail.

### **Embedding Integrated Mixed Methods Design-Based Research Within Integrated Mixed Methods Autoethnography**

Conducting (integrated mixed methods) DBR within the framework of (integrated mixed methods) autoethnography offers a unique lens through which to explore and to understand the autoethnographic process itself. This approach yields several key benefits, including, but not limited to, the following:

First, by situating (integrated mixed methods) DBR within (integrated mixed methods) autoethnography, researchers can explore design solutions through the prism of their own experiences. This personal connection to the research subject matter can reveal nuanced understandings of how and why certain design solutions resonate or fail, providing insights that are both deeply personal and broadly relevant. Further, this two-pronged approach allows for a profoundly reflective and personalized investigation of design practices, interventions, and their impacts.

Second, (integrated mixed methods) autoethnography encourages a rich, narrative-based exploration of data, emphasizing the importance of context in understanding and interpreting human experiences. When (integrated mixed methods) DBR is conducted within this narrative framework, it produces data that are not only detailed but also contextualized within the researcher's lived experiences. This contextualization can lead to a more comprehensive understanding of the context surrounding their design challenges and solutions. This contextual awareness is crucial for developing designs that are not only effective, but also culturally sensitive and appropriate for their intended users.

Third, integrating (mixed methods) DBR within (mixed methods) autoethnography enhances reflexivity, encouraging researchers to reflect continuously on their backgrounds, roles, beliefs, biases, assumptions, experiences, emotions, design practices, and influence on the research process. This reflexivity, which often is missing in DBR studies, can lead to more thoughtful, more informed, and more adaptable DBR methods that are more iterative and more responsive





to both the researchers' and the participants' needs and contexts. This deep personal engagement also can lead to more profound insights and innovative design solutions that are informed acutely by the lived experiences of researchers, and, at the same time, ensure that the research remains ethical and respectful of all participants.

Fourth, autoethnography's focus on personal narrative and experience can deepen researchers' empathy towards the participants or users involved in the design process, leading to more empathetic and user-centered design practices. By experiencing firsthand and reflecting on the (integrated mixed methods) DBR process and its cascading effects, researchers can gain insights into user experiences that otherwise might be overlooked.

Fifth, conducting (integrated mixed methods) DBR within an (integrated mixed methods) autoethnographic framework can heighten ethical sensitivity. Researchers are more likely to consider the ethical implications of their design practices and research activities when they are deeply engaged with the subject matter on a personal level. This can lead to more responsible and respectful research practices.

Sixth, the reflective nature of (integrated mixed methods) autoethnography, combined with the iterative cycles of (integrated mixed methods) DBR, supports the continuous adaptation and evolution of design practices. Researchers can quickly integrate insights from their personal experiences and reflections into the design process, facilitating ongoing improvement and innovation.

Seventh, the integration of (mixed methods) DBR within (integrated mixed methods) autoethnography encourages methodological innovation by incorporating the systematic, iterative approach of (integrated mixed methods) DBR with the narrative, exploratory nature of autoethnography. This can lead to the development of new, creative research and design methods that leverage the strengths of both approaches to tackle complex problems in novel ways.

Eighth, the narrative element of (integrated mixed methods) autoethnography can make the dissemination of (integrated mixed methods) DBR findings more engaging and accessible to a wider audience, including practitioners, stakeholders, and the general public. By framing research findings within a compelling personal narrative, researchers can communicate their work in a way that resonates more deeply and broadly.

Ninth, this approach enables researchers to use their own experiences not just as a lens for analysis but as a source of empowerment. It validates the researcher's personal journey as a critical component of the (integrated mixed methods) DBR process, thereby challenging traditional hierarchies of knowledge and of authority in research.

In summary, by embedding (integrated mixed methods) DBR within (integrated mixed methods) autoethnography, researchers can embark on a reflective, nuanced exploration of design practices that is informed by their own experiences. This approach not only enhances the depth and richness of the research, but also fosters innovation, empathy, and adaptability in the design process.

### **Examples of Embedding Integrated Mixed Methods Design-Based Research Within Integrated Mixed Methods Autoethnography**

An example of embedding IMM-DBR within IMMA is as follows: Suppose a teacher decided to conduct an autoethnographic study to explore her/his/their own biases and assumptions



around inclusion and special education needs within the classroom. Based on this reflective process, the teacher designs and implements a series of inclusive teaching strategies aimed at accommodating diverse learning needs. The teacher uses the autoethnographic context to guide the design of the intervention, iteratively refining inclusive practices based on reflective observations and student outcomes. The integration of reflective practice and intervention design leads to more nuanced, empathetic approaches to inclusion, with direct benefits for student engagement and learning.

As a second example, suppose that a teacher decided to conduct an autoethnographic study for the purpose of reflecting on personal experiences with stress and resilience in the teaching profession. Based on the emerging reflections, the teacher develops a classroom-based program aimed at building emotional resilience among students, incorporating mindfulness, stress management, and emotional literacy. In particular, the teacher leverages her/his/their personal understandings of stress and resilience to inform the design of the intervention, with iterative refinement based on student feedback and observed outcomes. The teacher's deep personal engagement with the topic enriches the intervention, leading to a program that effectively supports students' emotional and psychological well-being.

As a third example, suppose that a teacher embarks on an autoethnographic study to address personal challenges with classroom management, documenting experiences, feelings, and reflections on interactions with students. Within this autoethnographic framework, the teacher designs a mindfulness-based intervention to improve classroom dynamics, hypothesizing that personal mindfulness practice can influence classroom management positively. The intervention's effectiveness is assessed via student behaviors and the teacher's reflective journals, with DBR cycles facilitating iterative refinements based on both quantitative outcomes and qualitative self-reflections.

As a fourth example, suppose that a teacher conducts an autoethnography to explore the potential of games and game-informed approaches (Abrams, 2021, 2022; Begg, 2008; Begg et al., 2005) to enhance engagement from a personal perspective. Inspired by insights that emerge from this autoethnography, the teacher designs a game-informed learning module for a specific subject area. This intervention is structured to introduce the ethos of gaming (e.g., knowledge sharing, adaptive and trial-and-error learning, collaboration) in an educational context, aiming to boost engagement and learning outcomes. The effectiveness of game-informed learning is evaluated through student feedback, performance data, and the teacher's and students' ongoing reflections on the experience, with the DBR process enabling systematic and even collaborative testing and the subsequent adaptation of the game-informed approach.

As a fifth example, suppose that a teacher conducts an autoethnographic study to investigate her/his/their role in shaping classroom dynamics, particularly focusing on the development of teacher-student relationships. Based on autoethnographic findings, the teacher initiates a series of classroom interventions aimed at improving communication and trust between teachers and students. These interventions are designed collaboratively with students, incorporating feedback cycles to refine approaches based on direct experiences and outcomes.

As a sixth example, suppose that a statistics teacher, on reflecting on her/his/their personal experiences with undergraduate or graduate statistics courses, conducts an autoethnographic study to explore how these experiences influence her/his/their teaching approach and students' attitudes towards statistics. Motivated by this reflection, a professor develops a statistics course that incorporates anxiety-reduction techniques and positive reinforcement strategies. The



curriculum is tested and is refined in an iterative manner, with a focus on reducing statistics anxiety and improving student outcomes.

As a seventh example, suppose that a teacher conducts an autoethnographic study to reflect on personal and observed experiences of declining student engagement in reading activities. Based on these ensuing reflections, the teacher introduces a choice-based reading program, enabling students to select books based on interest. The teacher documents the students' selection process, their reactions, and their engagement levels, all the while using this reflective lens to adjust continually the program's design. The teacher's narrative showcases the importance of choice in reading engagement and how personal and observed experiences can drive meaningful educational innovation.

As an eighth example, suppose that a teacher uses longitudinal autoethnographic techniques to document her/his/their year-long journey of transforming classroom management practices in a challenging middle school environment. Within this narrative, the teacher systematically tests various classroom management strategies, such as positive reinforcement systems and student-led conflict resolution, documenting the iterative process of design, implementation, feedback, and redesign.

As a final example, suppose that a special education teacher conducts an autoethnographic study to explore her/his/their personal and professional growth in teaching students with diverse learning needs. The autoethnographic narrative includes a detailed account of developing and testing individualized learning plans, employing technology for personalized instruction, and engaging with parents and specialists. The teacher uses DBR principles to evaluate and to refine these practices within the autoethnographic exploration.

### **Embedding Integrated Mixed Methods Autoethnography Within Integrated Mixed Methods Design-Based Research**

This path has led us to the conclusion that conducting (integrated mixed methods) autoethnography within (integrated mixed methods) DBR studies offers several key benefits, including the following:

First (integrated mixed methods) autoethnography enables researchers to draw on their personal experiences and insights as they design, implement, and refine educational interventions, which can add depth and richness to the understanding of the design context. This depth is particularly valuable in (integrated mixed methods) DBR, wherein understanding the context of use is critical for designing effective interventions. Also, this autoethnographic-based reflexivity could enrich the understanding of the intervention's impact, challenges, and opportunities from a first-person perspective. Moreover, this could be particularly relevant in educational research, wherein the researcher also is a practitioner (e.g., a teacher designing new curriculum or learning tools).

Second, by incorporating (integrated mixed methods) autoethnographic methods, researchers are encouraged to reflect critically on their own roles, biases, and assumptions within the research process. This reflexivity can lead to more thoughtful and nuanced (integrated mixed methods) DBR designs and interpretations because it brings to the forefront the researcher's influence on both the design and research process.

Third, (integrated mixed methods) autoethnography's emphasis on personal narrative and experience can help center the design process on the users' needs, experiences, and



perspectives. This is especially beneficial in DBR, wherein the goal is to create interventions that not only are theoretically sound, but also are practically effective and meaningful to users.

Fourth, embedding (integrated mixed methods) autoethnography with (integrated mixed methods) DBR fosters methodological innovation by blending the rich, narrative-driven approach of autoethnography with the systematic, iterative cycles of design and testing in DBR. This integration can produce more holistic and empathetic research outcomes that are both theoretically informed and deeply grounded in personal experience.

Fifth, the narrative element of (integrated mixed methods) autoethnography can make research findings more accessible and compelling to a broader audience, including practitioners and stakeholders who might not be as engaged with traditional academic outputs. This can improve the dissemination and impact of the ensuing research findings, making them more likely to be adopted and applied in real-world settings.

Sixth, engaging in (integrated mixed methods) autoethnography within an (integrated mixed methods) DBR study can heighten researchers' ethical sensitivity to the communities and individuals for which they are designing, promoting a more empathetic and respectful DBR process. Also, it can empower researchers to use their personal experiences as a source of knowledge and insight, challenging traditional hierarchies of knowledge production.

Seventh, the incorporation of (integrated mixed methods) autoethnography within (integrated mixed methods) DBR can enhance the flexibility and adaptability of the DBR process. Researchers can quickly incorporate personal and observed experiences into the design cycle, allowing for rapid adjustments and iterations based on real-world feedback and reflections. Moreover, autoethnography calls for researchers to draw on their own experiences, embedding personal narratives within the broader context of the research. Within DBR, this can illuminate the nuanced ways in which educational interventions interact with individual and cultural dimensions. By situating the researcher's lived experiences at the heart of the design, implementation, and evaluation phases, (integrated mixed methods) autoethnographic accounts can provide profound insights into the contextual factors that influence the effectiveness and reception of educational innovations.

Eighth, (integrated mixed methods) autoethnography contributes rich and thick (qualitative and quantitative) data (cf. Geertz, 1973; Ryle, 1949, 1971) that capture the subtleties of human experience and interaction with the intervention. This depth of insight nurtures more nuanced adjustments between cycles, ensuring that the intervention evolves in a way that is not only theoretically sound, but also deeply resonant with the lived realities of participants.

Ninth, conducting (integrated mixed methods) autoethnography within (integrated mixed methods) DBR serves as a powerful bridge between theoretical research and practical application. Research grounded in personal experiences can ensure that theoretical developments continuously are tested against and informed by the complexities of real-world application. This grounding not only enriches the theoretical contributions of the research, but also enhances its practical relevance and applicability.

Tenth, the inclusion of (integrated mixed methods) autoethnographic elements within a (integrated mixed methods) DBR framework encourages creative methodological approaches within DBR. The personal and narrative nature of autoethnography can inspire innovative ways of thinking about and addressing educational challenges, leading to interventions that are effective, original, and transformative.



Finally, the introspective nature of (integrated mixed methods) autoethnography fosters a deep empathy and understanding between researchers and participants. In (integrated mixed methods) DBR, wherein collaboration with stakeholders is key, autoethnography can help break down barriers, facilitating a more engaged and meaningful participation from all involved. This can lead to a co-design process that is more inclusive, reflective, and responsive to the needs and experiences of those it aims to serve. This co-design process is consistent with our own research philosophy of critical dialectical pluralism (cf. Onwuegbuzie & Abrams, 2024).

In summary, incorporating (integrated mixed methods) autoethnography into (integrated mixed methods) DBR studies offers a holistic approach that leverages personal narrative and lived experiences to deepen understanding, to enhance contextual insight, and to foster innovation. This integration not only enriches the (integrated mixed methods) DBR process, but also amplifies its impact, making it more relevant, reflective, and resonant with the communities it aims to serve.

In all of these examples, the reflexive nature of (integrated mixed methods) autoethnography enriches the (integrated mixed methods) DBR process by providing deep personal insights into the teacher's role in the intervention, while (integrated mixed methods) DBR offers a systematic framework for testing and for refining educational interventions based on those insights. This combination fosters a more holistic understanding of educational innovations and their implementation in real-world classroom settings.

### **Examples of Embedding Integrated Mixed Methods Autoethnography Within Integrated Mixed Methods Design-Based Research**

An example of embedding IMMA within IMM-DBR is as follows: Suppose a teacher decided to conduct a DBR study to assess the use of ChatGPT as a tool to enhance students' research skills and critical thinking. The teacher then incorporates autoethnographic elements of the DBR process to reflect on her/his/their journey of selecting and of integrating the AI into the curriculum, considering her/his/their own skills, apprehensions, and learning process, as well as the affordances and constraints of the school's curriculum and infrastructure. Based on these reflections, the teacher iteratively tests and refines the use of the AI tool based on student engagement and learning outcomes. The teacher's and students' reflections reveal insights into the barriers and enablers of technology adoption in education, guiding the iterative refinement of the intervention to suit learners' needs more adequately.

As a second example, suppose that a teacher implements a culturally responsive teaching framework to improve engagement among culturally and linguistically diverse students. The teacher documents her/his/their personal journey understanding cultural diversity and her/his/their own cultural biases, including reflections on lesson plan adjustments and interactions with students. The teacher develops, implements, and refines culturally responsive teaching practices based on student feedback and learning progress. The teacher's personal narrative offers a deep understanding of the challenges and successes in cultivating a culturally responsive classroom, contributing to the development of effective practices.

As a third example, suppose that a teacher observes that traditional literacy practices do not engage all students equally. As a result, the teacher designs an intervention using audiobooks, hypothesizing that this will increase students' engagement and reading skills. The teacher then uses (integrated mixed methods) autoethnography to reflect on personal teaching experiences, biases towards traditional literacy, and the challenges faced by students from diverse



backgrounds. These reflections are used iteratively to refine the approach (e.g., when, where, and how to use the audiobooks in concert with the written text), considering cultural relevancies, accessible technology, and student interests. The intervention is implemented in multiple cycles, with the teacher collecting data on student engagement and reading outcomes, as well as using personal and student reflections to understand and to adapt the intervention's design.

As a fourth example, suppose that a science teacher notices a disconnection between the curriculum and the diverse cultural backgrounds of students. The teacher redesigns the curriculum to include culturally relevant science examples and community issues. The teacher then employs (integrated mixed methods) autoethnography to explore her/his/their own cultural background and its influence on perceptions of science education. This introspective journey helps to identify biases and assumptions that could affect the intervention's effectiveness. Implementing the redesigned curriculum in stages allows for the collection of data on student engagement and comprehension, guided by reflective insights from the teacher's autoethnographic findings.

As a fifth example, suppose that a teacher develops and implements a new reading comprehension strategy aimed at middle school students struggling with understanding complex texts. The teacher-researcher keeps a detailed journal reflecting on each iteration of the strategy development, focusing on personal experiences, challenges, and the evolving understanding of students' needs. These reflections highlight the teacher's growing awareness of how their background influences the design and adaptation of reading strategies, leading to more inclusive and effective approaches.

As a sixth example, suppose that a teacher designs a technology-integrated curriculum for a fifth-grade science class to increase student engagement and understanding of scientific concepts. Throughout the ensuing (integrated mixed methods) DBR study, the teacher documents her/his/their journey of learning new technologies, their perceptions of the specific technologies in education, and the cultural and institutional barriers encountered. This narrative provides insights into the adoption process of specific technologies in education, identifying critical factors for success and areas needing support.

As a seventh example, suppose that a teacher implements a program to develop emotional intelligence in high school students, with activities designed to enhance empathy, self-regulation, and social skills. The teacher autoethnographically explores her/his/their own experiences with emotional intelligence in her/his/their personal and professional life, reflecting on how these experiences influence the design and facilitation of the program. This introspection helps the teacher to tailor the intervention to address the nuanced emotional needs of students effectively.

As an eighth example, suppose that a teacher notices that students are disengaged during science lessons and, thus, decides to introduce an augmented reality (AR) app to explore scientific concepts. The teacher maintains a reflective journal detailing her/his/their observations, struggles with technology integration, student reactions, and adjustments made to lesson plans based on these reflections. This personal narrative captures the evolving understanding of how technology impacts student engagement and learning. Insights from these autoethnographic reflections, along with student feedback, help the teacher to refine the AR integration strategy, making it more responsive to students' needs and interests. These reflections highlight the importance of flexibility and adaptation in technology-enhanced learning environments.



As a ninth example, suppose that a teacher investigates the process of integrating Desmos 3D Studio into a fifth-grade mathematics curriculum to enhance interactive learning. The teacher reflects on personal experiences with technology, both inside and outside the classroom, documenting evolving perceptions, challenges, and successes in implementing technology-based teaching methods. This reflection helps in understanding the cultural and personal dynamics affecting technology adoption.

As a tenth example, suppose that a high school English teacher designs a curriculum that incorporates literature from diverse cultures to engage a multicultural classroom. The teacher then uses (integrated mixed methods) autoethnography to explore her/his/their own cultural biases and how these biases influence curriculum design and interactions with students. This personal narrative is used to refine the curriculum iteratively, making it more inclusive.

As a final example, suppose that an eighth-grade teacher implements a problem-based learning (PBL) initiative to enhance student engagement in history. The teacher then records her/his/their journey of learning PBL methodologies, the challenges of shifting from traditional teaching methods, and the impact on their teaching identity. These reflections inform the ongoing design and adaptation of PBL activities.

All of these examples demonstrate how (integrated mixed methods) autoethnography within (integrated mixed methods) DBR can enrich the design process, making it more personal, reflective, and attuned to the needs and experiences of users. By leveraging their own lived experiences, researchers and designers can create more meaningful, effective, and empathetic interventions.

### Conclusions

Of the 68 MM-DBRs identified by Onwuegbuzie et al. (2023a) over the 62-year period, not one of these studies involved the use of autoethnographic approaches. This makes our call for integrating (mixed methods) autoethnography and (mixed methods) DBR unique and relevant. In particular, we have highlighted the synergistic potential of integrating (mixed methods) DBR with (mixed methods) autoethnography, enhanced by the rigor of mixed methods research (Onwuegbuzie & Hitchcock, 2019a) and multiple methods research (Onwuegbuzie & Hitchcock, 2019b).

In concluding our exploration of IMMA and IMM-DBR, it becomes clear that this innovative methodological fusion yields a rich landscape of potential that extends far beyond traditional research approaches. Our journey, as documented in this article, has illuminated the nuanced interplay between personal narratives and systematic design, offering a holistic lens through which researchers can view the complexities of educational innovation and intervention.

The integration of both IMMA within IMM-DBR and IMM-DBR within IMMA not only enriches the research process with depth and reflexivity, but also champions a more empathetic and inclusive approach to educational research. By weaving personal narratives into the fabric of design and implementation, as well as designing studies that are informed by personal narratives, researchers can uncover hidden insights and foster a deeper connection with educators, with learners, with parents, and with other stakeholders. This approach underscores the significance of context, of culture, and of personal experience in shaping educational practices and outcomes.

Our call for marrying IMMA and IMM-DBR—what we refer to as IMMA-DBR—not only challenges the boundaries of traditional research methodologies, but also offers new pathways



for meaningful, innovative, and transformative investigations in the field of education and beyond. It calls for a paradigm shift that embraces the complexity and dynamism of educational settings. Through their reflective and nuanced exploration, we advocate for a research ethos that is both rigorous and reflective, that is both methodologically robust and deeply humanistic, and that values the complexity of human experience as a central element of the research process.

The marriage of DBR and autoethnography, underpinned by fully integrated mixed methods research—or what Onwuegbuzie (2017) and Onwuegbuzie and Hitchcock (2019a) refer to as the  $1 + 1 = 1$  integration formula, or meta-methods research—represents a significant advancement in the field of educational research methodology, promising richer, more contextually grounded insights and interventions. As such, we contend that the implications of this marriage are far-reaching, offering a framework for researchers to engage deeply with their subject matter, fostering empathy, reflexivity, and a nuanced understanding of the educational landscapes that they seek to transform.

As we look toward the future, the integration of IMMA and IMM-DBR offers a promising avenue for addressing the multifaceted challenges of the educational landscape. It provides a framework for conducting research that is both rigorously systematic and profoundly personal, enabling researchers to craft interventions that truly are reflective of the diverse tapestries of learning and teaching.

In conclusion, we have illuminated a path forward that transcends conventional research methodologies, inviting researchers, in general, and mixed methods researchers, in particular, to embrace the rich possibilities that arise from the integration of (mixed methods) autoethnography and (mixed methods) DBR. This exploration not only enriches our understanding of educational research methodologies, but also empowers researchers to craft interventions that are deeply informed by the intricate weave of personal experience and systematic inquiry.

We hope that our article contributes significantly to the field of educational research and sets a precedent for future inquiries that seek to integrate the empirical with the experiential, the empirical with the narrative, the personal with the systematic, the quantitative with the qualitative (and vice versa), and the theoretical with the personal. The journey of IMMA-DBR is just beginning, and its potential to transform educational research and practice in the era of 5IR and beyond is boundless.





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